BMS Institute of Technology and Management

Avalahalli, Yelahanka, Bengaluru-560064

DEPARTMENT OF MCA

"SAMSHODHANA"

RESEARCH COMPENDIUM

Volume-7, August-2019 to July-2020

"Research is to see what everybody else has seen,
and to think what nobody else has thought" ***-Albert Szent Gyorgyi***

Jnyaana-Vijnyaana-Ruupaayai Jnyaana-Muurte Namo Namah |
Naanaa-Shaastra-Svaruupaayai Naanaa-Ruupe Namo Namah ||

DEPARTMENT OF MCA

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Avalahalli, Yelahanka-Doddaballapur Main Road, Bengaluru-560064.

PH: 080-68730444, 080-68730419

WEBSITE: https://bmsit.ac.in

BMS Institute of Technology and Management

Avalahalli, Yelahanka, Bengaluru – 560064.

Department of Master of Computer Applications

Department Vision

To develop quality professionals in Computer Applications who can provide sustainable solutions to the societal and industrial needs

Department Mission

Facilitate effective learning environment through quality education, state-of-the-art facilities, and orientation towards research and entrepreneurial skills

Programme Educational Objectives (PEOs)

PEO 1: Develop innovative IT applications to meet industrial and societal needs.
PEO 2: Adapt themselves to the changing IT requirements through lifelong learning.
PEO 3: Exhibit leadership skills and advance in their chosen career.

Programme Outcomes (POs)

- Apply knowledge of computing fundamentals, computing specialization, mathematics and domain knowledge to provide IT solutions.
- Identify, analyse and solve IT problems using fundamental principles of mathematics and computing sciences.
- Design, develop and evaluate software solutions to meet societal and environmental concerns.
- Conduct investigations of complex problems using research-based knowledge and methods to provide valid conclusions.
- Select and apply appropriate techniques and modern tools for complex computing activities.
- Understand professional ethics, cyber regulations and responsibilities.
- Involve in life-long learning for continual development as an IT professional.
- Apply and demonstrate computing and management principles to manage projects in multidisciplinary environments by involving in different roles.
- Comprehend and write effective reports and make quality presentations.
- Understand the impact of IT solutions on socio-environmental issues.
- Work collaboratively as a member or leader in multidisciplinary teams.
- Identify potential business opportunities and innovate to create value for the society and seize that opportunity.

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

About the Department:

The Department of MCA is accredited by the National Board of Accreditation, New Delhi.

The MCA program is intended to provide a modern industry-oriented education in applied computer science, thereby focusing on providing a sound theoretical background as well as good practical exposure to students in the relevant areas.

The MCA Department was established in the year 2003 with an approved intake of 60 students with an excellent Library and Laboratory facilities. It has 12 qualified, experienced and dedicated young teaching staff (05 Ph.D. holders and 07 are pursuing Ph.D.) and 2 technical staff members creating an amicable teaching and learning environment. The faculty members of the dept. have executed their responsibilities as coordinators/ members of the BOS/BOE in VTU, other universities and Autonomous institutions as well as editorial board members / reviewers of international journals. The department has an aggregate of VTU examination result of nearly 90%, secured **11 VTU Ranks** and placement of nearly 90% since its inception. The faculty members are involved in an array of research interests such as Wireless Networks (Cognitive, Ad-hoc and Sensor networks), Network security, Cloud Computing, E-Commerce, Data Science and Digital Image Processing among others. VTU Research centre in MCA Department was established in 2016-17.

The Department has organized series of Technical/Expert Talk, Workshops, Industrial Visits, Alumni Interaction, Parents Teachers Meeting, Project Based Learning Evaluation/Exhibition, and Technical Competitions to enrich the students from different perspectives and weekly counselling through effective proctoring system to support slow learners and boost quick learners.

Faculty and Support Staff

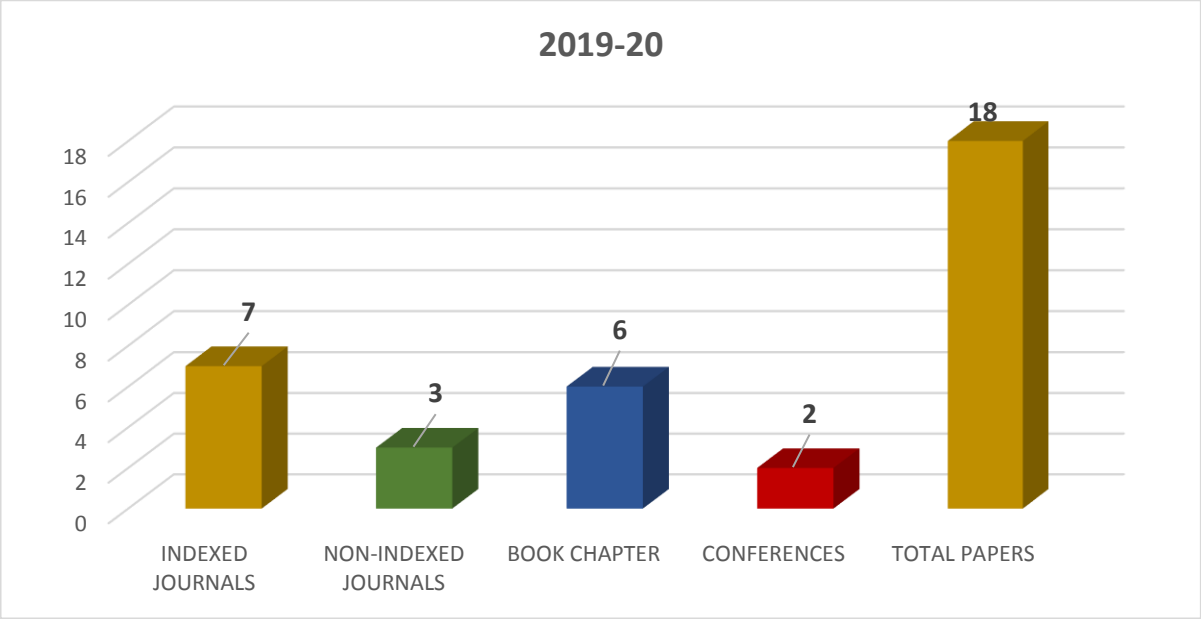
The Department of MCA is having highly qualified and well trained faculty members who strive to impart knowledge to the students who join MCA. Under the leadership of Dr. Aparna K, Associate Professor and HoD, the department is growing step by step with her vast experience and enthusiasm. The staff and students are performing well in academics, cultural and sports activities throughout the year. Below is the list of faculty members and support staff with their qualification and other details.

Sl No	Name of the staff member	Qualification	Designation	Research Area
1	Dr. Aparna K.	MCA., M. Phil, PhD	Associate Professor & HOD	Data Mining
2	Dr. Arunkumar B.R.	MCA, M. Phil., M.Tech. (CSE), Ph.D. (CS), PGDIPR (NLSIU)	Professor	Computer Networks, Data Science, Cloud Computing, Software Engineering & IPR
3	Dr. P. Ganesh	M.C.A., PhD	Associate Professor	Cloud Computing
4	Dr. Nagabhushan S.V.	M.C.A. Ph.D.	Assistant Professor	E-Commerce Modelling & Software Engineering.
5	Mr. Dwarakanath G.V.	M.C.A.	Assistant Professor	Computer Networks
6	Mr. Shivakumara T.	M.C.A.	Assistant Professor	Information & Network Security, Database
7	Mrs. Reshma C.R.	M.C.A.	Assistant Professor	Cognitive Radio Networks
8	Mrs. Drakshaveni G.	M.C.A., M. Tech.	Assistant Professor	Digital Image Processing
9	Mrs. Nirupama	M.C.A.	Assistant Professor	Computer Networks
10	Mrs. M. Sridevi	M.C.A.	Assistant Professor	Social Media Data Analytics
11	Mr. Venkatesh A.	M.C.A.	Assistant Professor	Sensor Networks
12	Dr. P. Sudarsanam	M.C.A., M. Tech., PhD	Assistant Professor	Grid Computing

Sl No	Name	Designation
1	Mr. Shashikiran J.S.	Instructor
2	Mr. Murulidhara K.N.	Asst. Instructor

Research Publication Summary:

Research papers published/ presented by faculty in various Indexed & non indexed International Journals, Book chapters & International conferences.



Research papers published in Indexed Journals:

Sl No	Paper Title & Source	Author(s)	Page No
1	**Efficient Intelligent Pot for Precious Plants** **SOURCE:** Journal of Critical Reviews, ISSN- 2394-5125 VOL 7, ISSUE 13, July 2020	Mr. Dwarakanath G V Dr. Aparna K Mr. Vishwanatha	1-6
2	**Aasthi – Asset Administration System** **SOURCE:** International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-9, Issue-6, April 2020, pp: 817-821	Mr. Shivakumara T Mr. Dwarakanath G V	7-11
3	**Automation of Trainee Life Cycle in the Corporate World** **SOURCE:** International Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277-3878, Volume-8, Issue-6, March 2020, pp:3864-3869	Mr. Shivakumara T Ms. Nirupama B K	12-17
4	**Self-Conceptualization and Multi Privileged Algorithm based Controller** **SOURCE:** International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-9 Issue-4, April 2020, pp:1715-1720	Mr. Shivakumara T Dr. Rajshekhar M Patil Mr. Shantakumar B Patil	18-23
5	**Detecting the Presence of Power Law to Understand the Distribution of Patient Groups Related to Chronic Diseases on Social Media** **SOURCE:** International Journal of Advanced Science and Technology, ISSN: 2005-4238, Volume 29, Issue 7, pp. 8160-8171, July 2020.	M.Sridevi, Dr. Arunkumar B.R	24-35

6	**Super-imposed cluster embedding for ring routing path identification in WSN** **SOURCE:** Soft Computing (2019) 23:8633–8642, https://doi.org/10.1007/s00500-019-04016-0, Springer-Verlag	Mr. P Sudarsanam Dr. G Singaravel	36-45
7	**Proficient IP multimedia subsystem automation framework** **SOURCE:** Journal of Critical Reviews, ISSN- 2394-5125 VOL 7, ISSUE 13, July 2020	Dr. P. Sudarsanam, Dr. P. Ganesh, Mr. A.Venkatesh Mr. Jagadeeshraman	46-53

Research papers published in Non-Indexed Journals:

Sl No	Paper Title & Source	Author(s)	Page No
1	**Management of Garbage using IOT and Cloud** **SOURCE:** International Journal of Computer Science Trends and Technology, Vol. 8, Issue 1, Jan-Feb 2020, pp: 44-49	Ms. Drakshaveni Mr. MedhaRajan	54-59
2	**Multi-function Smart-Bot using Arduino** **SOURCE:** Journal of Engineering Research and application, ISSN : 2248-9622 Vol. 9,Issue 12 (Series -II) December 2019, pp 01-05	Ms. Drakshaveni G Mr. Vishaar G N	60-64
3	**VPC: Virtual Private Cloud Overview** **SOURCE:** International Journal of Application in Engineering & Management, ISSN: 2319-4847, Volume-9, Issue-7, July 2020.	Mr. Venkatesh A, Mr. Shivakumara T, Dr. Sudarsanam P	65-68

Book Chapters:

Sl No	Title & Source	Author(s)	Page No
1	**Basics of Blockchain** **SOURCE:** Cover Story, CSI Communications, August 2019, Pg: 8-9	Dr. Aparna K	69-70
2	**Designing Safe and Secure Land Registration-Ownership Using Blockchain Technology with a Focus on Mutual Authentication** **SOURCE:** Sustainable Communication Networks and Application, © Springer Nature Switzerland AG 2020, P. Karrupusamy et al. (Eds.): ICSCN 2019, LNDECT 39, pp. 1–8, 2020 https://doi.org/10.1007/978-3-030-34515-0_53	Dr. Arunkumar B R Mr. B Rohith	71-78
3	**Big Data Analytics for Agriculture – Scope and Future** **SOURCE:** Research Front, CSI Communications, March 2020, Pg: 26-27	Dr. P Ganesh Dr. Aparna K	79-80

4	**An Game Theory Approach for Supplier selection** **SOURCE:** eBook, Publisher: Smashwords, Published: April 8, 2020, ISBN:9780463725603 Link:https://www.smashwords.com/books/view/1014265	Dr. Nagabhushan SV	81-88
5	**Raitha Bandhu** **SOURCE:** Cybernetics, Cognition and Machine Learning Applications, Springer Publication ISBN: 978-981-15-1632-0, Chapter no: 18, Pg: 195, April 2020	Mr. Dwarakanath G V Mr. Rahul M	89-97
6	**Investigation of the Temporal Evolution in Patient Networks related to Chronic Diseases on Social Media** **SOURCE:** Intelligent Computing, Information and Control Systems, ICICCS 2019, Print ISBN 978-3-030-30464-5, DOI: https://doi.org/10.1007/978-3-030-30465-2_70, Publisher Name: Springer, Cham October 2019	M. Sridevi Dr. Arunkumar B R	98-105

Research papers presented in the Conferences:

Sl No	Paper Title & Source	Author(s)	Page No
1	**Impact of Cyber Attacks on Electronic Patient Health/Medical Records** **SOURCE:** 3rd International Conference on Computer Networks and Inventive Communication Technologies (ICCNCT - 2020), 23rd and 24th July 2020	Dr. Arunkumar B R	106-121
2	**Raitha Bandhu** **SOURCE:** International Conference on Cybernetics, Cognition, and Machine Learning Applications, 16th and 17th August 2019, Goa, India.	Mr. Dwarakanath G V	--

JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

EFFICIENT INTELLIGENT POT FOR PRECIOUS PLANTS

DWARAKANATH G V[1], Dr. APARNA K[2], K VISHWANATHA[3]

[1]ASSISTANT PROFESSOR, DEPARTMENT OF MCA, BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT, BENGALURU-560064

[2]ASSOCIATE PROFESSOR, DEPARTMENT OF MCA, BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT, BENGALURU-560064

[3]MCA STUDENT, DEPARTMENT OF MCA, BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT, BENGALURU-560064

Received: 14 March 2020 Revised and Accepted: 8 July 2020

ABSTRACT: Indian farming is diverse from poor farm villages to large farms using advanced agricultural technology. Growing different types of precious plats in farm or house or in farm house is occupation for many people today. Maintaining of those precious plants is challenge. Watering, sprinkling and heat maintenance of such plants are difficult. If we miss watering of such plants than their will be great loss. Our paper is planned to address these issues. This system provides an intelligent IOT-based platform monitoring framework and system structure for the agriculture facility ecosystem. Our intelligent pot waters the plant based on its moisture level and sprinkles the water on leaves and flowers based on the humidity and temperature. Because of this the human intervention will be reduced and our intelligent pot itself will look after the growth of the plant. Our proposal is a prototype which can be adoptable even in today's drip irrigation where the consumption of water can be reduced. This would be a catalyst for the transition from conventional to new agriculture. This also creates incentives for the production of new IOT (Internet of Things) agriculture application technologies and business growth.

Index Terms - IOT, Moisture sensor, Ultrasonic sensor, Relay, NodeMcu, LED's, Water Pump, 12V Power supply, Arduino IDE, Blynk.

I. INTRODUCTION

India is viewed as the nation of plantations and ranchers. Approximately half of the number of inhabitants in our nation depends on farming and related exercises in either approach to help their vocation (while 22% exclusively on horticulture). Horticulture assumes a significant job by contributing 16% to the nation's all out GDP. Along these lines, agrarian requests ought to be completely dissected and overseen as their wastage of use will impact future.

Farming area needs a great deal water for irrigation. Water gracefully to the yield fields, as less water activates crop crash, although wealthy water flexibly may even pulverize them. Great cultivating techniques can assist ranchers with conquering this issue. A few techniques for water system have been tested and adjusted to bring about least wastage of water, for example, Ditch watering system, Terraced watering system, Drip watering system, Sprinkler watering system and Rotary watering system.

The best is being drip watering system, here in this watering system technique; here drop by drop water is provided exceptionally near the foundations of the plant. The loss of water by dissipation and spill over is limited, all things considered, in this technique [1]. By utilizing more current advancements, for example, the IoT and a couple of sensors for executing trickle water system, we can build up a framework to limit the water wastage during the irrigation process. This logical technique to control water flexibly will enormously build the water profitability, by decreasing the water wastage. The primary goal of this task is to contemplate and build up an overall database of barometrical example winning in a specific locale [2], after a seemingly endless amount of time after year and to keep up an automated arrangement of harvest checking and water system. This database will end up being valuable to make future expectations of yield prerequisites.

II. LITERATURE SURVEY

WSN Based Closed Loop Irrigation System [2013]

In most recent couple of years, remotely checked installed framework for water system purposes have become another need for farmer to spare his vitality, time and cash. This paper is proposing a total agrarian answer for the rancher dependent on Wireless Sensor Networks and GSM innovation [5]. The information obtained about ecological elements of the field is transmitted to the farmer empowering him to control the actuators in the field. Zigbee based low force gadgets are utilized to empower cost sparing and the valves and sprinklers are utilized to spare the water use for water system. The innovation utilized is straightforward and simple to actualize and the

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

parameters recorded encourage an extraordinary method to farmer to empower the "smart farms" hypothesis work for him. The microcontroller is the core of the thought which controls all the gadgets and initiates it and runs them in synchronization. So ongoing preparing of the data is done and the necessary move is made to build the profitability of the field.[1]

Automated Intelligent Wireless Drip Irrigation Using Linear Programming [2013]
In this paper, the Design of Intelligent Drip Irrigation drip irrigation for the Automation of Drip water system is introduced.[7] For the most part the Drip water system was named in Israel in 1959. Dribble Irrigation is the present need since water is nature's blessing to the humanity and it isn't boundless and free for eternity. World's water assets are fastly evaporating. The unparalleled one answer for this issue is Intelligent Drip Irrigation framework. In the traditional dribble water system framework, the rancher needs to keep watch on water system plan, which is distinctive for various yields. In Intelligent Drip Irrigation using Linear Programming water framework will happen exactly when there will be extraordinary need of water. Water framework structure makes use of valves to show water framework on and off. These valves can be helpfully modernized by utilizing controllers and solenoids [6]. The made water framework procedure removes the necessity for workmanship for flooding water framework similarly as stream water framework close by that it allows the farmer to utilize the appropriate proportion of water at the correct time, paying little psyche to the availability of the work to turn valves or motor on and off. In this introduced Intelligent Irrigation framework I have utilized straight programming idea and Interpolation Method. Straight Programming causes us to convey accessible water to the quantity of harvests so as to get most extreme benefit with least expense. Additionally direct Programming encourages us to do legitimate administration of accessible water. Interjection Method is utilized to delineate physical parameters readings in the ranch where taking manual readings is absurd. At long last both the system encourages us to build profitability of the yields and eventually profit [2] [10].

Microcontroller Based Automatic Plant Irrigation System [2017]
The main part of this paper is to give records roughly automated water system to the vegetation which empowers in setting aside water and money. Here the total gadget is constrained by using atmega 328 micro controllers. Here this micro controller is giving intrude on sign to the engine. Temperature sensor and moistness sensor is identified with inside pins of micro controller by utilizing comparator, at whatever factor temperature and dampness of the circumstance those sensors distinguishes the alteration in temperature and mugginess after which offers an intrude on hint to the micro controller and as such the motor is started, nearby this bell is used to uncover that motor is on [3] [8].

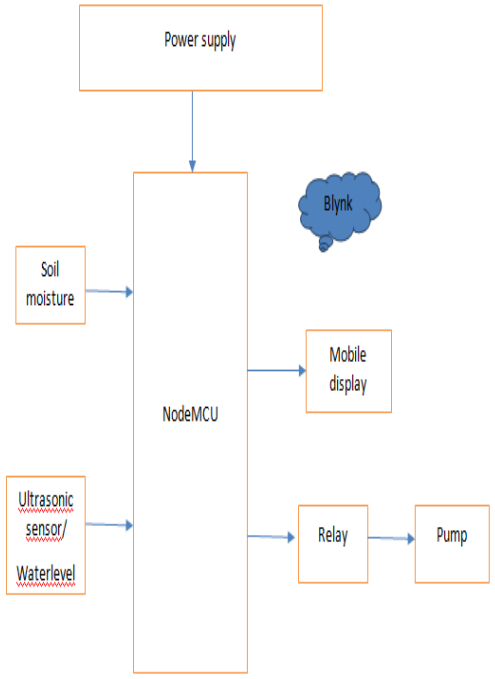
Automatic plant irrigation system [2017]
In the stream time period, food insufficiency and water need occurs because of the improvement in people. So to maintain a strategic distance from this irksome we need to drive the agribusiness zone. By and by, water wastage is more in this part as water logging while at the same time watering the agrarian fields through water system. Alongside these strains custom designed plant water framework system ought to be made preparations for the fine water easily inside the fields. This paper directs changed plant water framework device which in this manner belongings the sponginess substance of the earth. Here this shape utilizes atmega328 scaled down scale controller. It's miles redone to become aware of the moistness content material if the earth over a few c languages. Proper even as the sogginess content material isn't always certainly the lessen-off where it is predefined, it'll begin giving the appropriate volume of water till it appears at the lessen-off. So even as the soil is in dry state the siphon will commonly watering the fields and while the earth is wet the siphon will in this manner kill, there by means of damage the need of work and spare the time [4][9].

III. PROPOSED SYSTEM

The key purpose of the model is to avoid water wastage during the irrigation cycle. It is low cost, and an effective method. It contains NodeMCU, sensors such as soil moisture and ultrasonic, and pump and relay actuators.
Here we will achieve programmed control of the dc pump for supplying the plant with fuel. The system contains NodeMCU, which is interfaced with the relay board.
In addition, the soil moisture sensor was associated with the NodeMCU board. It is the main unit for the whole network. The water pump gets the power from a 12V adapter, and a 5V power supply is supplied to the relay. The NodeMcu-connected ultrasonic sensor or water level sensor is utilized to test the minimum or empty water presence in the tank to pump the water for the plants.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

IV. SYSTEM ARCHITECTURE



V. IMPLEMENTATION

ESP8266 NodeMCU

IoT is the trending technology in the world. It changed the working way of people. Here the physical objects and the digital world connected together. So by keep this in mind Espressif systems designed the ESP008266 NodeMcu micro controller. It is the Wi-Fi enabled micro controller. This board contains the Wi-Fi antenna, 3.3V voltage regulator, 3.3V output regulator, external power supply, micro USB connector, reset button, flash button, CP2102 UART Controller. The ESP8266 NodeMcu has totally 17 general purpose input and output pins.

ARDUINO IDE

It is a software application that is written in C and C++ functions. This Arduino IDE is utilized for writing and moving the code to the Arduino shields. This Arduino IDE helps the languages C and C++ utilizing principles and coding structure. This Arduino IDE gives the software libraries. In this Arduino IDE the composed code needs just two fundamental functions. That is void setup() and void loop(). Here the void setup() Sets things up that must be done once and afterward don't occur once more. And Void loop() Contains the directions that get rehashed again and again until the board is turned off.

BLYNK

Blynk is proposed for the IoT. It can manage hardware, it will display the information of different types of sensors, it will assemble data, envision it, and then it will do some other things also. Here there are three fundamental parts in the gathering:

- Blynk Application – Blynk application permit us to make stunning user interfaces for my project using different types of widgets.
- Blynk Server – This Blynkserver is liable for all the communication connection between the smart phone and the NodeMcu component. Here we can utilize the Blynkcloud or we can run the Local Blynkserver. This is open source; it can manage the huge number of components effectively and can be propelled by utilizing Raspberry Pi.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

- Blynk Library – It is for all the notable equipment shields – empowers the correspondence with the server and method all the imminent and out coming orders.

Fig: Arduino IDE

Fig: Blynk App

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

Fig: Intelligent Pot

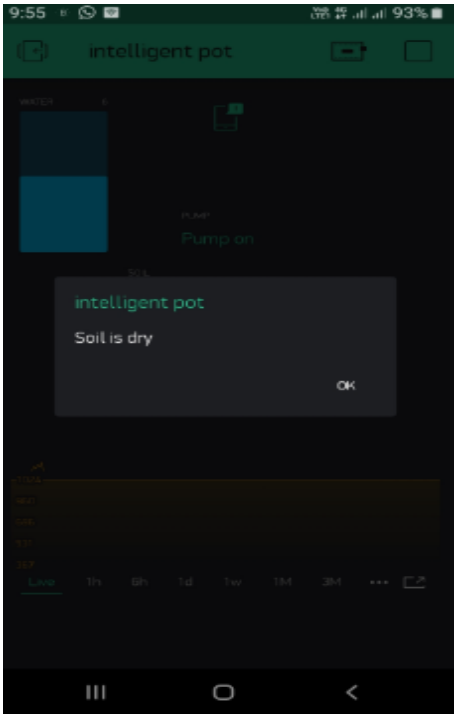


Fig: App Notification message.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

VI. CONCLUSION

Intelligent pot for precious plants using IOT has been experimentally shown to work satisfactorily by successfully controlling the sensor values. The engine in the field regulates through the phone. It also provides timely recording of the sensor parameters. It can help the user evaluate the conditions of various field parameters everywhere at any moment.

The hard work required for watering the fields can be significantly needed, giving users some relief. Additionally, the cloud-saved archive can be used at any time to forecast potential water needs. As they will be well prepared with the knowledge, this will prove to be of great benefit to users. Finally, we suggest that intelligent pot for precious plants automated irrigation is more effective than scheduled irrigation methods.

VII. REFRENCES

[1] D.Bansal and S.R.N.Reddy, "wsn based closed loop automated irrigation system," Ijsit, vol. 2, no. 3, pp. 229–237, 2013.

[2] M.Giri and D.N.Wavhal, "Automatic wireless drip irrigation" International Journal of Ijarcet, vol. 2, no. 1, pp. 1–5, 2013.

[3] B.D.Kumar, P.Srivastava, R.Agrawal and V.Tiwary "Micro controller based automatic plant irrigation system,"Irjet, vol. 04 no. 05, pp. 1436–1439, 2017.

[4] DevikaCM, K.Bose, and S.Vijayalekshmy. "Automated plant irrigation system using arduino." IEEE ICCS, Thiruvananthapuram, India 20-21 Dec,2017.

[5] Dursun,M.;Ozden,S.Control of soil moisture with radio frequency in a photovoltaic-powered drip irrigation system. Turk.j. Electr. Eng. Comput. Sci.2015,23,447-458.

[6] Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta- Gándara "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module " IEEE 2013

[7] Samy Sadeky, Ayoub Al-Hamadiy, Bernd Michaelisy, Usama Sayedz," An Acoustic Method for Soil Moisture Measurement ", IEEE 2004

[8] Jia Uddin, S.M. Taslim Reza, Qader Newaz, Jamal Uddin, Touhidul Islam, and Jong-Myon Kim,"Automated Irrigation System Using Solar Power" ©2012 IEEE

[9] D. Mishra, A. Khan, R. Tiwary and S. Upadhay "Automated Irrigation System-IoT Based Approach," 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU). IEEE, Bhimtal, India 23-24 Feb., 2018

[10] A. Stesel and A. Osanlou, "A Sustainable Indoor Plant Production Management System with Wireless Internet Access," Young Researchers in Electrical and Electronic Engineering (EIConRus), 2018 IEEE Conference of Russian IEEE Moscow, Russia 29 Jan.-1 Feb., 2018.

AASTHI – ASSET ADMINISTRATION SYSTEM

MR. SHIVAKUMARA T[1], MR. DWARAKANATH G V[2], DR. CHETHAN A S[3], MR. MUNESHWARA M S[4], MR. ANAND R[5]

Abstract:
Web Development is skill that is used to develop the web application, web development is rapidly growing as the technologies are also. A web developer should develop an application based on the client requirement and must be friendly and easily understood by the client or the users. AASTHI-Asset Administration System is the web application that is relevance to the asset management system in which plays typical role in the organizations and enables to computerized system widely spread which is used for the private network, communication between the members of an application, sharing the information between different users or members, automatically estimating the depreciation amount per annum is very important thing that has been focused on. The main theme of our paper AASTHI-Asset Administration System is to focus on the asset, license and to maintain the company environment. The procedure to calculate the depreciation amount of the asset is difficult and been estimated through the category of asset, asset type, asset devices, etc. In this paper work is focused on staff, vendor and allows them to communicate through the application called AASTHI which is Asset Administration System.

Keywords: Administration, Asset, License, system

1. . INTRODUCTION

Web Development, a creative work this involves developing a various website for the unique fields like company, institutions, organization, shopping, e-commerce, finance, banks, social network services, applications, etc. through internet and intranet. A Web development involves developing the static pages, dynamic pages depending on the type requirement of an application from the client.

Web development is also called web programming that enables the developer for the creation of the dynamic web applications and simple websites.

Our paper title "AASTHI Asset Administration System" is web-based application that plays an important role in the organizations. The main objective of our paper AASTHI is to enable computerized widely spread which is used in private network, communication between administrator, vendors and the staff member of the particular company. Information sharing between the different modules, viewing different documents, records of assets and to fulfill the basic requirements of the company, the prescription of asset and prediction of the asset will be generated through our paper website. The most important thing that remains in our paper is the depreciation value in which the value of any asset doesn't remain the same in all period so that it is important for the calculation and amount reduced at various periods like per annum.

Our paper involves the asset details of the organization that has three different modules such as admin module that plays very important role in our paper and monitors the content and members, admin has the privileges like adding, viewing, deleting, sending notifications for the staff and vendors, and admin can access the details of an any assets, license and also can perform some operations on the assets, license by administrator, staff and vendors assets, and only an administrator can insert the staff member and their details. The next module is staff module this includes the staff member added by the administrator of the application. Staff can perform few operations like specifying the assets, enables to provide the details about the assets and can view about the status about the assets, and in every module, the staff is allowed to get the notifications from the admin and the various member, when admin refers the vendor the particular staff member is allowed to contact the particular vendor so that the staff are enabled to know the status of the asset and the license. And the next module is vendor module that includes the details of the vendor and assets to solve by the vendors. An admin refers the assets to vendors to perform the task provided by the admin and staff. A vendor can view the details of the assigned asset.

Revised Manuscript Received on April 01, 2020.

***Correspondence Author**

Shivakumara T[1], Assistant Professor, Department of MCA, BMS Institute of Technology and Management, Affiliated to Visvesvaraya Technological University, Karnataka State, India, shivakumarat@bmsit.in

Dwarakanath G V[2], Assistant Professor, Department of MCA, BMS Institute of Technology and Management, Affiliated to Visvesvaraya Technological University, Karnataka State, India, dwarakanathgv@bmsit.in

Dr. Chethan A S[3], Professor, Dept. of Mathematics, BMS Institute of Technology & Management, Affiliated to Visvesvaraya Technological University, Karnataka, India, aschethan@bmsit.in.

Muneshwara M S[4], Assistant Professor, Department of CSE, BMS Institute of Technology and Management, Affiliated to Visvesvaraya Technological University, Karnataka, India**, muneshwarams@bmsit.in,**

Mr. Anand R[5], Assistant Professor, Department of CSE, BMS Institute of Technology and Management, Affiliated to Visvesvaraya Technological University, Karnataka, India**,** anandor@**bmsit.in**

AASTHI Asset Administration System is complete application that provides the details of the assets, product license and agreement details, etc. Our paper manages and maintains the complete asset and the environment of the organization and that makes easy for the staff to provide the details about the asset they required without often contacting to manager or the team leader.

This paper describes the two main categories of the application called IT and NON-IT, here in the IT category there includes the many asset like electronics asset, software, hardware, peripherals, computers, etc. and the components in IT assets like laptops, desktop, mouse, keyboard, personnel computers, television, wireless devices, printers, semi-conductors, scanner, 3D-printers, color-printers, paper or, VoIP phone, PBX phone, FAX, routers, LAN, calculators, windows, keyboard, and many other IT components that are required in any company. The NON-IT includes the tools type, furniture, equipment, etc. and the components like tables, chairs, file cabinet, table light, bulletin board, mission board, wall hangings, pens and papers, clocks, notebook and sticky notes, trash bin, etc. They manually can specify their requirements, complaints, details about the IT and NON- IT asset components, software product license details and notify to requirement to the admin. Admin is enabled to interact both with staff and vendors.

The proposed paper is that it's very difficult to often specify the asset in various department by the staff members and difficult to find the vendor details. So, this application enables the administrator to easily contact the staff and the vendors. It helps to follow the ethics and the good environment in the company. Our application focuses on the time saving regarding asset in the company and to provide the proper financial details, asset general information about asset, service information, notes and asset attachment.

II. LITERATURE SURVEY

A. Existing System

Asset Administration System, a collection of huge data and information about assets that is being stored so, that is inefficient to manage bulky information and data in existing system and store the data in the various files. As there is lot of department in the company and been located at different places. There might be chances of saving the same record in various departments and causes redundancy.

One of the major problem that very big company and the small company is that they are not enabled with the good asset management, changing the nature and working of the asset, and financial issues regarding the asset that they can't properly maintain the budget in the company environment procurement predicament and the budgetary blindness, discovering assets manually makes the staff and the manager lost in time, couldn't able get notification when the product license is expired and couldn't able to find the depreciation amount of asset, losing the asset through the misplacement, asset outs untimely or due to excess productions, difficult to lower the cost and overall maintenance, tough to reduce labor time, efficiency boosting and productivity of various tools, frequently breakdowns in the assets, lack of meeting regular certifications, fail in event because of tool unavailability, no reliability, etc. in existing system of asset management system survey about that says that it difficult to store the voluminous amount of data in back-end. When asset plays a very important role in all the companies and various organizations, lack of maintenance and support to the asset as it is difficult to maintain the financial details up to date. And testing whether the product license and the depreciation value of the asset is difficult, unavailable information about status of the asset in which all the asset is been deployed, not deployed, pending, ready to deploy, lost/stolen, not fixable, etc. Its very rare to get proper asset exact information and the work on asset fixation is been delayed due to improper communication between the staff, vendors and the administrator. As huge amount of data been stored and recorded time consume is more. Reliability is less, redundancy happens because of repeating the same kind of information repeatedly and Security and authentication problem.

B. Proposed System

By looking all the issues facing by the existing system our paper title called AASTHI provides clear and good interface that admin, staff and vendors can easily understand. And the status of the asset like whether it is deployed, not deployed, pending, ready to deploy, non-fixable, lost/stolen can be retrieved easily. An asset stores the very voluminous amount of data in an existing system so it makes redundancy problem so this is been clear in our application. Our paper AASTHI Asset Administration System is time consume less time in which the admin saves the staff information, vendor information and through this the staff and vendor gets the message through their email id in which staff and vendors can set their required password through their email securely thus it is highly secured authentication. Only an administrator can add staff and the vendors so that there are no chances of others/strangers can access to our application (only an authenticated staff, vendors added by the administrator can go through their modules and insert their asset and product license). Admin monitors the whole application an admin has all the privileges on application.

When comes to financial aspect it is difficult to estimate the depreciation value of asset as its category, type and the components are different so this problem is been fixed by our application by prediction and few different methods to calculate the depreciating value. Product license is been identified and notified when the expired date reaches and even the admin, staff and the vendors are enabled to check the license date purchase date and can also search the product by date and product-id.

The report is been generated for the asset like when the asset is inserted the general information, financial information, notes, attachments, history and the services by the vendors and service date, etc. frequently

breakdowns in the asset in which the status of the asset will change and never remains constant so it is importantly considered and been fixed by our paper application. It reduces the labor time down. Cost and the overall maintenance of the asset is been reported and recorded as its very rare to gain access of the proper details. This application is highly reliable, well authenticated, good user interface.

C. System Architecture

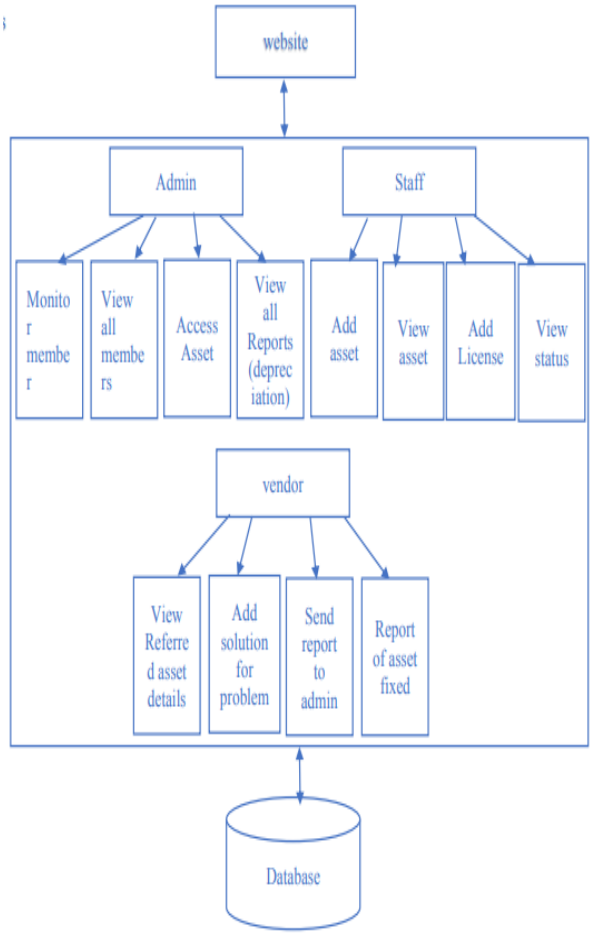


Fig. 1 Architectural Diagram

III. SYSTEM DESIGN

A complex application is dividing into small parts and been represented in picture called as the system architecture, so that the functionality and processing of the system can be clearly visible and the malfunctioning of the system is been easily identified and fix for the proper the solution. So in our application asset administration system the complex application is been divided into small parts and could able to attain the functioning of our application in this we are using the three modules and there functioning and represented that in the system architecture and in which the all the details and the information by the three different members is been saved in the database through website.

IV. DETAILED DESIGN

A. Sequence Diagram

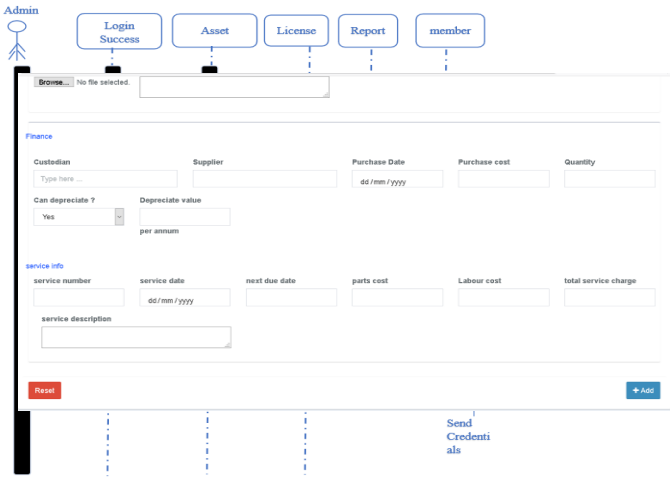


Fig. 2 Admin Sequence Diagram

V. IMPLEMENTATION

When developer works on the development field it is very important to consider the implementation field where it helps to develop the theoretical design and that will be generated as the system successful and work on the system practically. Developer must be confident while developing the website, implementation includes the interface design for our paper and thus, the interface been developed in a user- friendly, attractive and focus on the paper to execute properly so when designing the paper, you should take care of the paper components properly. Non-visual and visual representative for the social event mechanism interface has been designed with all the functions as user expectations. A design of user interface must be friendly like it must be understood easily and their functionality by the interface. Here it provides the complete information

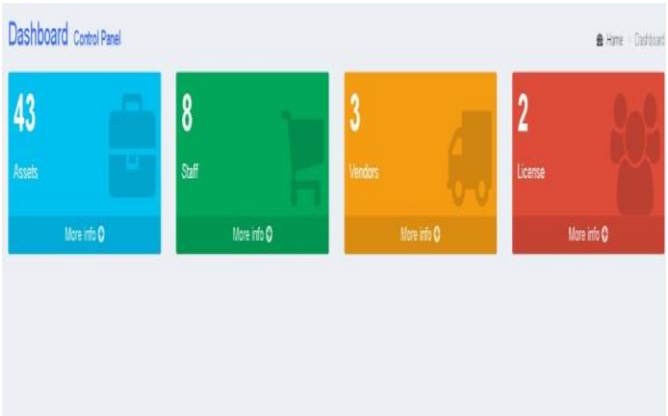


Fig. 3 Admin Dashboard

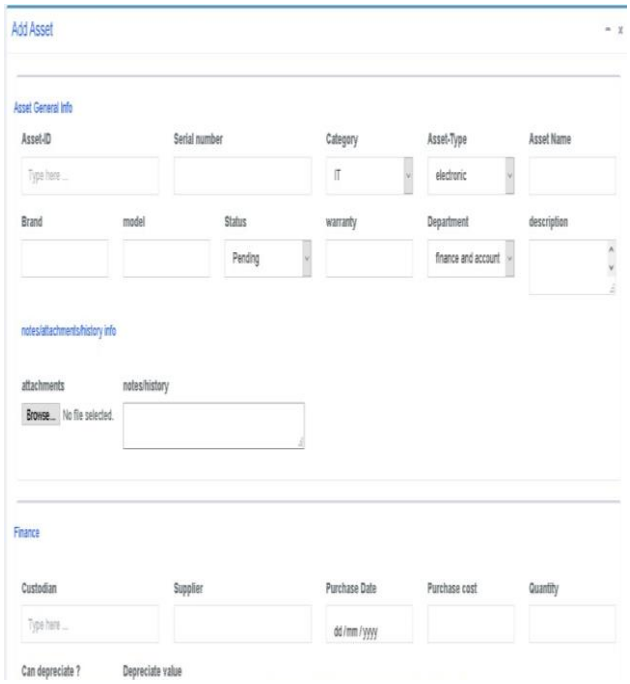


Fig. 4 General/Notes/Attachment/ History Information of asset Page

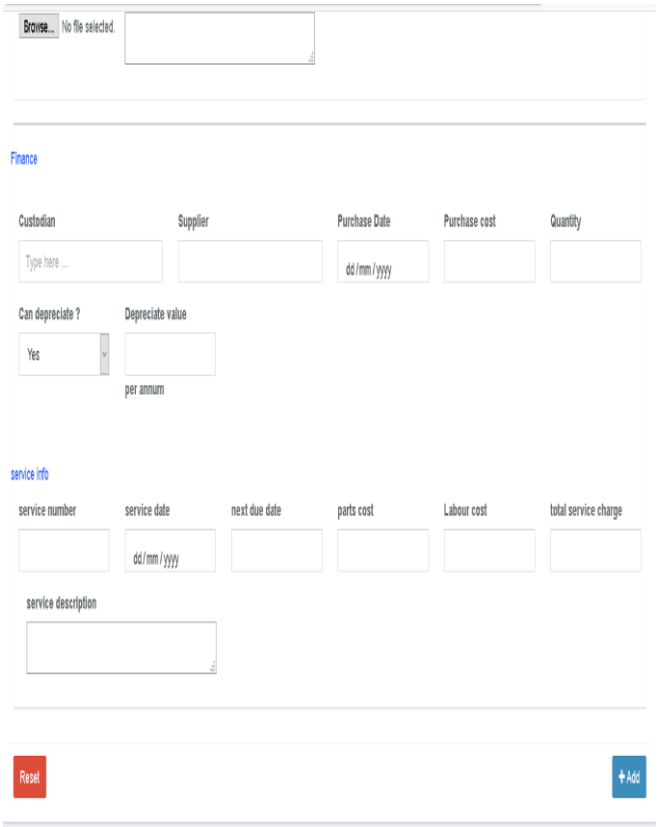


Fig.5 Finance/Service Information of asset Page

VI. RESULTS

Our paper Asset Administration System provides complete convenience, user -friendly interface and very informative on various asset are the important feature of our paper. The main theme of our paper is to maintain asset, details and information of asset properly. To check the product expiration license and thus, notify to an administrator. Our paper enables to maintain a company environment and ethics and most importantly it saves lot of time and money regarding asset as it provides the details about asset financial information and service information.

VII. CONCLUSION

To showcase any information website way to do that regarding AASTHI Asset Administration System has to be a website where it is used to provide a various type of services in different cases like asset information, product license details, reports on asset and many more with respective to asset and company. Our paper asset management is mainly focusing on the drawbacks of the existing system and is developed with real flexible in a proposed system. The main theme of our paper is to maintain asset, details and information of asset properly. To check the product expiration license and thus, notify to an administrator. Our paper enables to maintain a company environment and ethics and most importantly it saves lot of time and money regarding asset as it provides the details about asset financial information and service information. It is been interconnected to the various departments of the company under integrated network. Application is processed online that following the drawbacks of existing system. Some important features are considered in this paper such as security, data management and financial aspects.

VIII. FUTURE ENHANCEMENT

In our paper considering the drawbacks of existing we are here trying to build advance asset management system in a proposed system and to solve all the aspects of an existing system. In our paper Asset Administration System, we are here solving the category of NON-IT asset rather than the IT asset and to add a product license details and when a expiration date is reached then notification to user and a staff is been added so that a company software or product can be upgrading to a new version of software that makes the staff member to executing. Depreciation value is calculated based on the different types of formulae applied on the system and components based, calculating a depreciation value with exact result. And the prescription and prediction on asset and product license is manipulated by administrator and staff to their respective module and report. A report is generating based on dates, based on expiration, status of asset and cost of asset, etc. in this application here going to add two other important module rather admin called staff and vendor module in which a staff can also be enabled to specify the asset and product license, and a vendor to fix a problem online and allowed to chat with a staff member asset which has been referred by admin. So, our paper brings easy, flexible and reliable.

REFERENCES

[1] https://developer.mozilla.org/en-US/docs/Web/CSS

[2] https://developer.mozilla.org/en-US/docs/Web/JavaScript.

[3] https://www.php.net/manual/en/intro-whatis.php.

[4] https://laravel-news.com/.

[5] https://www.w3schools.com/php/php_form_url_email.asp.

[6] https://getbootstrap.com/docs/4.3/examples/.

AUTHORS PROFILE

Prof. Shivakumara T, working for Department of MCA, BMS Institute of Technology and Management, Bangalore as an Assistant Professor since 2008. He has completed his masters' degree (Master of Computer Applications) in 2007. Teaching the masters' degree computer applications courses prescribed by Visvesvaraya Technological University (VTU). Actively involved in teaching-learning process, as an outcome of it he was able to publish 3 text books, laboratory manuals, learning materials in coordination with co-authors in the same field. He has published few national conference papers and journals. His current research focuses on data and information security - data leakage prevention. He has been engaged to create awareness on cyber security-cyber safe Karnataka in association with cyber security center of excellence, Government of Karnataka, to school and college students. He is the member of ISTE chapter. Currently, pursuing PhD in Computer Applications under VTU.

Prof. Dwarakanath G V working for Department of MCA, BMS Institute of Technology and Management as an Assistant Professor since 2007. He has completed his masters' degree (Master of Computer Applications) in 2003. Teaching masters' degree courses computer applications courses prescribed by Visvesvaraya Technological University (VTU). He has published few national conference papers and journals. His current research focuses on Internet of Things . He is the member of ISTE chapter.

Dr. Chethan A S received M.Sc., Mathematics from Bangalore University and Doctorate Degree from VTU in 2013 respectively. From 2003 to present affiliated to BMS Institute of Technology and Management & Presently working as Professor at Department of Mathematics, actively involved in research area like Fluid Mechanics & Computer Science. Several papers published in reputed International/National Journals and conferences. Lifetime Member of Professional bodies like ISTE, ISTAM etc.

Prof. Muneshwara M S received B.E. and M. Tech from VTU in 2005 and 2012 respectively. During 2006 to present affiliated to BMS Institute of Technology and Management as Assistant Professor at Department of CS&E, actively involved in research area like Distributed Network security and Cloud Computing. Several papers published in reputed Journals and conferences. Currently, pursuing PhD in Computer Science under VTU.

Prof. Anand R currently working as Assistant Professor in the Department of computer science & Engineering . BMS Institute of Technology & Management, Bangalore, Karnataka, India. He is also a research scholar in the prestigious VTU University & simultaneously doing his research work & progressing towards his Ph.D. in the computer science field. He has also published a number of research papers in various national & international conferences. He has conducted a number of seminars, workshops, conferences, summer courses in various fields of computer science & engineering. His research interests are Data Mining and Computer Network.

Automation of Trainee Life Cycle in the Corporate World

Shivakumara T, Muneshwara M S, Rajshekhar M Patil, Nirupama B K , Chethan A S

Abstract: The paper proposes Automation of trainee Life cycle to override the problems that exist in the current manual system. This paper is supported to eliminate and to reduce the difficulties faced in existing system. This system is particularly designed for a company to carry out their operations in a smooth and effective manner. Automation of trainee Life cycle refers to an employee's journey in the company, the trainee to employee life cycle from the initial phase of recruitment to resignation or terminations. The selection of the centers will be based on the previous year days for a particular center. After the selection of center's the interview dates will be selected and the interview will be held for that particular center on the selected dates and in the end result of the interview will be updated to the application.

Keywords: Automation, Interview, Life-cycle, Trainee

I. INTRODUCTION

Automation of Trainee Life Cycle is a task that is created to defeat the issues in existing framework. This application causes us to dispense with and to lessen the troubles looked in existing framework. This framework is especially intended for an organization to do their tasks in a smooth and successful way.

Student Life Cycle alludes to a worker's voyage with the organization. From being student to an Employee, beginning from being selected and winding up with abdication or end. The "Computerization OF TRAINEE LIFE CYCLE" application is a web application that is for the most part created to lessen the manual work and get the surmised outcomes. In this application we have given 2 login certifications one to administrator, another is for hopefuls. The determination of the focuses will be founded on the earlier year information of every specific focus. After determination of the focuses the meeting dates will be chosen and meeting will be booked for the focuses on chosen dates and toward the end, aftereffects of the meeting will be refreshed to the applications.

Revised Manuscript Received on March 25, 2020.

***Correspondence Author**

Mr. Shivakumara T[1], Asst. Prof. Dept. of MCA, BMS Institute of Technology & Management, Affiliated to Visvesvaraya Technological University, Karnataka State, India, shivakumarat@bmsit.in.

Mr. Muneshwara M S[2], Assistant Professor, Dept. of CSE, BMS Institute of Technology & Management, Affiliated to Visvesvaraya Technological University, Karnataka, India, muneshwarams@bmsit.in.

Dr. Rajshekhar M Patil[3], Professor, Department of CSE, School of Engineering, CMR University, Karnataka, India, pvsmr1@gmail.com

Mrs. Nirupama B K[4], Assistant Professor, Department of MCA, BMS Institute of Technology and Management, Affiliated to Visvesvaraya Technological University, Karnataka State,India, nirupamabk@bmsit.in

Dr. Chethan A S[5], Professor, Dept. of Mathematics, BMS Institute of Technology & Management, Affiliated to Visvesvaraya Technological University, Karnataka, India, aschethan@bmsit.in.

An applicant after enlisted is considered as a Trainee at an association. It is most significant for the association to have a powerful support of the applicant's subtleties for the future use. With the goal that an association can have information about the student's and can see their status toward the end. In our application the administrator's main responsibility is to give required number of applicants, year and learner type for which the meeting must be held and our application will compute and get the top focuses to be visited for a grounds drive dependent on the necessities given by the administrator.

A table will be shown to administrator which contains information like I) expected of students, ii) Letter to be offer, iii) Candidates for composed test, iv) Number of Center. At the point when administrator taps on "number of center's" segment, the rundown of universities and focuses will be shown in like manner, this gives simplicity in choosing the best schools/focuses from the rundown. Administrator gets this rundown of the focuses dependent on the earlier year's joined rate and standard for dependability of that specific focus. Administrator needs to choose the no of focuses he needs to visit and every one of these focuses are been allotted with specialists.

Later the meeting results will be transferred in our application, and put away in associations' database that can be brought at whatever point it is required. With these information and data standard for dependability, cushion rate, joining rate for one year from now's grounds drive can be determined. A different rundown is made for the applicants who are chosen, rejected and put on hold. The applicants who are chosen must be approached the grounds yet not every person can be approached to come around the same time. So the association will make bunches, the groups are framed dependent on the past information (bunch prioritization + Numbers). Individuals from human asset makes telephone call to every possibility to report the joining dates and directions that are to be pursued and they will decide status of the applicants into application whether he'll be joining or not or might be far-fetched with reasons, these method will be completed multiple times i.e., first is before one month of joining, second before 15 days of joining, third is before 2 days, whenever expected number of hopefuls are not going to come at that day then they need to pull up the competitors from the other bunch, this will occur in the wake of calling contender for second time..

After the third call they will give the competitors' names to the security.
After finish of the joining conventions the applicants needs to login with their qualifications given by the association so they can fill the information application structure, Bank Advisory structure, ID identification Forms, ESI shapes in the application itself which will decrease the manual work. Utilizing these information given by the ace page (for example exceed expectations) is framed and after that report confirmation is directed, where they gather every one of the records from the competitors and send that information to human asset for ace creation. At that point the hopefuls will have instructional courses where they'll be furnished with a total association consider, after that the competitors will be apportioned to specific offices , the portion for the division will be done dependent on the office prerequisite. At that point the competitors will be allocated with movements' example and dates that will be handover to the division chief. So the learner needs to go to the classes dependent on the movements distributed to him. Toward the end, Academic outcomes will be reported of every competitor dependent on their presentation. In the event that the applicant neglects to clear scholarly tests, at that point he/she needs to suspend the preparation.

II. LITERATURE SURVEY

A. Existing and Proposed System

In the current framework, every one of the procedures that are incorporated into a grounds drive are been done physically in the present association. Ascertaining joining rate, standard for dependability of each inside was done in exceed expectations Document. What's more, an exceed expectations report for consistently grounds drive was put away. Joining rate, degree of consistency, support rate are been determined taking past three or four years information of each inside or school information into record. In the wake of figuring these rates, a rundown is been shown to the client. This rundown contains names of universities whose joining rates are high and are recorded in like manner. The client needs to choose the middle's that are to be visited for a grounds drive. In the wake of choosing the focuses, dates are been doled out to each inside. Following to this is making letters to each middle and mailing the separately. This includes a great deal of human exertion again for composing separate letters to each inside and mailing them to their specific location. To locate a precise degree of consistency, joined rate and other information it requires least of 3 years information and finding every year's information from administrative work is a monotonous activity to do. Ascertaining these information physically would regularly result in incorrect information. In current framework they didn't have alternative of choosing specialists, they used to make an exceed expectations sheet where they would record every specialist name and send it to make a trip work area to organize travel courses of action. However, our application is beating all these manual issues.
In the wake of completing a grounds drive, a rundown is made of hopefuls who have been chosen. Their subtleties, for example, name address telephone number scholarly subtleties are recorded in an exceeds expectations sheet. These understudies are called multiple times before joining so that to know their joining status. In the wake of knowing the joining status a groups are framed.

In current framework after all the joining customs have been finished the competitors should fill the association's application structure, Bank Advisory structure. These things were been recorded through desk work. These paper works are been called as ace information and are been sent to HRS office for further preparing. There might be where a candidate's structure would get lost and the candidate would confront issues to get a representative number as his structure has not achieved the HRS office.

B. Proposed System

Computerization of Trainee Life Cycle application is been created to supersede issues in the current framework. This Application goes for overseeing subtleties of schools, applicants, specialists of organization and to robotize current manual procedure with assistance of mechanized types of gear and undeniable PC applications to satisfy the organization's necessities so their significant data can be put away for an extensive stretch of time and kept up securely. It is the ideal device to give great execution and fulfillment to the customers. This application computes cushion rate, standard for dependability of every inside in foundation and presentations the outcome to the client on the screen. Our applications give adaptability to change the chose focuses, specialist if a client wishes to roll out any improvements .This application consequently makes various letters of each inside with this present HR's need to simply send the sends individually to specific focuses. This limits the human exertion of composing each letter for each inside. Framing bunch has been done greatly simple, administrator needs to transfer the exceed expectations report that contains rundown of chose understudies and our application will effectively shape groups in a base time necessity.

This device additionally helps in keeping up hopefuls joining status having a place with their separate groups. On the off chance that some of understudies are not going to join the association, at that point our application is sufficiently adaptable to include understudies from other group so the base number of understudies required for joining procedure can be met. Or maybe filling application frames by recording; our application empowers possibility to fill these structures carefully. These structures are been spared in database and kept verified.
Later these structures are been sent to HRS division with the goal that every applicant can get their own worker numbers. At that point applicants are been doled out to their separate divisions alongside their work shifts. Later these applicants are given their joining dates. This is the date that they'll begin working in the organization. On the starting days of a competitor as a learner he needs to experience an acceptance of the association. Enlistment is only an Organizational examination. There three 2 levels in Induction, Level 0 and Level 1. Both of the dimensions allude to

hierarchical investigation. Classes will be held each weekdays and organization tracks applicant's participation. On the off chance that a hopeful has withdrawn without advising the division, at that point he is pardoned just on the off chance that he has a legitimate purpose behind his nonappearance. On the off chance that a competitor execution is great, at that point is been elevated to various office and gets the opportunity to work in various

C. Feasibility Study

In current examination of "Computerization of Trainee Life Cycle" each procedure associated with a grounds drive was finished physically and man-took care of joining rate and standard for dependability were determined in exceed expectations record and each archive was kept for every year. In the wake of computing the joining rate and degree of consistency the schools having the most elevated number of rate will get chose for grounds drive, later the dates were allocated and every school or focus would get a different mail from organization. This was dull activity as HR division needed to re-compose each letter independently for every school. In the wake of sending letters to universities every one of these focuses are been relegated with specialists. These specialists are from HR of an association and they'll be the one's meeting those chosen communities for procuring hopefuls. To figure standard for dependability and joined rate, we need 3 years of information records of a school/focus association were having these information in a different exceed expectations sheet for consistently. so including every one of the numbers from each exceed expectations sheet would be tedious and furthermore results may turn out erroneously.

After the grounds drive, the chose understudies data was recorded in an exceed expectations sheet. These understudies will get an affirmation letter from organization on the day they got chose. These hopefuls will be called thrice before the joining day and their joining status will be noted down joining status was recorded in a paper subsequent to knowing the quantity of competitors that will go along with they needed to shape a bunch physically which is again tedious assignment. Our application is been built up every one of these issues and limit human exertion via computerizing however much procedures as could reasonably be expected.

III. SYSTEM DESIGN

A. System Perspective

Framework point of view is joining each viewpoint and conduct of an application all in all with regards to its condition. It clarifies the correspondence between each part of a framework. It accentuates a framework in general. It delineates the connection between the elements of a framework part's that depends on their connection with each other. It clarifies how this application is organized for the handling of information and characterizes the general conduct of the application.

B. System Architecture

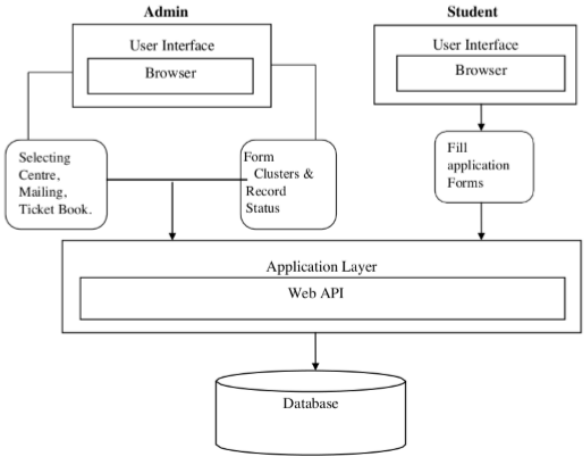


Fig.1. System Architecture

The figure above demonstrates the total working and engineering of the framework. This application has two levels, i.e Admin and understudy. All in this entire framework is a three level engineering framework.

First Tier – This level in the framework is User Interface. The User Interface in our application is straightforward and can give access to clients to normal highlights. This UI was worked to keep multifaceted nature to least however much as could be expected. It's through UI an administrator or understudy can speak with the gadget.

Second Tier – This level in the framework is application level. Application level exists between UI and database. It is utilized to speak with User interface, gets the data from UI and passes on to Database. It goes about as center layer between UI and the Database. This level procedure the data gotten by UI and after that stores it in Database. Furthermore, when a client needs to see that information it additionally gets required information from Database and show it to client in UI.

Third Tier - The Third level of framework is the Database. It is the storehouse of the information. It is the place all the prepared information is been put away. It is a gathering of report, questions, patterns and different components. Information is put away and furthermore recovered from the database to show to client.

In this application there are two clients. Initial one is administrator and the other one is Candidate. The Admin/Candidate enters or solicitation information from UI. The Web API process the data given to it and presentations data to client separately by recovering information from the database. In the event that any information is changed by clients, at that point it is again handled by the API and stores it in database.

C. Context Perspective

Context diagram is the overall view of a system. The initial level of data flow diagram is called as context diagram. it explains the complete working and functionalities required by the external entities. It can be subdivided into a number of data flow diagrams displayed in a hierarchy.

Context diagram is used to understand every entities and their interaction with each other in a system. Context diagram are typically included in a requirements documents. Diagram does not store any data in it. It is just a graphical representation of flow of system processes.

Admin has complete privileged over the application. He can access every candidate data, modify it, delete it or even add a new data. Admin manages all the details of a candidate. Admin is the person who decides which Centre's are to be visited and also he is the one who forms the cluster. After forming cluster he calls every candidate and asks them to join the company by assigning them a particular date. After candidates have joined, they have to fill the application forms .Its admin responsibility to keep these applications safe and secure. Later these applications are sent to HR department where each candidate is been assigned with employee id, their department and work shifts. Candidate's job is to fill the application form, bank advisory form and complete rest of the formalities, A candidate can apply for a leave through our application and also he can keep track of his attendance status through our application.

Above graph plainly demonstrates various elements of the framework and the correspondence between them. Initially, Administrator needs to sign in to framework by administrator id and secret word. Application's entrance can be increased just if administrator gives right client id and secret word. At that point administrator enters the quantity of required contender for that specific year.

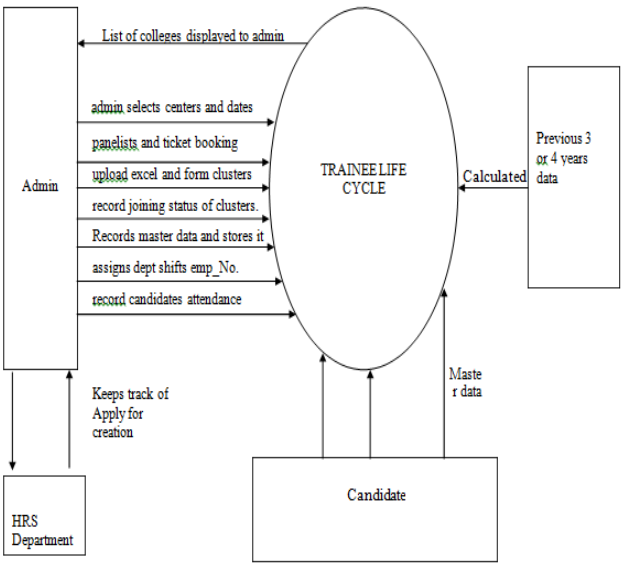


Fig. 2. Context Diagram of Application

Our application will figure cradle rate, joined rate and maintenance utilizing the information given by administrator. These rates are been determined out of sight utilizing 3 years of past information. In the wake of figuring a rundown is been shown to administrator as per the most astounding joined rates of each schools/focuses. Administrator chooses focuses to which his organization will visit for a grounds drive.

Following this is the determination of dates to visit and furthermore making an archive containing subtleties of the specialists visiting the grounds drive. This archive is sent to make a trip work area through mail to settle travel courses of action. Administrator has simply to choose name of specialists and submit in our application, archive of specialists will be consequently created utilizing specialists data that is put away in database.

After the grounds drive HR's transfer an exceed expectations report that contains nitty gritty data of chose understudies, understudies who are put on hold and furthermore understudies who have been rejected. This information is kept securely in our application.

After this group is shaped utilizing that exceed expectations record. Bunches are framed by consolidating the rundown of understudies of two unique focuses so to call these understudies without a moment's delay amid the joining day.

Rests of the benefits of administrator are

- updating bunches
- Add or expelling understudies from bunch
- Store hopefuls joining status
- Record understudies participation amid their classes.
- Uploading and putting away information of understudy's participation, their advancement all through their span in organization.

IV. DETAILED DESIGN

Itemized configuration is the execution part of the proposed framework where it portrays about the structure part of the framework. It incorporates the entertainers, use cases, functionalities and classes associated with the undertaking. It likewise includes the utilization case graph, grouping outline, movement chart and the database chart of the proposed framework.

A. Sequence Diagram

Arrangement chart of this application demonstrates how the various items in this application associate with one another. How the data is traded between the objects of this framework is obviously comprehended. The succession graph of this application unmistakably demonstrates the progression of data between the items in the framework.

In the beneath succession outline elements of the framework and the correspondence between them is clarified. Initially Administrator needs to login to framework utilizing the given login qualifications. Application access can be increased just if administrator gives right client id and secret key. At that point administrator enters the quantity of required possibility for that specific year. Our application will ascertain cradle rate, joined rate and maintenance utilizing the info given by administrator. These rates are been determined out of sight utilizing 3 years of past information. In the wake of figuring a rundown is been

shown to administrator as per the most elevated joined rates of every school/focuses. Administrator chooses focuses to which his organization will visit for a grounds drive
After the grounds drive HR's transfer an exceed expectations report that contains nitty gritty data of chose understudies, understudies who are put on hold and furthermore understudies who have been rejected. This information is kept securely in our application. After this bunches are shaped utilizing that exceed expectations report. Groups are framed by consolidating the rundown of understudies of two distinct focuses so to call these understudies on the double amid the joining day.

The following is taking understudies participation amid their classes, transferring and putting away information of understudy's participation, their advancement all through their term in organization. Sequence Diagram for Trainee Understudy must login first to fill the applications structure. These application shapes are been utilized to make ace information. This ace information is made to store the data of understudies. This ace information contains understudies close to home information, training subtleties, interests, and family data. This ace information is sent to HR division to get worker id to a hopeful. On the off chance that an issue is

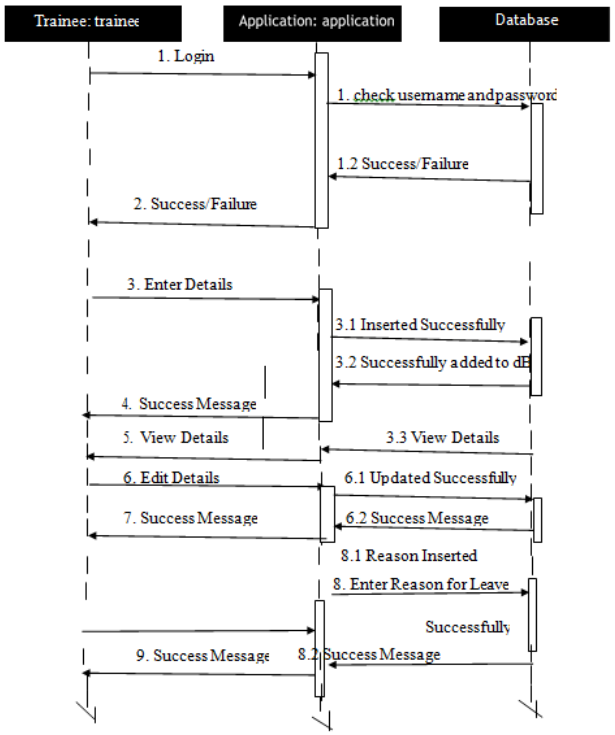


Fig. 3 Sequence Diagram for Trainee

found in ace information, at that point competitors would not get their worker id. Our application can likewise produce leave letters for applicants. on the off chance that an understudy is intending to disappear from work, at that point he/she can make leave letters in our application.

Understudies are been made to go to authoritative examination classes ever week. These classes clarifies everything about how that association functions, what is their motivation, for what reason are they fabricating their items, and considerably more subtleties of them. Amid this period HR should gauge participation of the competitors who go to these classes. This participation is been transferred in our application by administrator. Understudies can ready to monitor their participation by signing in and seeing their participation status

V. IMPLEMENTATION

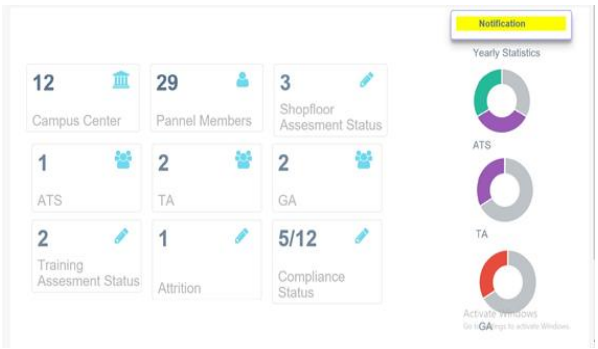


Fig. 4 Home Page

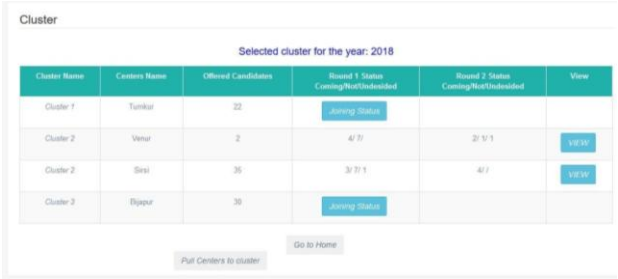


Fig. 5 Joining Status

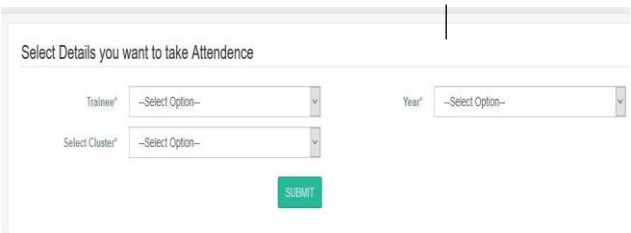


Fig. 6 Attendance

VI. RESULT

The primary point of utilization is to lessen all administrator works, to conquer the manual work process by computing the cushion rate, joined rate and the fulfillment rate and these counts out of sight and demonstrates the results on a site page and it is truly adaptable to change chosen focuses, specialist and dates. The bunch for the chose understudies from various focuses will be made and fix the joining dates for those focuses and furthermore adaptable to change the division of the learners, if the hopeful isn't performing up to office's desire. The administrator reserves all privileges to change the division of the learner.

VII. CONCLUSION

This Paper is formed for the organization use since they are keeping up every one of the students records in the exceed expectations sheets, there is an opportunity of missing records and there is an issue for ascertaining all the Buffer Rate, Joined rate and Retention Rate and the

learners are filling there subtleties in the physically in the structures, this turns out to be again a manual work for the administrator to make the ace information by gathering every one of the information of the students. So the organization thought of creating "Automation of Trainee Life Cycle" to store every one of the records alright for the future use.

B. Future Enhancement

They are checking all the qualification criteria physically, before joining all conventions of the archive confirmation is done physically, and refreshed into the application So they thought of consolidating scanner to the application with the goal that they filter every one of their records and append that to the application while filling the application structure.

They are directing the classes, this isn't appended to the application since this can't be joined to the application yet they can lead the test in this application. Anyway students can login to see the outcome in the application and they can step through the examination in the application itself, with the goal that crafted by the administrator will diminish. Also, they are leading the two unique tests for the learners one is from the office side, another is from preparing office, later they are joining both the outcomes and they are refreshing it in the application. On the off chance that this is incorporated into this application they can take up both the test in the application and join the two outcomes to get the normal and show the outcomes. This encourages the administrator to do practically everything physically.

.

ACKNOWLEDGMENT

The authors would like to thank the editor, mysterious reviewers for their valuable suggestions that appreciably improved the quality of this paper.

Finally also thankful to Parents, Friends, BMS Educational Trustees, Principal and HoD Department of MCA, BMS Institute of Technology & Management, Yelahanka, Bengaluru-560064, Karnataka, India.

REFERENCES

1. https://www.peocompare.com/product_pdfs/Employee
2. http://ieeeaccess.ieee.org/editorial-leadership-and-staff/Employee
3. http://anchorage2018.iot.ieee.org/files/2018/03/IEEE-IoT-Vertical-and-Topical-Summit-Alaska-2018-Call-for-Papers-v3
4. https://inside.6q.io/six-stages-to-success-with-the-employee-lifecycle/
5. http://www.balancepointpayroll.com/5-stages-of-employee-life-cycle-management
6. https://bizfluent.com/info-8132024-disadvantages-manual-accounting.html
7. https://www.bosch.in/our-company/bosch-in-india/naganathapura/
8. https://ideal.com/3-ways-recruitment-automation-will-change-recruiting-forever/
9. http://www.onrec.com/news/news-archive/automation-the-future-of-recruitment
10. http://www.selectinternational.com/blog/4-reasons-why-an-automated-hiring-process- will-help-your-company
11. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8856

AUTHORS PROFILE

Prof. Shivakumara T, working for Department of MCA, BMS Institute of Technology and Management, Bangalore as an Assistant Professor since 2008. He has completed his masters' degree (Master of Computer Applications) in 2007. Teaching the masters' degree computer applications courses prescribed by Visvesvaraya Technological University (VTU). Actively involved in teaching-learning process, as an outcome of it he was able to publish 3 text books, laboratory manuals, learning materials in coordination with co-authors in the same field. He has published few national conference papers and journals. His current research focuses on data and information security - data leakage prevention. He has been engaged to create awareness on cyber security-cyber safe Karnataka in association with cyber security center of excellence, Government of Karnataka, to school and college students. He is the member of ISTE chapter. Currently, pursuing PhD in Computer Applications under VTU.

Prof. Muneshwara M S received B.E. and M. Tech from VTU in 2005 and 2012 respectively. During 2006 to present affiliated to BMS Institute of Technology and Management as Assistant Professor at Department of CS&E, actively involved in research area like Distributed Network security and Cloud Computing. Several papers published in reputed Journals and conferences. Currently, pursuing PhD in Computer Science under VTU.

Dr. Rajshekhar M. Patil is a Professor in the Department of Computer Science and Engineering, in the School of Engineering and Technology, CMR University. He served as Principal in an Engineering College affiliated to Jawaharlal Nehru Technological University, Hyderabad. He has worked in the capacity of Assistant professor to professor and shouldered responsibilities from HOD to Principal and Director. He has also worked as a customer support engineer and handled many clients. His area of research interests are computer networking, information and network security, cryptography, data communication and networking and Network Data Mining etc. He has published several research papers in reputed Journals. He holds B.E. and M.Tech. in Computer Science from Gulbarga University and Visveswaraya Technological University respectively. He obtained Ph.D. in Computer Science from Dr. MGRRI, Chennai. He is a recognized research guide in Visveswaraya Technological University, Karnataka and is a reviewer of many national and international journals and conferences. He comes with an experience of over two decades in teaching and was working with Guru Nanak Institute of Technology prior to joining CMR University.

Prof. Nirupama, B K received MCA degree from VTU in 2010. From 2011 to present affiliated to BMS Institute of Technology and Management as Assistant Professor at Department of MCA actively involved in research area like Network security paper's published in reputed journals and conferences. Currently pursuing PhD in Computer Science under VTU.

Dr. Chethan, A S received M.Sc., Mathematics from Bangalore University and Doctorate Degree from VTU in 2013 respectively. From 2003 to present affiliated to BMS Institute of Technology and Management & Presently working as Professor at Department of Mathematics, actively involved in research area like Fluid Mechanics & Computer Science. Several papers published in reputed International/National Journals and conferences. Lifetime Member of Professional bodies like ISTE, ISTAM etc.

Self-Conceptualization and Multi Privileged Algorithm based Controller

Shivakumara T, Rajshekhar M Patil, Shantakumar B Patil

Abstract: ***The paper proposes to reduce the workspace, provide users to work on multiple applications in a single domain, provide the security for associates and the privileged people by giving a single sign on authentication. It is very complicated to oversee various factors related as far as bigger associative working. It is very hard to keep up with various kinds of workability on the individual dimension. We are using AES and DES algorithm for the authentication purpose. The design is based on established technical specifications that have been taken for multi domain working, add the technological variations are required to be consolidated. Self-repulsive identity-based panel will help the companies to secure their workability with advanced implied methodology and with variations of governance that is provided with cloud support. The system will be more useful when large, complicated instance are required to be organized. The conditional understanding with the policies will be also supported which will be more helpful to organize that type of working orientations needed by a particular company. The system provides identity provisions for managing a particular appliance also so as to organize large working environment. The framework is synchronized such that may be utilized very well by the customers with the typical comprehension of innovation.***

Keywords: identity-based, security, sign-on, self-repulsive

I. INTRODUCTION

The dynamics that are required to regulate multiple fold of resource standard can be properly established from a central working unit. To provide the specified privileges in terms of information security and other principles that are required to be followed when multiple integrated work force with various resources have to be established. The system provides all types of cloning for individual specifications of the clients as the need for Central service is required. The design of the system will provide well planned factorial specifies to accomplish essential consolidated working with various terms of workforce utilization, resource utilization, factorial incorporation, associations and statistical information.

The system acknowledges multiple Technologies on platform usage which can be easily established once the service orientation has been provided by the provider. Various types of hierarchies that are needed to be maintained when various paper implications are required to be organized can be established from a central point. System also provides all token establishments to ensure that policy and factor based security can be provided. To ensure proper understanding the factors that are provided is related with substantial guidance or guidelines so that is implementation is possible on the client side in terms of the complicated processes that are required to be undertaken add each and every factorial and factor options provided will be predefined with all the selective form based pages so that the inputs and collections can be provided by the client.

As the inputs are provided by the clients multiple categories can be added for the implementation of the particular rule that has been defined or even individual identities of our organization can be considered. Systematic approach to maintain all the working steps of an organization are defined with different types of functionalities included which can be individually selected and used. If a particular organization is not willing to use a particular option provided it can be skipped and other operation can be performed for example if a particular security inclusion is not needed it can be skipped. The implementation considerations will be self-defined and can be properly managed according to the individual requirements of the client and taking the services for example of a particular resource is required to be used it can be selected and incorporated in particular account.

The resources and the related work optimization from a central space will help the organizations to optimize their working as multiple vendors are included and easily all the types of Logistic challenges can be organized. The systematic valuation of the work with all types of statistics needed will be provided to the users with various formations and filters to get the exact information required. The system provides well defined working in variations of hierarchy and the accessibility control which will provide a significant controlled to the organization based on individual identity based on different teams. Standard lightweight directory protocol command system for the application log can be properly established to manage the sensitivity of the IT resources on the network working where individuals systems full communicate with the central system to get the trusted accessibility. The list of information can be organized in a hierarchy and individual systems will login to the server and with the help of the protocol different levels of accessibility will be provided. The rules are design in a way that it can be simplified for the implementation and the users and the teams incorporated can be easily managed from a central interface so at any time the control can be established.

Revised Manuscript Received on April 21, 2020.

***Correspondence Author**

Mr. Shivakumara T, Asst. Prof. Dept. of MCA, BMS Institute of Technology & Management, Affiliated to Visvesvaraya Technological University, Karnataka State, India, shivakumarat@bmsit.in.

Dr. Rajshekhar M Patil, Professor, Department of CSE, School of Engineering, CMR University, Karnataka, India, pvsmr1@gmail.com

Dr. Shantakumar B Patil, Professor, Department of CSE, Nagarjuna College Of Engineering and Technology, Karnataka, India, shanthakumarbpatil@gmail.com

The policy option is also help to establish the control in a desired fashion as different types of inputs can be provided from a central page by the administrator to govern the entire Network and Organization work force.

The Identity Federation that is provided will be acknowledged by the system in real time with all standards to be followed. The system also provides the replicated authentication with the help of multiple machine identification methods which is also supported to provide higher end self-defined structuring if required by the client. Adaptive access system will be provided in

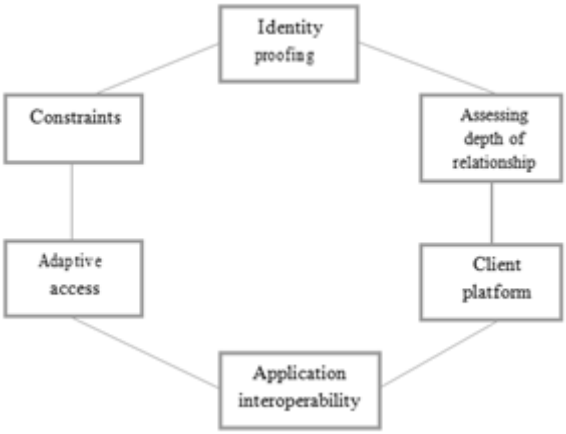


Fig. 1 How interoperation ability waste resource

terms of the resources where are self-service option will be provided from which the request can be incorporated to get the resources needed with direct vendor communication. Detailed environment matrix can be achieved with a simple click by providing the requirements as the system keeps on multiple Matrix report for better understanding of the entire working within the organization.

The above figure shows that how the ability of interoperation waste the resource will be provided on a service platform with all identity proofing and other constant management options so that central mechanism can be achieved with secure large organizational working management.

A. Problem Formulation

To provide the users with the central activity platform as the system will help them to provide different activities so for each activity the workability accuracy has to be undertaken.

B. Scope and Objective

Lots of compliance standards and different situations related to security can be centralized with a well define working processes which will be a benefit for the organization

Centralization is the main objective in terms of work flexibility and global skill support so that any organization can use it in a define fashion. System can be used in different work as multiple functionalities are provided which can be used accordingly so we can say that system provides multi-functionality working on a larger scale with all sensitivity requirements

C. Methodology

Selected SDLC is agile methodology which will be used as it will provide better transparency and all types of cost and schedule predictions are properly associated where is even with the help of the agile methodology the changes that are required in regards to the features can be properly organized and it also provides use of focused workability. If the system provides multiple functionalities and in the future more options can be added, we have to apply agile methodology.

II. LITERATURE SURVEY

A. Existing System

The analysis of multiple client for the drawback specifications in terms of define methodologies and policy has been conducted and we found that inclusive architecture management with multiple workflows requires multiple resources, teams, data structuring, security, control accessibility, report etc. which will be managed and organized with the help of various expertise and when the resources which is quite difficult as individual perceptions are required to be acknowledged. We have outline the detailed references that has been analyses and are listed as following which will be taken for proposed system design development.

- Security needs with different base methodologies cannot be centralized to organize various environments and platforms in the existing system making it quite complicated to manage different factors associated in terms of larger organizational working.
- Resources and the referential associations that are needed to maintain different types of workability in a particular organization or within multiple bunch of environment it's quite difficult as it is maintained on the individual level.
- Policy requirements cannot be maintained on a input based structuring for the entire work force from a solitary page in the current framework.
- Centralizing the work of entire organization through a service based platforms not possible with different work channel working at the same time in the existing system which indeed requires multiple environment and work channel management by the organizations.
- Service and the direct integration for self-service based resource inclusion is not provided in the existing system and all references will be undertaken according to the requirements with detail setup.
- Work centralization with data integrity and accessibility on individual perceptions is not possible and it's quite difficult to organize as different teams in individuals have different requirements.
- Machine based security in terms of biometrics and other factor securities cannot be managed in a hierarchical fashion in the existing system from a single console in various resources are required.
- Working acknowledgements require multiple expertise as overall multiple activities has to be managed in different regards in a particular organization making it expensive work.
- Hierarchy control from a central space is not supported as various factors are included
- Data in terms of organizational working and control for the report generation is also based on individual perception and activities making it quite complicated to filter the required information for the control and management.

B. Proposed System

The problems faced and as listed above in the existing system is taken into deep consideration to design a system that can provide an alternative to the organizations in a way where all aspects of working can be customized and a systematic approach in terms of security can be provided. The proposed system is well established in a way where multiple vendor partnership will be seen to provide various types of working resources and collaterals required where is the design of application is to provide a self-oriented multiple security formations according to the Criterion and according to the mechanism that is required to be followed by a particular client.

The proposed system provide multiple working features some of them are listed as following-

- Utilities in a distributed format with various work culture support provided from a central space as multiple when the integration will be incorporated which will help various types of organizations to have associated work.
- The requirements in terms of rules that are required to be implemented on the work force that will be integrated will be acknowledged from central space by selective inputs which will be set up by the administrator of particular organization so it will provide the flexibility of control to regulate the policy.
- The techniques that are required in different variations of organizational working will also be added which can again be selected and when a particular option will be selected guidance system will be provided as structures are predefined.
- Complicated structures are incorporated at one place to provide the work flexibility and better understanding to the client.
- Proposed system will be cost effective as multi variation of working will be included add a particular account service has been taken various selective options can be used.
- To have more reflex and to have more understanding of the overall distributed working a detailed tracking system is included which can be used by the authenticated administrator to learn and understand the work matrix.
- The working organization required adaptability in terms of multiple team integration the proposed system will provide a base space which can be used directly for the working and for incorporating the resources required.
- Hierarchies are supported with individual security implementation as various methodological options can be systematically included on the individuals and teams.
- All customization support is provided including self-service option where the request to the director wonder working can be sent apart from which all aspects of working and branding can be organized on the preferences of a particular organization.

III. SYSTEM DESIGN

This paper describes approximately the system perspective of the proposed framework. It depicts about the interplay between database and modules. This paper involves architecture system, data flow diagram and context diagram of the proposed system.

A. System perspective

Fig. 2 Sequence Diagram

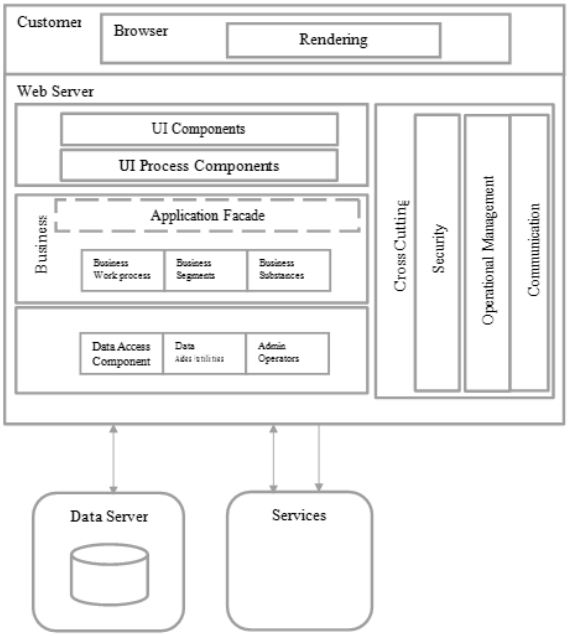


Figure 3: Architecture diagram

IV. DETAILED DESIGN

Detailed configuration is the piece of executing the proposed framework where it depicts about the design part of the system. It includes the collaborations between the instructions, and the activities recognized within the system. This paper incorporates the use case outline, sequence graph, activity chart, ER diagram and database scheme of the proposed framework.

IV. IMPLEMENTATION

This paper while the hypothetical plan wound up onto the working machine. This can be very well may be the best significant in examining a productive new contraption on providing an individual, conviction that the new structure will work and be convincing. Utilization paper entails investigation and planning of the present framework and it's necessities on execution, strategies and organizing.

5.1 Screen Shots

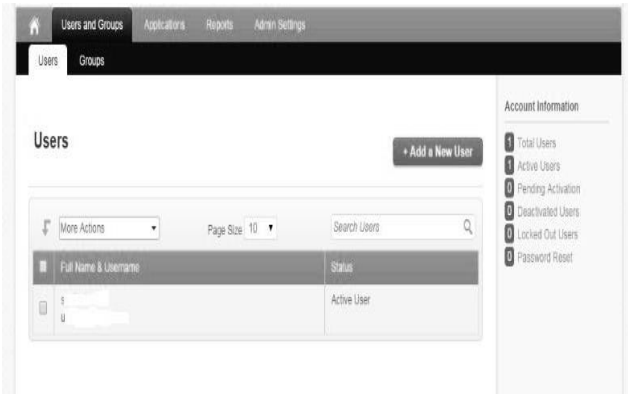


Fig. 4: User's Management

In user field administrator can include another user, can search users by their full name or by username. In the right side corner this page contain matrix information which is named as account information that shows the total number of users added, All out number of users signed in or active, who are not logged in yet, who are deactivated, locked out users and password reset.

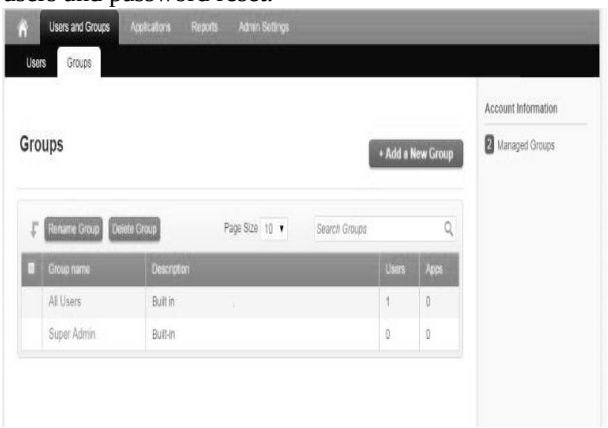


Fig. 5- Defining Different User Group

In the groups page admin can add groups or admin can divide the multiple users into single group to provide or assign them some work like testing, documentation, coding, designing etc.,. Admin can search group by the group name, can delete the group and can rename the group. In the right side corner this page also contains account information where admin can know how many groups are managed.

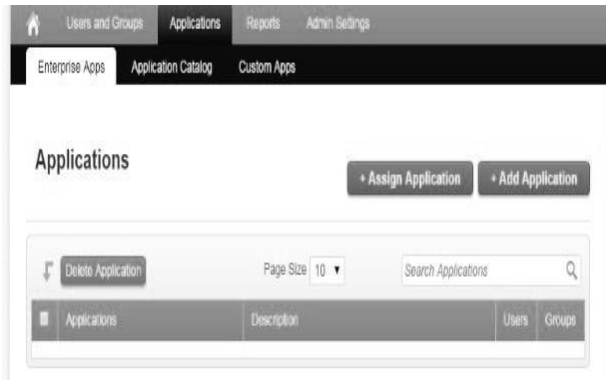


Fig.6: Resource Allocation and Selection

In application page we have three fields in that one is enterprise apps which contains the selected tools or applications from the application catalog field will be saved under this. Admin can delete application, can add applications and can assign applications directly to the users and groups.

Fig.7: Browse resource for the usage

In this page we can see application catalog field where some application are provided to the client as per their requirements that will be shown under this with application name, SSO integration type, and action. The one more field we can see under application page is custom apps, here admin can request for the particular application that he needed which is not provided in the application catalog.

By taking billing from the application catalog we can see getting started, SSO, users and groups. Getting started is used to know the features of the software. SSO is used to do one time login and no security process will be asked. In user they can assign applications to the users, can search users and can remove users. In group they can assign applications to the group, can search group by group name, can remove group.

In the below report page shows the generated reports which is structured by the system. Admin can search the report by the date range from – to, can search by user name, email id or by IP address and can also search by the type of action. The selected report can be exported i.e., sharing.

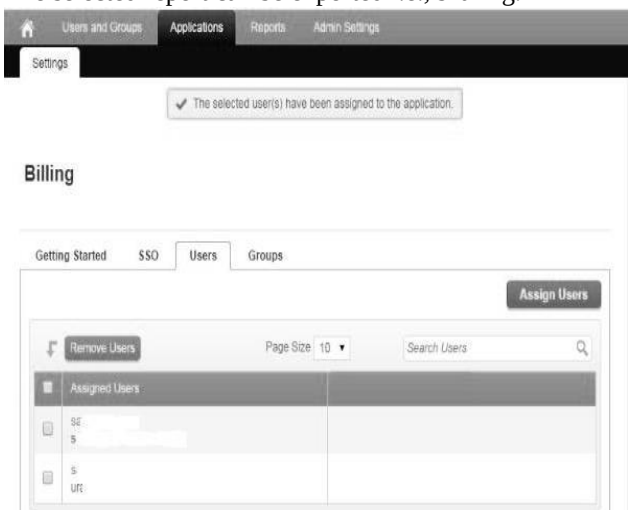


Fig. 8: Manage billing tool that has been selected

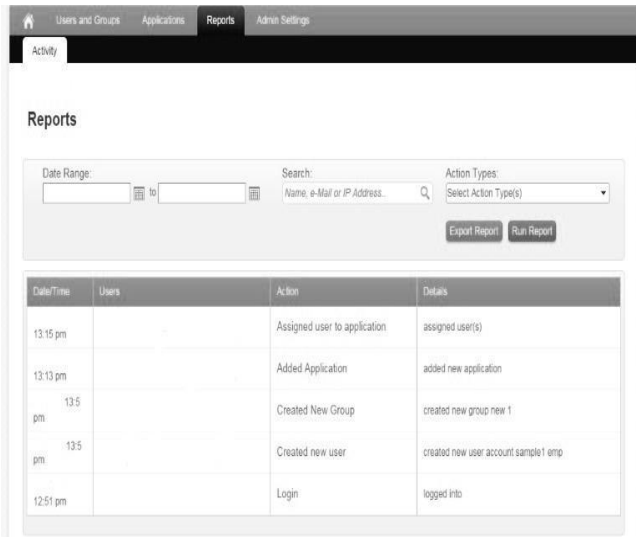


Fig.9: Report generation

V. RESULT

The sensitivity of data that is more important for the organizations these days due to more security threats that involves and the data leak is required to be handled properly. For the proposed design we found that everything synchronized in a way that it can be used by the clients with a normal understanding of a technology. Easy process formations and synchronization is included. Flexibility is provided to the clients by including multiple types of features related to the corporate working. Multi security processing can be involved. Multiple workforce involvement is supported. Multiple policies in fusion supported and can be properly implemented from central control system.

VI. CONCLUSION

The rise of cloud communication and intended market on a global scale is taken into consideration for the development of the system as it can handle larger organization requirements for the implementation of different types of corporate activities and the related factor security has been taken into consideration. The sensitivity of data that is more important for the organizations these days due to more security threats that involves and the data leak is required to be handled properly. As we have seen the system we found that all processes required for an integrated implementation of working is provided in a way that it can be used according to the organization need and practically it will be quite cost effective for the organizations as according to the collateral usage the charges are undertaken. Due to the usage of the system on a global scale based on different types of accounts and accessibility rights the digitalized working will be enhanced and will be quite flexible as all the control will be centralized for the organizations from the customized rule implementation based on security to the related collateral usage and even in terms of the guidelines that are required to be implemented in terms of the policies for the larger work force. All types of working considerations can be properly processed and for the detailed references inbuilt working input forms are provided. Implementation of the policies are quite easier and even the related methodology required to be incorporated are made in a way that it should be simple for the clients as the complications of multiple integrated system involves in the existing scenario which have taken into consideration

FUTURE ENHANCEMENT

Enhancement is much needed as the contribution in terms of the component acknowledgement provided by the system will be on a large scale with multiple Global clients working at the same time including multiple types of working methodology so proper service investigations are required to be done, and the design of the system can be modified with more inclusion requirements. So, all the points that are taken for the consideration are as follows. Involvement of more collateral on self-service by including more clients in the future. Including more advanced reporting with more filters in report types for better control. Including more references and collaborations in terms of workforce management.

ACKNOWLEDGEMENT

I would like to thanks to my research supervisors, my colleague Mr. Muneshwara M S for their continuous support. I also thanks to the persons who are directly or indirectly helped to achieve in writing this article. And also thanks to my college Management, Principal and HoD, MCA, BMSITM.

REFERENCES

1. Java Platform, Enterprise Edition (Java EE).
2. Oracle Technology Network. Oracle. December-18-2014.
3. "Java-One 2013 Review: Java Takes on the Internet of Things". Archived from the original on April-19-2016.
4. https://en.wikipedia.org/wiki/MySQL
5. https://www.scribd.com/book/375674864/Java-Platform-Enterprise-Edition-Java-EE-Complete-Self- Assessment-Guide

AUTHORS PROFILE

Prof. Shivakumara T, working for Department of MCA, BMS Institute of Technology and Management, Bangalore as an Assistant Professor since 2008. He has completed his masters' degree (Master of Computer Applications) in 2007. Teaching the masters' degree computer applications courses prescribed by Visvesvaraya Technological University (VTU). Actively involved in teaching-learning process, as an outcome of it he was able to publish 3 text books, laboratory manuals, learning materials in coordination with co-authors in the same field. He has published few national conference papers and journals. His current research focuses on data and information security - data leakage prevention. He has been engaged to create awareness on cyber security-cyber safe Karnataka in association with cyber security center of excellence, Government of Karnataka, to school and college students. He is the member of ISTE chapter. Currently, pursuing PhD in Computer Applications under VTU.

Dr. Rajshekhar M. Patil is a Professor and HoD of IT, CMR University, Bangalore. He served as Principal in an Engineering College affiliated to Jawaharlal Nehru Technological University, Hyderabad. He has worked in the capacity of Assistant professor to professor and shouldered responsibilities from HOD to Principal and Director. He has also worked as a customer support engineer and handled many clients. His area of research interests are computer networking, information and network security, cryptography, data communication and networking and Network Data Mining etc. He has published several research papers in reputed Journals. He holds B.E. and M.Tech. in Computer Science from Gulbarga University and Visveswaraya Technological University respectively. He obtained Ph.D. in Computer Science from Dr. MGRRI, Chennai.

He is a recognized research guide in Visveswaraya Technological University, Karnataka and is a reviewer of many national and international journals and conferences. He comes with an experience of over two decades in teaching and was working with Guru Nanak Institute of Technology prior to joining CMR University.

Dr. Shantakumar B Patil, working as Professor in Nagarjuna College of Engineering & Technology. He obtained his B.E degree in Electrical & Electronics Engineering from Karnataka University Dharwad in 1993 and M. Tech in Computer Science & Engineering from VTU Belagavi in 2002. He obtained Ph. D degree from Dr. MGR University, Chennai in 2011. His areas of interest are Data Mining, Artificial Intelligence, and Formal Languages & Automata Theory. He has 24 years of experience in teaching and published twenty Research papers in National / International Journals and conferences. He is recipient of BEST TEACHER award twice, when he was in MVJ College of Engineering and has received BEST PAPER awards in National and International Conferences across the world. He is guiding five Research Scholars for Doctoral Degree. He is Life member of ISTE, CSI and member of IEEE.

International Journal of Advanced Science and Technology
Vol. 29, No. 7, (2020), pp. 8160-8171

Detecting Presence of Power Law to Understand the Distribution of Patient Groups Related to Chronic Diseases on Social Media

M. Sridevi[1], B.R. ArunKumar[2]

[1] *Research Scholar, VTU Research Centre and Asst. Professor, Department of MCA, BMS Institute of Technology & Management, Bangalore, India*
[2] *Research Supervisor, VTU Research Centre and Professor & Head, Department of MCA, BMS Institute of Technology & Management, Bangalore, India*
[1]*sridevim@bmsit.in*, [2]*arunkumarbr@bmsit.in*

Abstract

Social networking has opened up new research avenues in diversified domains and healthcare is one among them. Interactions on online social networks may result in discussions on health and healthcare related issues that enable the participants to share their experiences in dealing with the disease. This is especially useful in the scenario of chronic diseases where the disease persists with various stages of progression having different symptoms, diagnosis and treatment. Even the lifestyle parameters affect the onset and progression of chronic diseases. In this context, healthcare consumers tend to use social networking as a tool to share their experiences for emotional and informational support that would help to overcome geographical barriers and come together as a group. Our present study attempts to analyse the distribution of patient groups of two chronic diseases namely Alzheimer's and Diabetes on Facebook, their compliance with power law distribution that is inherent characteristic of real-world networks, trends of creation of these groups over the last decade and their current activity status. The outcomes of our research provides a good foundation for further study on the usage of social networking in healthcare and allied sectors.

Keywords: *Patient groups, Zipf's distribution, power law, chronic diseases, social media, healthcare.*

1. Introduction

Prior to the advent of social media, patients used to receive advice related to health and doctor referrals through their relationships in private social networks. Now, sophisticated social networks provide reviews of doctors or physicians, advice on patient care, review of diagnosis and treatment methods, and personal experiences with a disease condition. The social networks are actively used by patients for medical care advice and assistance, for education, emotional and psychological comfort and support. The patients would like to compare the effects of treatment with the experiences of other patients. They can also obtain valuable advice, from their peers in the homophily networks, on self-care and what they may confront in the treatment process. Patients suffering from chronic diseases and their caregivers (in cases of cognitive impairment) might use social networking sites as a rich source of information on diet, exercise, caregiving and medication. The members of the network might assess and review the received care from healthcare professionals. They can also rate the services received so that it provides useful information in selecting best rated healthcare provider.

Healthcare researchers and providers are encouraging the patients' usage of social media as it offers a wider view to the world of patient experiences with respect to services as well as diseases. Also, the patient-centric social media provides a complex web of data which can be mined for social science

based healthcare research providing huge benefits to caregivers, patients and researchers. In this scenario, exploring the features of context specific patient networks provides a strong base to explore new avenues of research in healthcare and patient empowerment. This work focuses on analysing data collected about Facebook patient groups to find their compliance to real world networks using power law approach. We also tried to understand the trends of patient groups' formation on Facebook in the past decade from 2008 to 2018 which further explains the rising awareness and participation of patients and caregivers in utilizing the social media for emotional, informational, esteem and network support as mentioned by Sridevi and Arunkumar (2017).

1.1 Relevant Work

There are limited number of studies that analysed patient networks on social media and their dynamics. The "Social Network" term was framed by Barnes in the year 1954. Social networks are used to represent the complex relationships between people who participate in communication with each other. The communication can be of two types: symmetric model that demonstrates two-way relationship where both the nodes should confirm the participation in the relationship and asymmetric model that demonstrates a one-way communication or relationship that can be established by a node or person who is interested in the connection. The value of any type of network can be influenced or controlled by the activity between the nodes in it as stated in the work by Rastogi (2016). The white paper by IBM Software (2012) highlighted that social network analysis may help to understand and make predictions about future behaviours of the network such as their likely intentions and courses of actions in certain contexts. It also showed that the network structure can determine the connections between crucial people of interest whose position in the network may greatly influence the remaining network.

Ngo et al. (2015) proposed a framework for crowd monitoring based on emotional analysis of tweets on social media to find out types of crowds in an event for managing the emergencies in mass gatherings. The emergence of social media platforms provides rich opportunities to capture and record valuable information about what and how people think and feel. In case of patient networks, the social media serves as a stage for exchanging emotional support as well as providing advice based on one's experiences with the disease, diagnosis, treatment, medical professional, or in caregiving.

Emily et al. (2015) performed a study by using a survey that is web-based to gather opinions of difficult but important aspects of diabetes care from the patient members of a community hosted on a website-based social networking. The qualitative and quantitative results after the study emphasized that important challenges faced by the patients were lifestyle concerns and interpersonal concerns. The study demonstrated the novel usage of online communities and social networking to gather meaningful and relevant perspectives of patients in a rapid way that can be used to inform the research agenda development. Though there are some limitations of online surveys like selection bias because of the potential unrepresentativeness of these community members, and lesser response rates, patient engagement through this channel has number of strengths like easy identification of individuals who are interested to participate, quick collection of information from considerably large community of stakeholders, and cost effectively collect a large volume of qualitative data. The study is completely based on web-based survey conducted to collect data from members of online diabetes community on PatientsLikeMe website.

Social networking online makes it hassle free for the individuals to interact with others experiencing health issues similar to them and enables them to exchange social support. This leads to increasing interest to understand the dynamics of patient networks on social media. Yan et al. (2015) proposed a framework with two dimensions of social capital namely network embeddedness and cognitive capabilities that shape the patient networks. The authors highlighted that patients, in online health

communities, are unlikely to form close connections that form cohesive groups and supported their argument by their results showing significant but a negative coefficient for a dense relation. This claim is further backed up by the well-known network phenomena that a strong tie ensures the effectiveness of communication while a weak tie brings in new ideas and characteristics. For this study, the authors have collected data from patients' subscription network. They asserted that this kind of online healthcare communities contribute to the transformation of the way the healthcare is delivered.

Relatively less research has been carried out in the domain of social media network analysis that focused on opinion and extraction of e-health data that constitutes of data expressed or discussed in various website pages or blogs by users related to diversified aspects of their health. Analysing sentiment and network on this kind of data can unveil health patterns that help various organizations to understand and address concerns of the people or predict the patterns of outbreak in the scenario of contagious diseases. Sonia Saini and Shruthi Kohli (2016) outlined in their paper, the machine learning techniques which help in the analysis of data belonging to medical domain collected from social networks. They have discussed about various data mining techniques that are suitable for social network analysis and provided a comparative study of different text mining techniques to extract related data in the context of medical domain.

Popoiu et al. (2012) aimed at promoting scholarly inquiry about the usage of social media in the development of best practices in teaching learning process in medical education. They introduced theoretical aspects of social media usage and its estimated impact on healthcare and medicine, and the ways in which medical education currently employed social media to enhance its permeability. The points like transformation of healthcare and how it is perceived by the patients by using social media applications/ tools like Facebook, Twitter etc. and how higher education in medicine could focus on opportunities, risks and barriers of Medicine 2.0 in social media were discussed.

The research carried out by Guimaraes et al. (2017) suggests that one of the most important parameters in the user profile on social media is the age group that would help in exhibiting typical behaviour among the same age group users and that too when they communicate about the same topic. More reliable results in sentiment analysis on social networks can be obtained if the profile information of users and their writing characteristics are taken into consideration. It was concluded that the Deep Convolutional Neural Networks, among other machine learning algorithms, reached the best performance when used to perform classification of age groups in social networks.

Research on what factors influence intentions of users to share and seek health information on social media is shared by Li et al. (2018) The extensive literature review performed by them unveiled benefit factors such as informational and emotional support that are anticipated by the users of healthcare social media. Benefit factors such as perceived usefulness and credibility, and risk factors such as privacy, social, psychological, time and mental intangibility were also identified. They proposed that in the social media healthcare applications scenario, the consequences of observed benefits include observed credibility and usefulness of health information shared on social media as well as informational and emotional support from social media health communities. The Net Valence Model (NVM) developed by them, which integrated both benefit and risk factors, was used to investigate intentions of users to share and seek health related information on social media.

Social networks provided a paradigm shift in the way people expressed their views and opinions. This is channelized by online discussion and opinion sharing sites, blogs, textual publications, product review websites etc. People started relying more on this kind of user-generated content. Birjali et al. (2017) proposed a method to predict ideas or acts of suicide using the data that is collected from social media. Data mining tool Weka is used to extract relevant information for the classification of this data.

Algorithm to calculate the semantic similarity of tweets collected in the training set based on semantic analysis resource using Wordnet, was presented.

Bogdanov et al. (2013) developed a model to incorporate dynamic user behaviour for information propagation in social media. They coined a new term called 'genotype' which was explained as per-topic user interest and activity summary, and susceptibility to adopt new information. It was demonstrated that the user genotypes doesn't change within a topic by assuming them for classification of spread of new information in scale-free networks. The knowledge of user genotypes and structures of influence facilitates for the framing of effective and efficient strategies for minimization of latency for topic-specific spread of information in social networks.

Social network analysis provides a new view on the evidence-based practice implementation in healthcare as presented in the study by Heijimans et al. (2014). Insights into the network-related mechanisms in healthcare and self-management in terms of health-related behaviours are yet to be explored. They explored the role of healthcare providers' and patients' social networks in the delivery of care and outcomes of cardiovascular risk management in primary care. The social networks in this study were constructed using data that is captured from information exchange between participants involved in cardiovascular risk management network. Data collection process for these social networks of patients and health professionals was performed using manual questionnaires. The results obtained by them can have clinical implications by highlighting the role and importance of social environments of patients for disease handling and altering self-management.

Patients and caregivers dealing with chronic diseases confront a wide range of treatment options that would require knowledge in healthcare, the ability to navigate healthcare providers and services, and a constructive approach to self-care. In order to address these, healthcare providers and organizations have started to recognize the importance of making patients involve in their treatment more proactively. Many findings highlighted the importance of engaging patients in self-care that patients with the confidence and skills to self-manage health tends to achieve better health outcomes at lower costs (Health Affairs (2013)). The survey presented by Emil et al. (2016) studied patient empowerment in terms of their involvement in seeking health information, peer and provider interaction and the healthcare access. Even a fairly proactive chronic disease population can face difficulties with synchronizing their goals with that of treatment providers'. Customized disease-specific strategies for patient empowerment have to be formulated as empowerment levels vary across diseases, especially those that are difficult to diagnose and treat. The patients for this survey were recruited through PatientsLikeMe, an online research platform that facilitates sharing of personal health information of patients through structured data collection.

The elaborate review made by Griffiths et al. (2015) on the impact of online social networks on healthcare and health systems, and related case-studies revealed that interactions through health related social networking provides a platform to link people having similar health experiences who would otherwise remain geographically isolated. Major part of interactions on social networking sites constitute individuals seeking support from peers, as they struggle with either caregiving or with their health conditions. Health related social networking improves awareness of available health services, and educates individuals about their need for healthcare. This can indirectly lead to rise in healthcare demand which may further lead to amendments in service provisions and policies. The study carried out by Griffiths was limited to established platforms where the trained platform managers have control to shape the flow of campaigns. But, social networking culminating in radical changes or in destabilization of healthcare provision may arise from transient social networking platforms like Facebook and Twitter.

Some physicians are of the view that social media can be beneficial for patients and caregivers dealing with chronic diseases like Diabetes, Alzheimer's etc. (Modahl et al. (2011)). Especially, the patients have the access to platforms to share their stories, express themselves, spread knowledge about health and learn from their peers (Househ M (2013)). An exploratory study was conducted by ZA Alqarni (2016) on sharing of health information related to Diabetes Mellitus on Facebook and its consequences in the Arabic speaking world. A qualitative Facebook content analysis using predefined criteria was conducted but was restricted to groups related to diabetes in the Arabic speaking countries. The study helped to inform further research related to health information sharing and appropriate intervention design to harness the potential of social media in improving the healthcare systems.

1.2 Our Contributions

The extensive literature reviewed mainly focused on the social networks related to healthcare and the role of social media in the framing of health service provisions and policies. But, very less is focused on patient affiliation networks or membership networks on social networking platforms like Facebook which provide rich source of information in the form of discussions made and experiences shared by patients and caregivers. This type of membership networks is increasing gradually allowing the members to seek and share information related to disease symptoms, diagnosis, treatment, caregiving etc. The patients obtain emotional as well as informational support through this kind of social networking. Our study highlighted the inherent characteristics of these patient and caregiver membership networks on Facebook and detailed about the distribution of patient groups related to two chronic diseases namely Alzheimer's and Diabetes. It is also found during the process of data collection that there are no membership networks present for common and seasonal diseases which are not persistent or long lasting.

2. Study design and experimental setting

A quantitative data analysis method was adopted to exhibit the distribution of patient and caregiver membership networks on Facebook. Two chronic diseases namely Alzheimer's and Diabetes were considered and all patient and caregiver support groups data under these two categories were collected manually which were created during the period of 2008 to 2018 till the month of June. The details viz. number of members in each group, year in which it was created and the frequency of posts normalized to posts per day in the month of June, 2018. There are around 40 Alzheimer's and Dementia support groups and around 100 diabetes support groups that were created from 2008 through 2018 on Facebook.

3. Zipf's Distribution and Power Law phenomenon

The real-world networks are scale-free networks. So they follow the power law distribution that exhibits a skewed distribution of links. In mathematical form, the number of links (l) from any given vertex or node that follows power law can be written as follows:

$$P(l) \cong l^{-\alpha} \quad (1)$$

For real-world networks the value of α lies between 2 and 3 (Clauset et al. (2009)).

Power law helps to plot the relationship between two parameters. A change in one parameter will induce a proportional change in the other parameter irrespective of the initial value of both the parameters. This can be represented as -

$$p = a.q^{\beta} \quad (2)$$

where 'p' and 'q' are the parameters of interest, 'β' is the power law exponent and 'a' is a constant. β is positive for increasing functions and negative for decreasing functions.

Applying log on both sides,

$$\log(p) = \log(a.q^{\beta})$$

$$\log(p) = \log(a) + \beta.\log(q) \quad (3)$$

From equation (3), power law follows a linear relationship when the variables are plotted on a log scale. This is frequently used to determine the underlying characteristics of any social and natural systems.

Real-world networks follow the power law which can be used to reveal the characteristics of scale-free networks. With the temporal evolution of the network, more number of new connections might get added to nodes which already have a high degree, thereby increasing their degrees disproportionately. This culminates into a few highly connected nodes and many weakly connected nodes further resulting in a skewed or long-tailed degree distribution.

Power-law existence is better explained by Zipf's distribution in the area of social data approximation. Zipf's distribution states that the frequency of an element occurrence, in a sample space that is well-defined, is inversely proportional to its rank in that space. This can be mathematically represented as (Moreno et al. (2016)) –

$$R = \frac{F}{\sum_{i=1}^{N} i} \quad (4)$$

where, R is the occurrence frequency of the element at rank 'i' and

F is the frequency of the element ranked as 1.

Thus, equation (4) shows that the value of an i^{th} rank element (where iϵN) will be $1/i^{th}$ times the value of the 1^{st} ranked element.

4. Data Analysis and Results

We have used Python and its libraries to perform the data analysis and visualization. Groups that were formed around two chronic diseases namely Alzheimer's and Diabetes were considered, to understand their distribution, the group creation trends and the activity status of each disease group. This study helps us to understand the characteristics of patient membership networks and the awareness among patients and caregivers to tap the potential of healthcare social networking that enables sharing and seeking of health and allied information by posting their experiences in dealing with the disease. The increasing sense of seeking and providing emotional and psychological support on social media can be understood from current study which further enables patient empowerment and emotional togetherness though they are geographically apart.

The Alzheimer's & Dementia Support groups and Diabetes Support groups created on Facebook over 10 years duration i.e. from 2008 till June, 2018 were collected by using the Facebook search function. Approximately 40 groups were created for Alzheimer's & Dementia support whereas around 100 groups were created for Diabetes support. When these two datasets were analysed, the membership distribution of the groups under each disease was observed to follow the Zipf's distribution. Figures (1) and (2) depicts the compliance of the Alzheimer's and Diabetes related patient groups respectively with the Zipf's distribution.

The groups are ranked based on the members joined in each group. Next, the ranked groups are plotted on the x-axis and the number of members in each group is plotted on the y-axis. As seen in Figures 1 & 2, the resulting graphs follow Zipf's distribution as defined in equation (4).

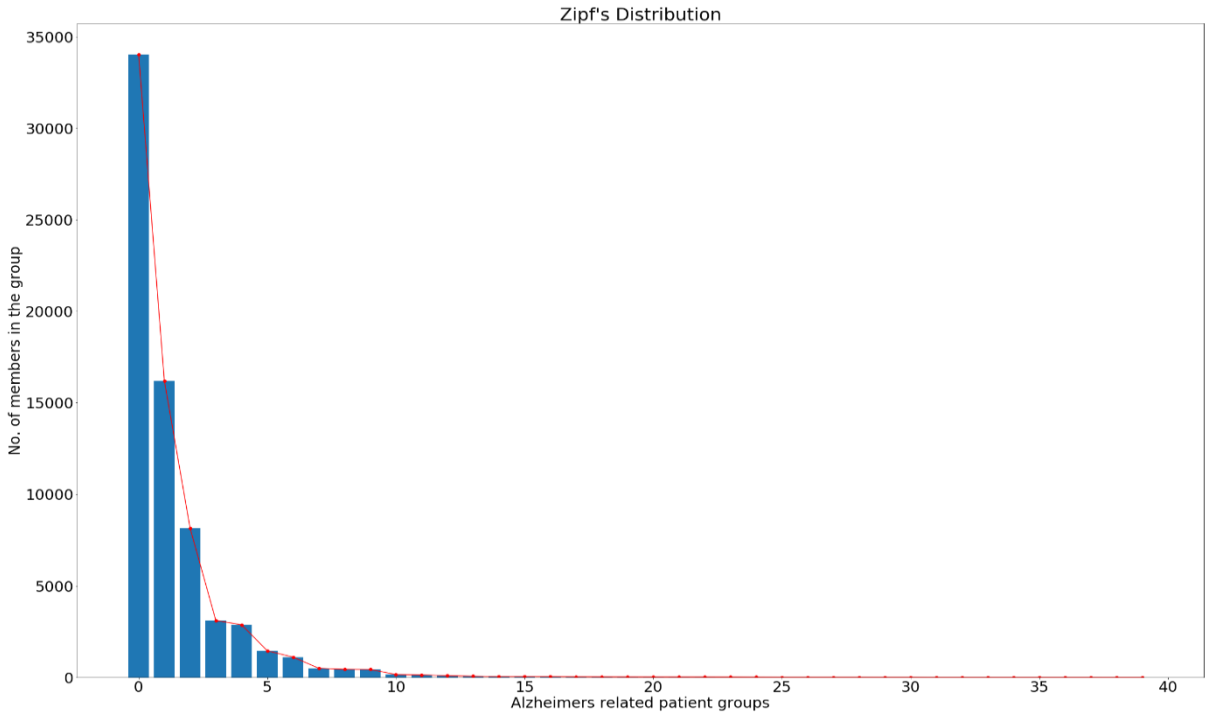


Figure 1. Alzheimer's & Dementia support groups' distribution

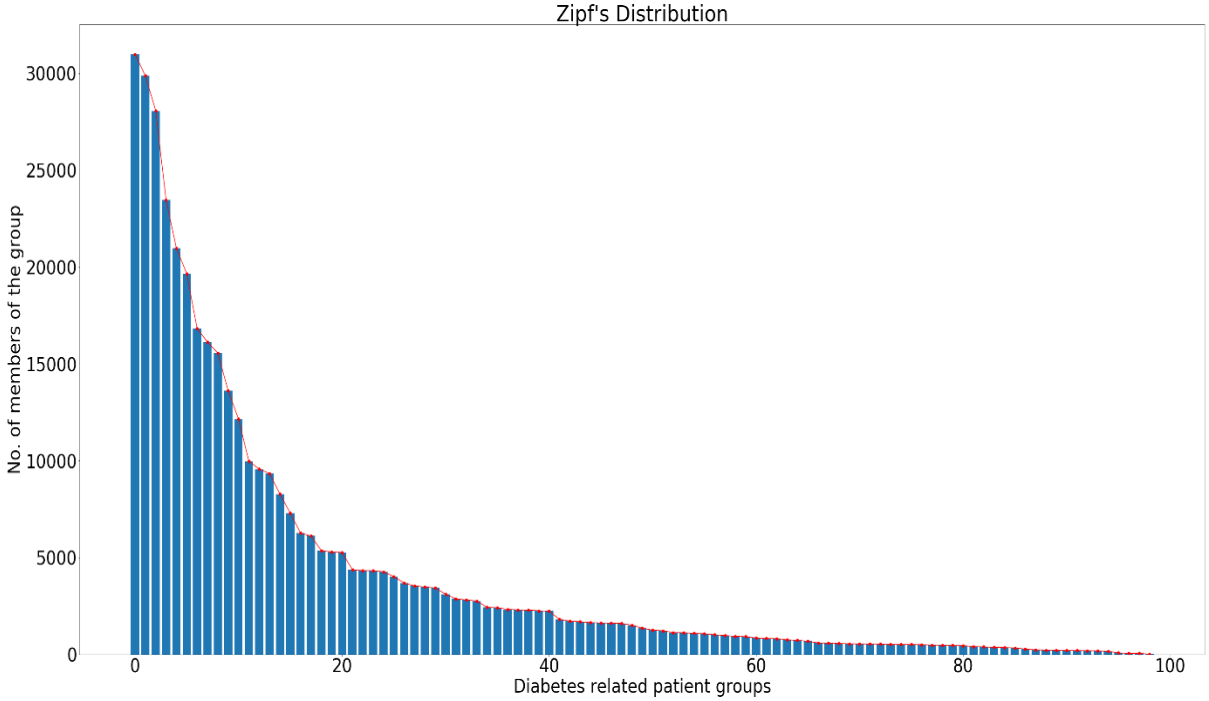


Figure 2. Diabetes support groups' distribution

The group ranked 1st has members approximately twice as large as group ranked 2nd and thrice as large as group ranked 3rd and so on. The graphs show a good fit for Zipf's distribution. When the semi log graph is plotted, the Zipf's distribution exhibits the power-series model defined in the equation (3) by

forming a linear plot. Thus the power law holds good for our dataset. This can be demonstrated by figures 3 & 4.

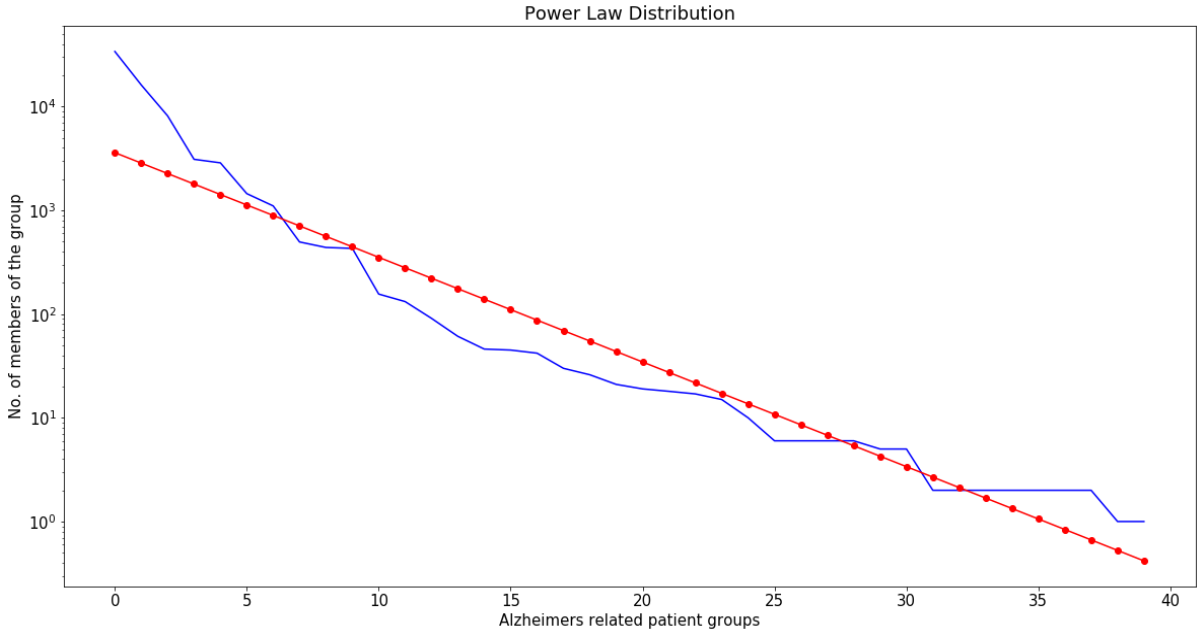


Figure 3. Power law model exhibited by Alzheimer's support groups

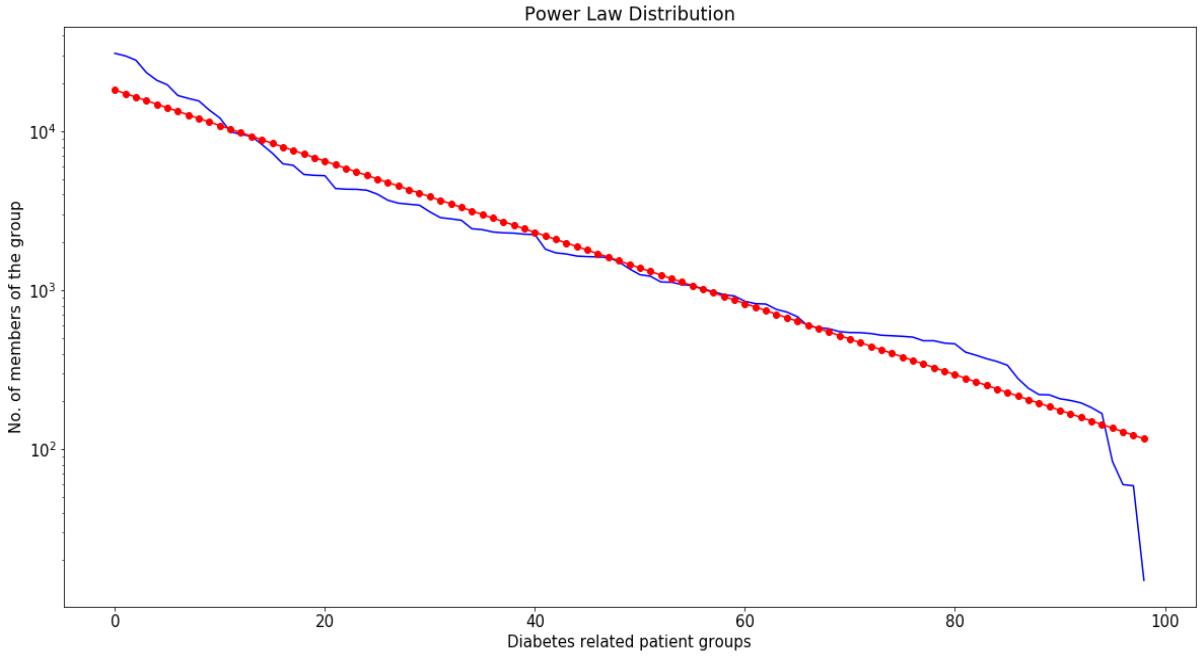


Figure 4. Power law model exhibited by Diabetes support groups

The patient groups on Facebook thus follows the characteristics of real-world or scale-free networks. This might be due to preferential attachment or rich-getting-richer phenomenon that is true even in the case of patient groups on social media as people tend to become members of groups that already have large number of participants. This may help the new members reap intended support from large number of group members actively participating through information sharing and responding to them. Large

group collaborating will always result in wide range of information, experiences, opinions etc. available to deliberate on and arrive at useful decisions.

In order to understand the cognizance of patients' usage of social media in the healthcare domain and their inclination to use it as a platform to join with similar others in the process of getting support and feeling of virtual togetherness, the trend of patient or caregiver group creations on Facebook were plotted over 10 years from 2008 to June, 2018. This can be seen in figures 5 & 6.

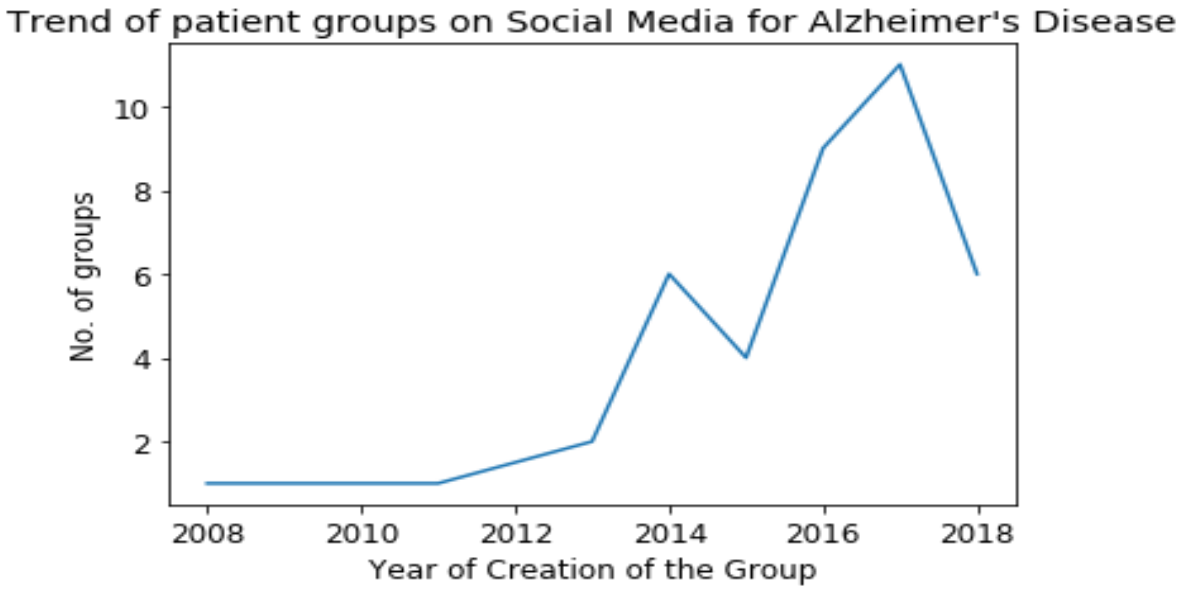


Figure 5. Trend of Alzheimer's support group's creation on Facebook

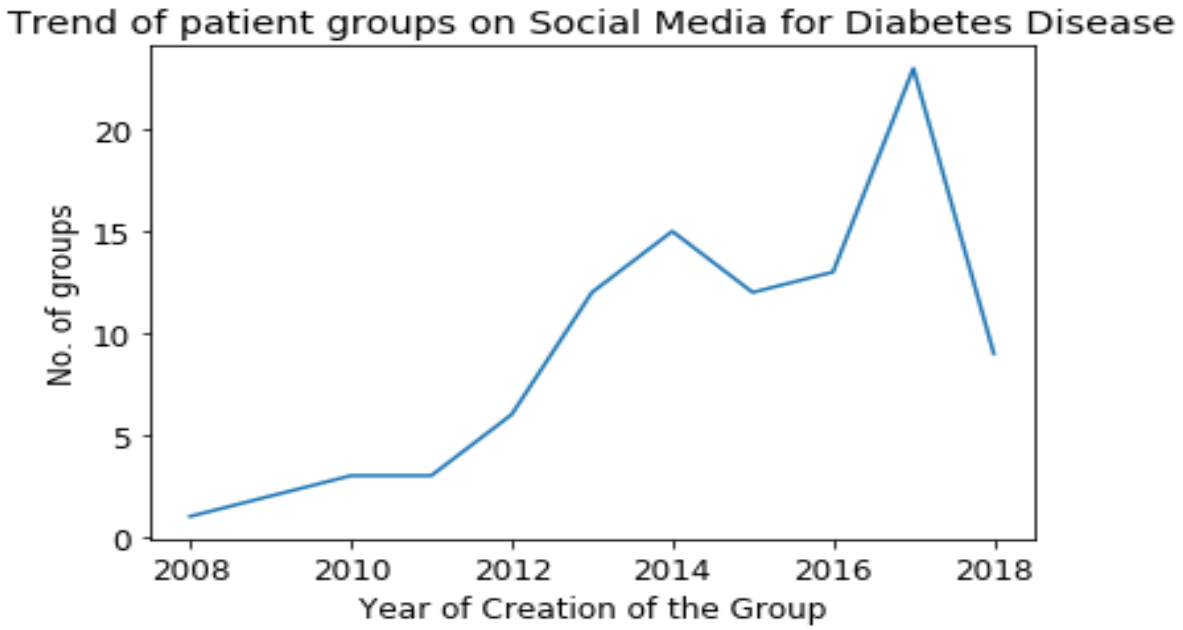


Figure 6. Trend of Diabetes support groups creation on Facebook

The trend line for the Alzheimer's and Dementia support groups on Facebook in figure 5 initially followed linear progression from 2008 to 2011 but showed a nominal rise in 2011 till 2013. Then, there was a considerable hike seen during 2014 and again in 2016 and 2017. Later, in 2018, new members kept joining the existing groups rather than creating new groups. So, the trend line lowered to 6 groups created in 2018. Overall, we can conclude that the awareness of people using social media for healthcare related issues has increased in the last 5 years thus providing a rich source of information for the healthcare professionals and researchers. Even the trend line for the Diabetes support groups creation can be seen from figure 6 which is quite appealing.

Further, we focused on the current activity status of these groups under each disease by taking the number of groups with frequency of posts/day lying between 0 and 10. This is visualized by the graphs in figures 7 & 8.

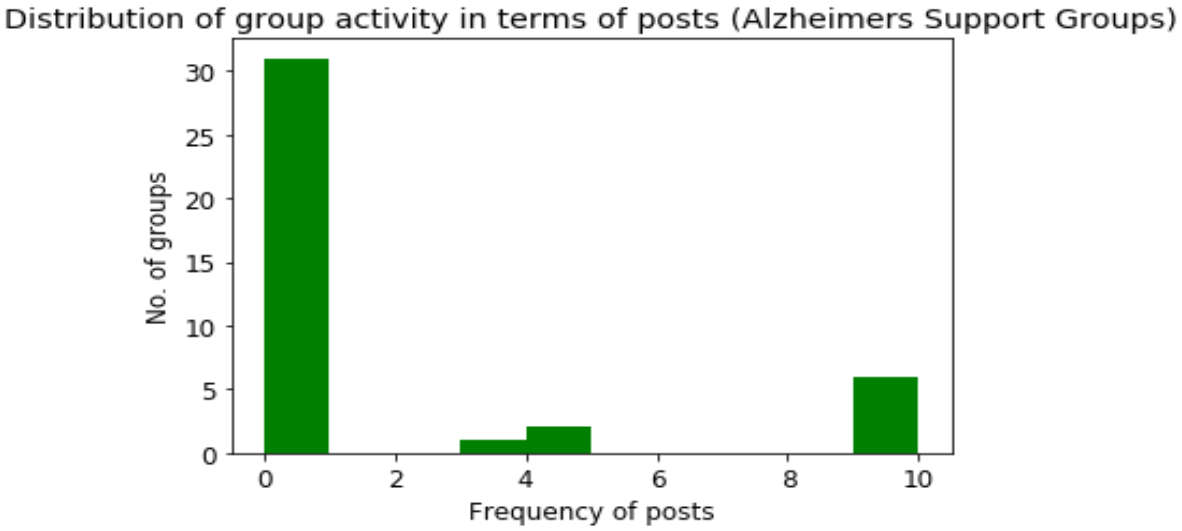


Figure 7. Group activity of Alzheimer's support groups

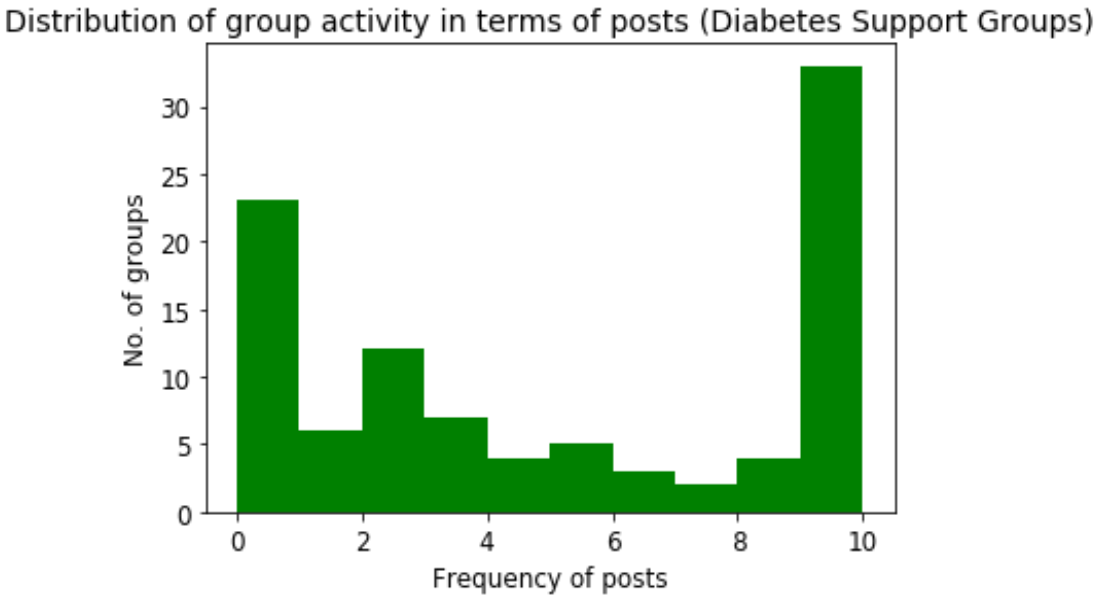


Figure 8. Group activity of Diabetes support groups

The figures indicate that more number of Alzheimer's and Dementia support groups are less active and very few of the groups are currently active whereas in the case of Diabetes support groups, the graph shows a bimodal distribution. Around 30% of the groups are more active currently with 10+ posts/day. Comparatively, diabetes support groups are more active on Facebook compared to Alzheimer's & Dementia support groups. This may be due to the direct interaction of patients suffering from diabetes in the groups whereas in Alzheimer's, the progress in cognitive impairment gradually reduces the social activity of the patients. Though major part of the Alzheimer's & Dementia support groups' members are caregivers, still the level of activity in these groups is less compared to diabetes groups. From this, we can conclude that diabetes groups on Facebook contribute more in healthcare information seeking and sharing indicating manageability of the disease lifelong and Alzheimer's & Dementia support groups contributing less indicating the progression of the disease can't be reverted once a certain stage is reached and most of the victims of this disease tend to experience the same trajectory from the initial stages of the illness to its end ("What are the 7 stages of Alzheimer's Disease?" 2018).

5. Conclusion and Future Work

The paradigm shift from static web to highly participative Web 2.0 has been impacting the usage of social media. Patients and healthcare consumers started realizing the importance of social media as a promising tool in seeking and sharing health-related information to obtain emotional and informational support to overcome geographical barriers and fight psychological isolation with respect to their health condition. Our present study focused on patient and caregiver support groups created on Facebook, their compliance with the scale-free networks in terms of their characteristics exhibiting power-law distribution, the trend of their creation over the last decade, and the status of their current activity. Two chronic diseases namely Alzheimer's (Dementia) and Diabetes were selected for this study as patients suffering from these diseases deal with them persistently thus providing a rich source of information for healthcare social media usage. This research provides basis for further study of patient networks on social media which could be of great interest to healthcare consumers, providers and researchers. The dynamics of patient networks on social media have interesting research issues related to healthcare enhancement that may result in patient empowerment which would further result in highlighting the complexity and nuances of social relationships on patient networks.

References

[1] M. Sridevi and B.R. Arunkumar, "Role of Social Media in Healthcare Domain: An Integrated Review", International Journal of Engineering Research and Application, vol. 7, no. 6, **(2017)**, pp. 49-54.

[2] J.A. Barnes, "Class and Committees in a Norwegian Island Parish", Human Relations, vol. 7, no. 1, **(1954)**, pp. 39-58.

[3] T. Rastogi, "A Power Law Approach to Estimating Fake Social Network Accounts", arXiv: preprint arXiv: 1605.07984, **(2016)**.

[4] IBM Software, White Paper. "IBM i2 Analyst's Notebook Social Network Analysis", **(2012)**.

[5] Ngo et al. "A Crowd Monitoring Framework using Emotion Analysis of Social Media for Emergency Management in Mass Gatherings", Australian Conference on Information Systems, University of South Australia, **(2015)**.

[6] Schroeder et al. "An Innovative Approach to Informing Research: Gathering Perspectives on Diabetes Care Challenges from an Online Patient Community", Interactive Journal of Medical Research, vol. 4, no. 2, **(2015)**.

[7] Lu Yan et al. "Network Dynamics: How can we find patients like us? Information systems Research", vol. 26, no.3, **(2015)**.

[8] S. Saini, S. Kohli, "Machine Learning Techniques for Effective Text Analysis of Social Network E-health Data", IEEE International Conference on Computing for Sustainable Global Development, **(2016)**.

[9] Popoiu et al. "What do we know about the use of Social Media in Medical Education?", WCES, Procedia Social and Behavioral Sciences, 46: 2262-2266, **(2012)**.

[10] Guimaraes et al. "Age Groups Classification in Social Network using Deep Learning", IEEE Access, 5, **(2017)**, pp. 10805-10816.

[11] Li et al. "Seeking and Sharing Health Information on Social Media: A Net Valence Model and Cross-Cultural Comparison", Technological Forecasting & Social Change, 126, **(2018),** pp. 28-40.

[12] Birjali et al. "Machine Learning and Semantic Sentiment Analysis based Algorithms for Suicide Sentiment Prediction in Social Networks", The 8th International Conference on Emerging Ubiquitous Systems and Pervasive Networks, Procedia Computer Science, 113, **(2017),** pp. 65-72.

[13] Bogdanov et al. "The Social Media Genome: Modelling Individual Topic-Specific Behaviour in Social Media", IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining, **(2013)**.

[14] Heijimans et al. "Social Networks of Healthcare Providers and Patients in Cardiovascular Risk Management: a Study Protocol", BMC Health Services Research, 14: 265, **(2014)**.

[15] Health Affairs. Health policy brief: Patient Engagement, **(2013)**. http://www.healthaffairs.org/healthpolicybriefs/brief.php?brief_id=86. Accessed June 2018

[16] Chiauzzi et al. "Factors in Patient Empowerment: A Survey of an Online Patient Research Network", Patient, vol. 9, **(2016),** pp. 511-523.

[17] Griffiths et al. "Digital Social Networks and Public Health", Policy & Internet, vol. 7, no. 4, **(2015)**.

[18] Modahl et al. "Doctors, Patients and Social Media", QuantiaMD, **(2011)**.

[19] M. Househ, "The use of Social Media in Healthcare: Organizational, Clinical, and Patient Perspectives", Studies in health technology and informatics, IOS Press, 183, **(2013),** pp. 244-248.

[20] Alqarni et al. "Health information sharing on Facebook: An exploratory study on diabetes mellitus", Journal of Infection and Public Health, vol. 9, **(2016),** pp. 708-712.

[21] Clauset et al. "Power-Law distributions in empirical data", SIAM Review, vol. 51, no.4, **(2009),** pp. 661-703.

[22] Sanchez et al. "Large-scale analysis of Zipf's law in english texts", PLOS ONE, **(2016)**.

[23] What are the 7 stages of Alzheimer's disease? (Last updated: July, 2018). Retrieved from http://www.alzheimers.net/stages-of-alzheimers-disease/

Soft Computing (2019) 23:8633–8642
https://doi.org/10.1007/s00500-019-04016-0

FOCUS

Super-imposed cluster embedding for ring routing path identification in WSN

P. Sudarsanam[1] · G. Singaravel[2]

Published online: 27 May 2019

Abstract
Wireless sensor networks (WSNs) are widely used in sensing applications. The efficiency of the WSNs depends on the effective data transmission from the sensor node and data collection unit called the sink. The sink node forwards to the data to the system processing center. The data sensed by the sensor node, and it should reach the processing center within a short duration to initiate necessary actions in real-time systems. The efficiency of the WSNs rely on the real-lifetime of the sensor nodes to be increased. The lifetime of the sensor nodes directly depends on the residual energy to transmit the information. Since the wireless sensor nodes are operated with battery power, the WSNs are not offered to lose energy within a short interval of time. This paper proposes a novel data transmission method in which the clusters are formed with the nodes of the same diagonal in a ring routing path. The energy of each node consumed by the transmitter unit of the sensor nodes is reduced with the multi-hop transmission. The data transmitted from the sensor node propagate through intermediate nodes to reach the sink. Thus, every node in the cluster needs to transmit the packets to the neighbor and eventually the data reach the sink. K-nearest node algorithm is used to form the clusters along the diagonal of the ring. Comparative analysis of single-hop and multi-hop transmission proves that the total energy consumed by the sensor nodes in the network is less in multi-hop transmission. The multi-hop transmission also reduces the risk of a single node depleting its energy in a short period. This multi-hop transmission ensures the even distribution of energy consumption and increases the lifetime of the entire sensor network.

Keywords Ring routing · Cluster formation · Energy efficient · K-nearest node · Distribution energy

1 Introduction

Wireless sensor networks (WNSs) are a sensitive technology in the recent decade and have grown in technology with autonomous schemes to develop and evaluate the performance measuring data analysis about the sensing node for transmission from one place to other. Wireless sensor network creates a new infrastructure based on the design of nodes installed on the network connectivity in real time where the node is being placed in the network (Tunca et al. 2014). Major focus areas of network are in the deployment of the sensing node, monitor and measure the environmental circumstances either physically or logically created. Lifetime of the network depends on the sensing node routing technique which is made by the network architecture as well as the network increases the well-balanced load of sensor nodes with uniform energy consumption for transmission (Yu and Hsu 2017).

The wireless sensor network analyses various parameters such as sensing the environmental information, location placed, power consumed, operating time, execution of signal processing techniques, connectivity systems required. Ring routing techniques are the best methodology for energy-saving efficient routing protocol for many applications to avoid the delay and quick response in the transmission process of the network. Issues of various researches point out the improvement in the lifetime of

Communicated by Sahul Smys.

✉ P. Sudarsanam
mcasuda@rediffmail.com

G. Singaravel
singaravelg@gmail.com

[1] Department of Master of Computer Applications, BMS Institute of Technology and Management, Bangalore, India

[2] Department of Information Technology, K.S.R College of Engineering (Autonomous), Tiruchengode, India

sensor and make the efficiency of data transmission depend on the environment. When considering the power factor, the battery lifetime of the sensor extends for a long time when distributed equally.

2 Materials and methods of literals survey

The ability of the sensor network to aggregate the data collected can greatly reduce the number of messages that need to be transmitted across the network. Ring routing is a protocol that targeted for large number of scale to deploy outdoors nodes with stationary sensor and a mobile sink (Kaur and Singh 2017).

2.1 Ring topology

Every node is connected with a ring. Each and every node is well connected to two other nodes by either left or right sides and to intermediate nodes between the sources and designation. The best reliability of ring topology is better than bus topology. When the network breaks at time of data transmission, the network may itself find the alternate path automatically which makes the data transmission reliable in a system (Tiete et al. 2014; Benaddy et al. 2017). The object is an intermediate node that can put forward from one neighbor to the other node, and it makes a cluster formation; ultimately, reaching the destination of the target position of the network transmission is as shown in Fig. 1.

Acquiring the sink node position from the ring route path with minimal overhead is needed. Zhang et al. (2017) studied the design analysis and experiment about the IPv6 distance vector of routing for a network to minimize the energy and computation. Wenbo Zhang analyzed the nodes which are divided into different levels for optimal direction angle to form inter-ring domain communication to save energy level for the transmission of the data packets, and clustering algorithm was proposed to create the heterogeneous cluster to find out the residual energy of balanced node with related position of cluster to avoid energy consumption. It is based on the energy-efficient algorithm that is constructed with probability threshold which identifies the layer circle of the ring, direction angle, node residual energy and hop difference. E2HRC routing protocol was used to improve original routing protocol for low power and loss network (RLP) performance.

In Benaddy et al. (2017), the author developed a multipath routing algorithm of WSN for reliability of data transmission and the distance between the node and energy consumption through node energy as formula of Epu-State. The multipath algorithm consists of two-phase construction and data transmission with the weight setup packet format. Received signal strength from RSSI to show the distance nodes and transmission between the sender and receiver the node of information through weight node to computation process.

Kaur and Singh (2017) proposed that the power-efficient ring and tree-based routing protocol were introduced to merge the areawise routing protocol to find the minimum path routing to optimize the energy-efficient consumption for transmitting data. The algorithm describes about finding out the length of region and breath of region as input variable. The path can be found through the source node of first ring node and first ring to second ring node and second ring node to third and so on to sink. By this method, we can calculate the distance, energy, delay and load. After

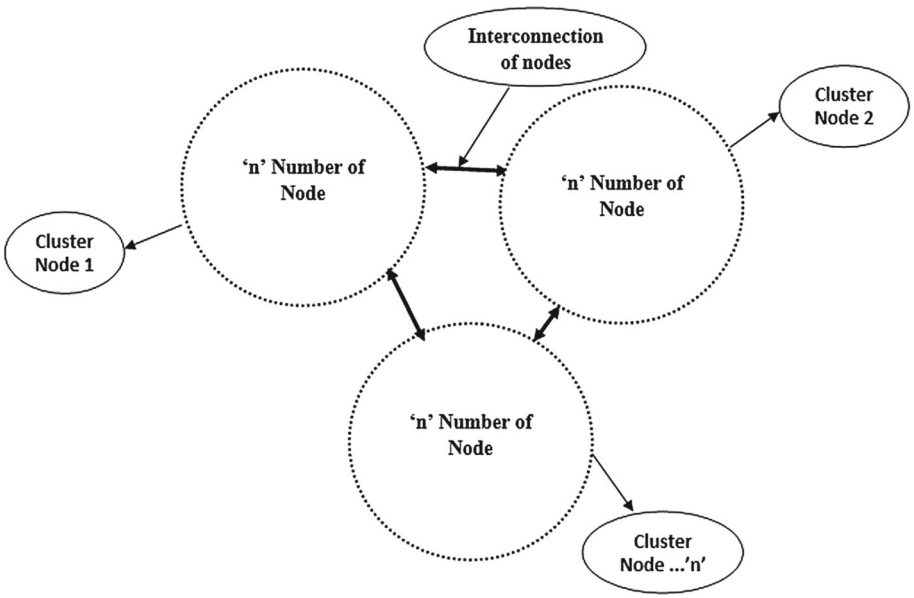


Fig. 1 Cluster formation of nodes

deployments of the network and form, the concentric ring was established in the circular path and made a comparison of ring routing and hybrid routing protocols based on the basic metrics respective with delay, energy and delay. The analytic performance was superior to any other methods.

Adil Mahdi et al. (2016) presented alternate effective clustering mechanism and the last mile data delivery which is maintained for enhancing the network lifetime through reasonable load balancing and the residual energy is the main factor of consideration.

Zhang et al. (2017) introduced a new concept of heterogeneous ring topology for equal area communication to maintain the energy balance and address problems of IPv6 routing protocol such as low power as well as the network loss issues. A novel idea of clustering algorithm promoting the even cluster rotation technology is proposed in this research and based on the topology method of RFC and RPL message structure. The RPL and E2HRC are more effective for wireless sensor network to energy consumption problem.

2.2 Drawback of the system

Based on the section materials and methods of literature survey of the ring routing, the most significant sink routing is reviewed and noted and the benefits and drawbacks are well determined to take future action. The highlights of ring routing with respect to these following points are as follows:

- The continuous space to locate the optimal node for each sink node is not carried out automates.
- Achieving overall routing diversity is not carried out by the sink node.
- Scheduling the node in a narrow path angular is not uploading from multiple sinks.

3 Basic concept of ring routing

This research is to promote the ring routing shortest path algorithm identifying through the location where the nodes are stipulated, and ring nodes form a structure which is a closed loop of single-node width (Ghosh and Banerjee 2017). The basis of ring routing algorithm is trailer of position to the ring and whenever energy requirement for node is encountered, the regular nodes locate the position information from the ring circle. The distributing nodes which serve as intermediary agents connect the sink to the network.

The main objective is to reduce the energy consumption to avoid the unnecessary path between the transmissions and increase the energy efficiency (EE) to find the shortest path in the network for data nodes by specific algorithm identifying the ring routing and topology which are hired in this research (Smys et al. 2010; Praveena and Smys 2016). The energy efficiency of the network is considered to be a crucial issue for recent trends, and it focuses on the limited battery capacity of the sensor nodes for data sharing. Load balancing is a tactic to provide the sink mobility to share the nodes and shifting the nodes from one hotspot to around the sinks nodes and spreading the energy drainage around the sink node, and it achieves the uniform energy consumption to the network lifetime and it extends to around the circumstances. Each node is visited and selected as the node which can have efficiently gathered data for forming cluster nodes and transport the node to the sink to find out the shortest path ring route (Zhang et al. 2017).

Individually, node makes cluster formation with the nearest node and finds the ring routing shortest path to reduce the energy efficiency or sharing the energy for activating other nodes to send to sink. Basically, they are different type of cluster; they are partition-based cluster, hierarchical clustering and density-based cluster (Clausen et al. 2017). For research, focusing on the density-based cluster for energy accumulates with other nodes for transmitting the data. And this is to find the distance of ring of first circular path with second ring forming circular path and so on. Clustering has several methods for finding the distance between the ring through various methods such as Euclidean distance, Manhattan distance, Murkowski distance, Jacquard distance, Cosine distance and Gower distance.

4 Research methodology

The performance analysis of ring routing algorithm with shortest path of the node is extensively evaluated by simulations conducted in the new environment with the help of angle degree position where the nodes are plotted on circular ring. A wide range of data in different scenarios with varying network paths and sink speed values are elaborately defined and used in this research. Comparison of single-hop and multi-hop performance evaluation results of ring routing with two efficient mobile sinks was developed and the analysis was provided in the graphical plot with respective outcomes. The results show that ring routing shortest path in the circle indeed is an energy-efficient algorithm which extends the network lifetime of the node. The reporting outcome and delay performance also confined within reasonable limits which prove that ring routing path is suitable for time-sensitive applications in real life.

5 Ring construction

The ring topology consists of a one-node width between the nodes in a same path for distance measure, and nearest of nodes is called the ring routing path nodes. As long as the ring construction to summarizes the pre-determined network center is a mention as sink node. The shape of the ring routing path might be imperfect as long as it forms and finding the path is called closed loop.

- In the initial ring, the radius is determined by the angle position which can closed in the same path. The nodes closer to the ring, which is defined by this radius and the network center (sink), by a certain distance, is determined to be ring routing path.
- Traversing from the sink, the packet forwarding takes place in the direction of the ring (clockwise or anti-clockwise) and the neighbor nodes forward the data packets from one node to the other in a closed-loop structure.
- The procedure is repeated until the starting node is reached. On selecting a path, if the destination is not reached, then backtracking is performed and an alternate node in each hop is chosen.
- The radius of the ring is increased after performing certain number of trails on failure to form a ring, and the above procedure is repeated.

5.1 Sink node with cluster forming

This module describes the cluster formation. The sensor nodes collect the information from the neighbor peers about the existing clusters. The sensor node associates itself with any one of the existing clusters to balance the processing and transmission load. The sensor node decides the cluster to which it gets attached based on the information received from the cluster heads. If none of the neighboring cluster heads transmits the information, a particular sensor node may announce itself as the cluster head along with its peers.

In rare circumstances, a cluster can have two cluster heads. Both the cluster heads coordinate among themselves and balance the load. Each sensor node calculates the energy required to transmit the data to one of the cluster heads and associates with that cluster head.

Cluster head on continuous operation tends to lose energy at a faster rate when compared with other nodes. The cluster head broadcasts the reclustering messages to its cluster heads. On receiving the reclustering message, the cluster members switch to initialization phase to elect the new cluster head.

5.2 Distance type of calculation for two nodes of transmission in the ring routing construction

In wireless sensor network, data collected by the sensor nodes are forward to a sink node. The base station in the sensor network receives the data from the neighbor node and forwards the data to the sink through the intermediate nodes. N4 is a source node, N1 and N2 are transfer nodes, and N3 is sink node. Basic connections are shown in Fig. 2.

The main issue of the workstation is, if there is any problem in the network, it affects the entire network. The problem is solved by using ring routing path algorithm, and it has advantages as such as moving, adding and charging the device which can affect the network through finding the angle position of the node plotted in the network. Communication delay is directly proportional to the number of nodes in the ring routing path network. The basic idea is to know the various distances calculation between the two nodes and examples of band distances as given below:

Agree in all rows of a particular band, then Sr.
At least one row of a particular band, then $1 - \mathrm{Sr}$.
At least one row of each of the band, then $(1 - \mathrm{Sr})$ b.
Agree in all the rows of at least one band, then $1 - (1 - \mathrm{Sr})$ b.

The distance measures between the nodes and the space of the function mention is $d(x, y)$, then $d(x, y) \geq 0$ (no negative distance), $d(x, y) = 0$ (positive, points itself), $d(x, y) = d(y, x)$ is called symmetric, and $d(x, y) \leq d(x, z) + d(z, y)$ is called triangle inequality.

Euclidean distance can be measured in terms of $d([X1, X2,\ldots,Xn], [Y1, Y2,\ldots,Yn]) = d(x, y) = d(y, x)$, even the distance between two points cannot be negative (in same line), because the positive square root is intended. Then, all square of real number is nonnegative, i.e., $xi \neq yi$, $xi = yi$ for all I values, and then the distance is clear to zero.

The distance to be calculated is the cosine distance. First, compute the cosine angle and then apply the arc-

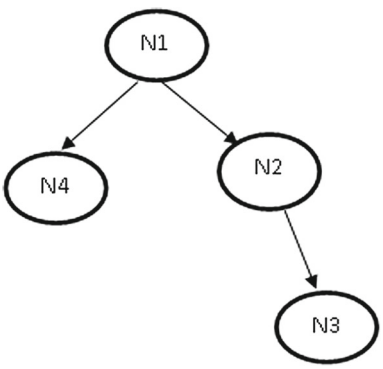


Fig. 2 Basic connection of nodes

cosine function to translate to an angle in the 0–180 and 180–360 degree range. Similarity relative size of the intersection is called "Jaccard Similarity," and Jaccard similarity set, *T,* is the ratio of the size of the intersection of *S* and *T* to the size of their Union (nearest distance).

5.3 Find optimal ring routing path

In this module, for any given node (A), the nearest cluster heads (NCH) are found and it is used when there is a need for reclustering. Figure 3 shows overview structure for the optimal ring routing to reduce the energy efficiency of WSN.

Computer cluster is a group of loosely coupled computers that are working together closely or occurring closely together with other nodes. Routing is an unstructured addressing for sending the information. The network hardware devices are routers, bridges, gateways, firewalls or switch.

In a ring network, a set of network nodes are connected together by a set of links as a cycle, and every node plays the same role. This node symmetry simplifies the design of network algorithms such as routing and path coloring. Moreover, a ring is a two-connected topology. There exist two distinct paths between any pair of nodes in a ring network, so it remains connected even in the presence of any single node or link failure. Taking account of these advantages over other network configurations, the ring topology is widely used in communication networks.

Ring routing is an energy efficient, reliable routing protocol that provides fast data delivery. Ring domain communication topology can effectively use 360 degrees signed transudation while also reducing message collision during the transmission process. Signal intensity decreases during the wireless signal transmission process as transmission distance increases. Here, the Distance = speed × Time, Time = distance/Speed and Speed = distance/Time.

From Fig. 4, a four number of ring routing circular path are formed which are named as r1, r2, r3 and r4 in a various diameter circular path and each ring path has a number of node in the path. The dataset of each ring is given as $r1 = \{0,1,2\}$, $r2 = \{0,3,4\}$, $r3 = \{2,3,4,5\}$ and $r4 = \{2,4,5\}$, which are circulated in the ring routing construction. The matrix formats are given in Fig. 5.

The above table to be converted to normal form which is given below as well the matrices to identify the pair matrix

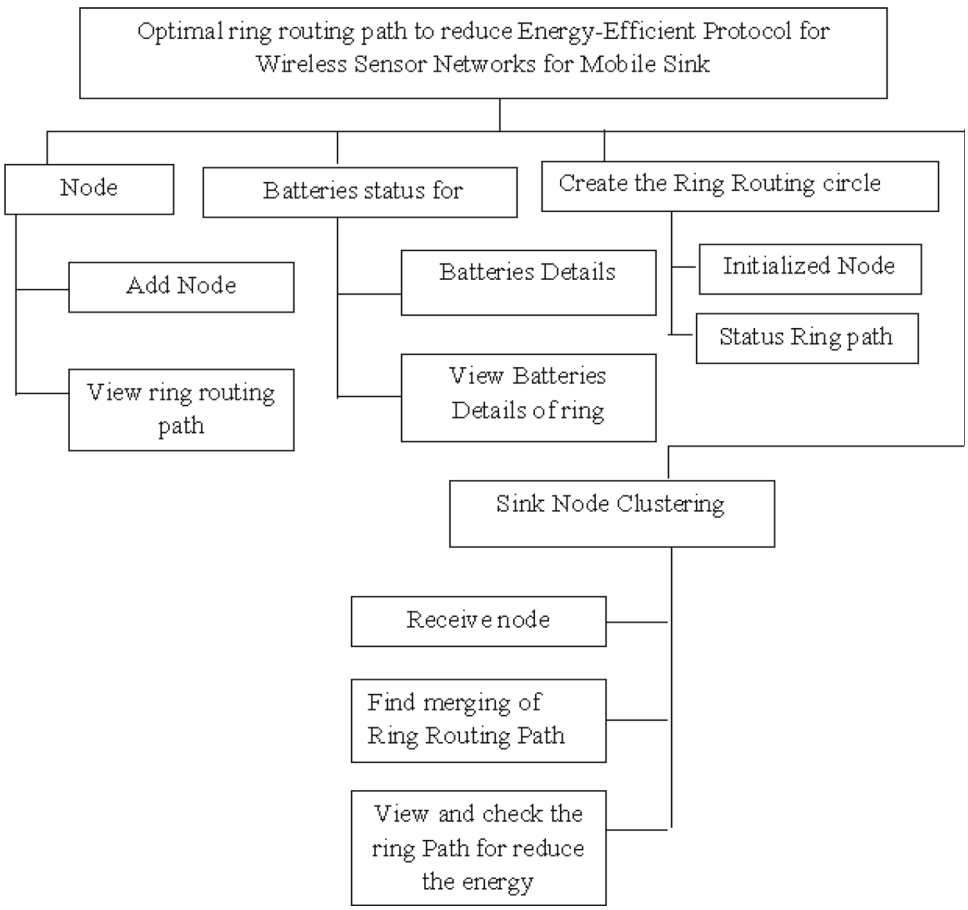


Fig. 3 Workflow of energy-efficient ring routing in WSN

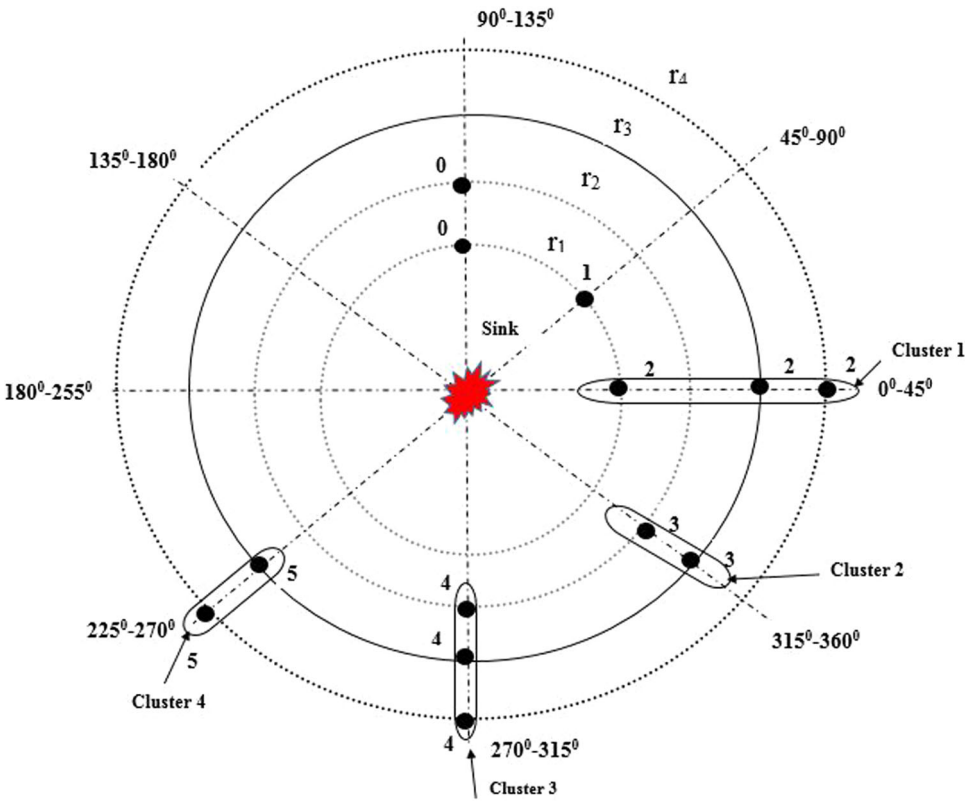


Fig. 4 Dataset in ring routing path

for forming into single node to save the energy consumption to transmit the data information with the shortest time period, even though a path of routing to use multi-time (Fig. 6).

From kNN algorithm, 'k' is the number of nodes, 'NN' is the nearest neighbour to find the shortest and multi-time path for travelling node to save the energy.

From Fig. 7, assessing the distance between the routing paths with the nearest node is to share and make the cluster formation to sink node for transforming the data from one destination to another. From the angle 0°–45°, the node is formed in r1, r3, r4, so total three nodes are in the angle and it is named as cluster 1

Where $R = x$

$$R1 = R + y = x + y$$
$$R2 = R + 2y = x + 2y$$
$$R3 = R + 3y = x + 3y$$

The coverage region of the sink is partitioned into four quadrants, and each quadrant has two ranges of angles as shown in Table 1.

Condition 1 $(x + y) < (x + 3y)$ where, $x + 3y$ sink distance is greater than $x + y$ to sink. For example, $(x + 3y)$ distance to sink consumes n Joules, as given below

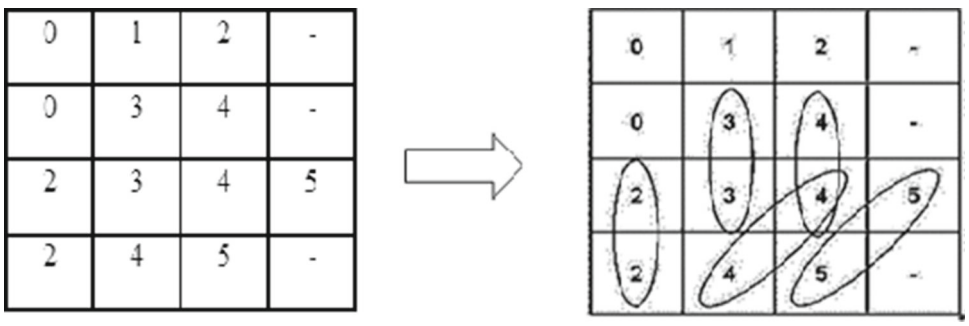


Fig. 5 Matrix table format for dataset in ring routing path

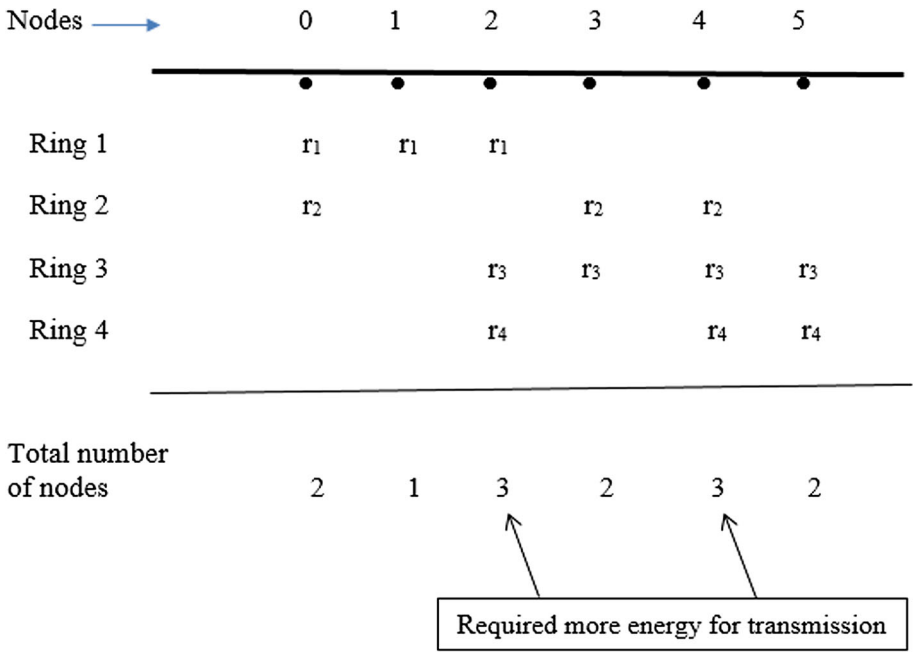


Fig. 6 Conversion formation matrix table format for dataset in ring routing path

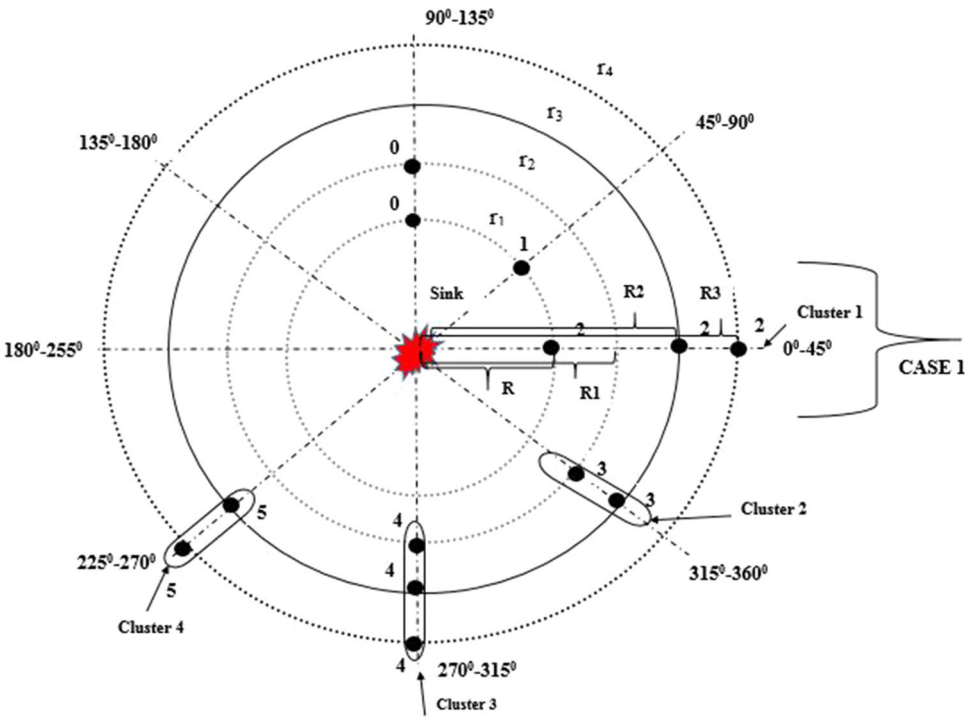


Fig. 7 Cluster formation along the radius

$x + 3y$ to sink $= 3n/4$ J
$x + 2y$ to sink $= n/2$ J
$x + y$ to sink $= n/4$ J
$x + 3y$ to $x + 2y = n/4$ J
$x + 2y$ to $x + y = n/4$ J.

6 Individual node direct transmission to sink

Total energy spent by node in a single cluster when transmitting data directly to the sink = $n + 3n/4 + n/2 + n/4$, $3n + 2n + n/4$, final solution is $6n/4$ J and total

Table 1 Node location in the quadrants

Node position	Number of nodes located in various quadrants							
	0°–45°	45°–90°	90°–135°	135°–180°	180°–255°	225°–270°	270°–315°	315°–360°
Quadrant 1	3	1						
Quadrant 2			2	0				
Quadrant 3					0	2		
Quadrant 4							3	2

Table 2 Energy consumption in single-hop transmission

S. no	Distance between sensor node and sink	Coverage range of sensor node	Energy consumed by transmitter unit in joules
1	1	1.5	200.125
2	2	2.75	151.0
3	3	4.0	100.50
4	4	5.25	50.25

energy consumed = 1.5*n J. The coverage region of the sink is partitioned into four quadrants, and each quadrant has two ranges of angles as shown in Table 1.

6.1 kNN algorithm: cluster formed

The cluster formation is done with k-nearest node (kNN) algorithm. The kNN uses the information from the k number of nearest neighbors to form the cluster. The cluster formation is based on the distance of each node from the sink. The energy consumed for transmission of data from the sensor node is directly proportional to the distance of the sensor node from the sink. Table 2 shows the distance between the sensor node and the sink and the energy consumed by the transmitter unit in a single-hop transmission. Hop-by-hop transmission, energy revised for 1-bit transmission is n/u J. Total energy = $n/4 + n/4 + n/4 + n/4$, and it is total energy = 4/4 nJ and the final total energy consumed is nJ.

The graph in Fig. 8 shows the variation of the energy consumption by the sensor node in accordance with the distance. As the distance increases, the node nearer to the sink has to increase its transmission range to receive the data from the node in the outer ring. Thus, the increase in distance shoots up the energy consumption by the transmitter unit of the sensor nodes in the innermost rings.

6.2 Energy consumption in multi-hop transmission

The data from the transmitter may reach the sink in multi-hop fashion which reduces the total energy consumed by the individual sensor nodes. Each node can transmit the data to the next neighbor in one direction toward the sink. Table 3 shows the energy consumed by the transmitter unit and the distance between the neighbors.

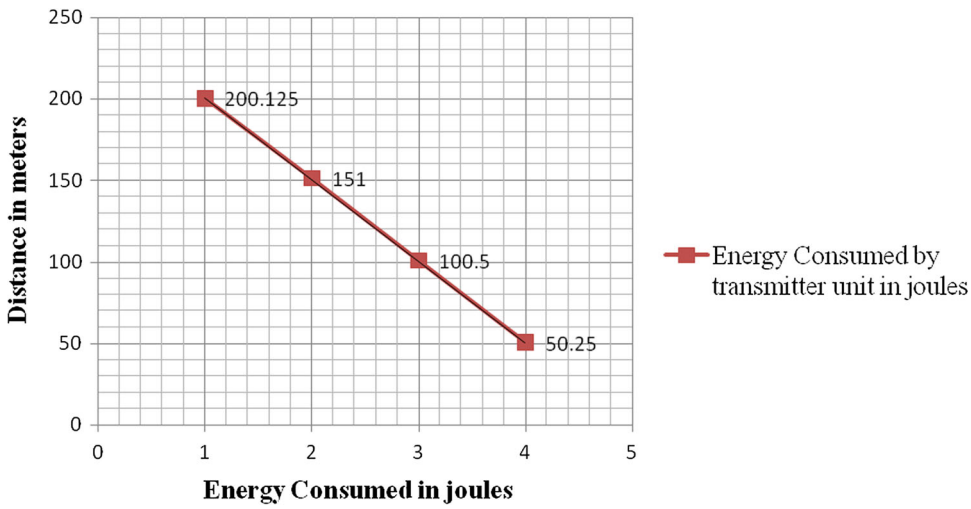


Fig. 8 Energy consumed in single-hop transmission

Table 3 Energy consumption in single-hop transmission

S. no	Distance between sensor node and sink	Coverage range of sensor node	Energy consumed by transmitter unit in joules
1	1	1.5	50.25
2	2	1.5	50.25
3	3	1.5	50.25
4	4	1.5	50.25

The graph below shows the energy consumed by the sensor nodes during the transmission of data by the sensor unit. The energy consumption is higher around 200 J at the shorter distance. As the distance increases, there is a steep decrease, and at around 50 J, the energy consumed remains at a constant rate. Even the distance increases, the energy consumed is constant (Fig. 9).

Table 4 shows the comparison of energy consumed by the transmitter unit of the sensor nodes in single-hop and multi-hop transmission. The single-hop transmission involves the energy consumed in transmitting the data from the sensor node directly to the sink, and the multi-hop transmission involves the energy consumed in transmission of data to the nearest neighbor in the direction of the sink.

The below graph in Fig. 10 shows the comparison of energy consumption by the sensor nodes in single-hop and multi-hop transmission. The comparison gives a clear view of the fall in energy consumption in the multi-hop node with an increase in distance.

7 Conclusion

The energy consumption by the transmitter unit of the sensor node decides the saving energy of the lifetime of the sensor network in a topology. Each sensor node transmits the data directly to the sink which consumes more energy than the sensor nodes transmitting the data indirectly using multi-hop transmission. The multi-hop transmission ensures that every individual node spends only minimum of energy to transmit the data to the sink. The total energy consumed by the sensor network is distributed evenly among the sensor nodes in the network and increases the lifetime of the wireless sensor network.

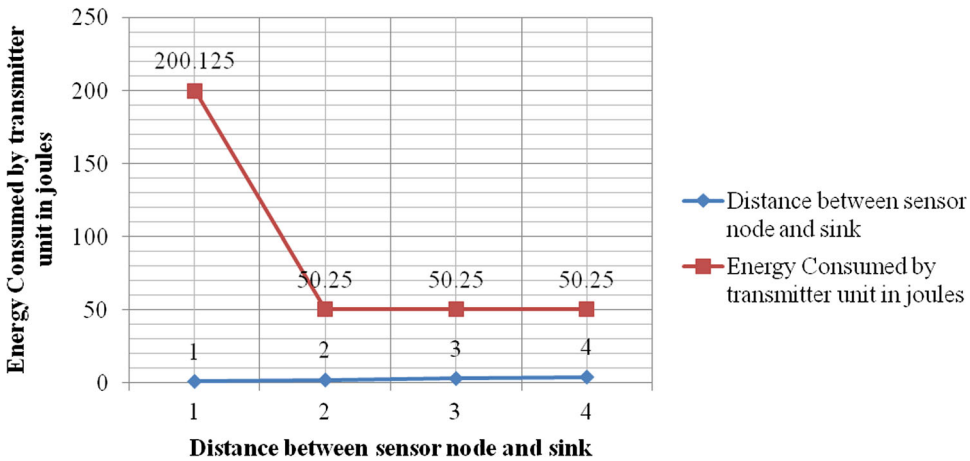


Fig. 9 Energy consumed in multi-hop transmission

Table 4 Comparison of energy consumption in single-hop and multi-hop node

S. no	Distance between sensor node and sink	Coverage range of sensor node		Energy consumed by transmitter unit in joules	
		Single-hop	Multi-hop	Single-hop	Multi-hop
1	1	1.5	1.5	200.125	50.25
2	2	2.75	1.5	151.0	50.25
3	3	4.0	1.5	100.50	50.25
4	4	5.25	1.5	50.25	50.25

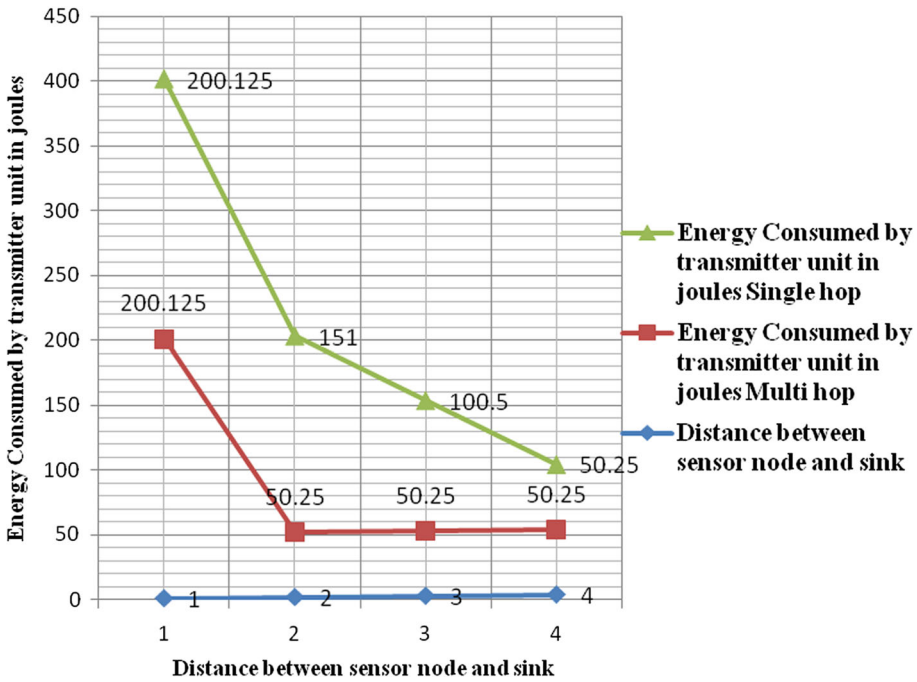


Fig. 10 Comparison of energy consumption in single-hop and multi-hop node

Acknowledgements No funding is received for this work.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflicts of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

Adil Mahdi O, Abdul Wahab AW, Idris MYI, Abu Znaid A, Al-Mayouf YRB, Khan S (2016) WDARS: a weighted data aggregation routing strategy with minimum link cost in event-driven WSNs. J Sens 1–12

Benaddy M, El Habil B, El Meslouhi O, Krit S (2017) A mutlipath routing algorithm for wireless sensor networks under distance and energy consumption constraints for reliable data transmission. Int J Sens Sens Netw 5(1):32–35

Clausen T, Yi J, Herberg U (2017) Lightweight on-demand ad hoc distance-vector routing-next generation (LOADng): protocol, extension, and applicability. Comput Netw 126:125–140

Ghosh S, Banerjee A (2017) A survey on energy efficient multicasting in ad hoc networks. Int J Comput Sci Mob Comput 6(6):228–235

Kaur G, Singh J (2017) Power efficient ring and tree based routing protocol. IRJET 4(4):1914–1922

Praveena A, Smys S (2016) Efficient cryptographics approaches for data security in wireless sensor network using MES VU. In: 2016 of 10th international conference on intelligent system and control (ISCO), January 7. IEEE Open Access, pp 1–6

Smys S, Bala GJ, Raj JS (2010) Self-organizing hierarchical structure for wireless networks. In: 2010 International conference on advances in computer engineering. IEEE Open Access, pp 268–270

Tiete J, Domínguez F, da Silva B, Segers L, Steenhaut K, Tou A (2014) SoundCompass: a distributed MEMS microphone array-based sensor for sound source localization. Sens J 14:1918–1949

Tunca C, Isık S, Donmez MY, Ersoy C (2014) Ring routing: an energy-efficient routing protocol for wireless sensor networks with a mobile sink. IEEE Trans Mob Comput 1–15

Yu C-M, Hsu T-W (2017) Determining the optimal configuration of the multi-ring tree for bluetooth multi-hop networks. Energ J 10:1–16

Zhang W, Li L, Han G, Zhang L (2017) E2HRC: an energy-efficient heterogeneous ring clustering routing protocol for wireless sensor networks. IEEE access on special section on future networks: architectures, protocols, and applications

JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

PROFICIENT IP MULTIMEDIA SUBSYSTEM AUTOMATION FRAMEWORK

[1]Dr. P. Sudarsanam, [2]Dr. P. Ganesh, [3]A.Venkatesh and [4]Jagadeeshraman

[1]Assistsant Professor, Department of MCA, BMSIT&M, Bengaluru

[2]Associate Professor, Department of MCA, BMSIT&M, Bengaluru

[3]Assistsant Professor, Department of MCA, BMSIT&M, Bengaluru

[4]Verification Architect, Nokia Siemens Networks, Bengaluru

[1]sudarsanamp@bmsit.in, [2]pganesh@bmsit.in, [3]venkatesha@bmsit.in

[4]jagadeesh.raman@nokia.com

Received: 14 March 2020 Revised and Accepted: 8 July 2020

ABSTRACT: As the third Generation (mobile) networks (3G) become commercial reality, strong movements occur into the direction of a common infrastructure based on the Internet protocol. The users' mobile devices will be like another IP host connected to the Internet. In such a scenario, the network operator structure will be degraded to bit pipes. To avoid so, the 3G Partnership Project (3GPP) and ETSI TISPAN have considered the IP Multimedia Subsystem (IMS), a service platform that aims to place again the network operator in the central role of service provisioning. IP Multimedia Subsystem is mainly used to provide the VoLTE and multimedia services. IP Multimedia Subsystem commonly known as the IMS is the liquid core mobile broadband service that is used to provide the VoLTE services. It is the alternate to the GSM networks communication. The protocol beneath IMS is the SIP which is the heart of internet. The Session Initiation Protocol is a signaling protocol. It is a control protocol present beneath IMS for establishing, modifying and terminating sessions that involve one or many participants. These sessions include audio calls, video calls, internet telephone calls and multimedia distribution. CFX-5000 can provide data on performance measurements across all main functional application roles that it supports. Collection of data, considered as crucial information for customer's network behaviour awareness, is done on pre-configurable time intervals and are provided to NetAct. Then NetAct additional tools and set of functions (Reporter) allows the operator to supervise the entire system by displaying several kinds of information in a graphical interface.

KEYWORDS: Third Generation, IP Multimedia Subsystem, 3G Partnership Project, VoLTE, CFX-5000, NetAct, performance.

1. INTRODUCTION

Framework Designed [1] by Qualcomm which allows the device or user equipment(UE) to access the quality a user may be experiencing on an Enhanced Voice Services(EVS) code based VoLTe call and changes the bite rate adaptively to improve user experience. The big challenges [2] in 4G, in market utilities using the applications processors and also modern and powerful technologies to deliver the right performance, size and battery life of the consumer demand. This path tells 4G to reality and deliver computing applications and performance that will tell the future performance. The world is moving [3] wireless technology board band to provide throughputs to get importance day by day for customers. Being an operator should provide coverage of 4G network. 4G LTE advanced and WiMAX 802.16m may be possible to deploy in the network 3G technology. So, the cost would decide whichever low-cost deploying throughput. Discussed about memory system models, performance out of order memory access scheduling hampering potentials and memory expenses. [4][5]. The network providers [6] provides offer like wide range network, low-cost, better battery usage and next generation services to customers. IMS infrastructures provide transport network brings more benefit to this area. IMS (IP Multimedia System) of configuration [7] and reconfiguration would help to reduce the cost and complexities of the current network. IMS node functionalities with network and operational environment is changing. Evaluate the uplink VoLTE performance [8] variance, setting of RLC segmentation TTI binding is applied. Coverage performance is measured with the required power. Practical [9] mechanical support multiple public identities on a VoLTE connected smart phone.

IMS eases the amalgamation of video, voice, IM/Presence, video & voice conferencing over different devices, all this provides smooth communication experience while substantially reducing operating costs. IMS allows for new revenue chances because multimedia services can be rendered over the present IP infrastructure. With this

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

structure in place, providers can offer what we call session-based services. With IMS enabled, any IP device can establish a session with the control servers and then make connections with other IP devices to send voice, video & data sessions between the two end clients. This breaks the regular obstacles affecting end devices. With IMS empowered, we can initiate a call from one cell phone and communicate with any other, over his WLAN PC at his home. The major benefit of IMS is ability to separate the underlying infrastructure from the services provided.

The main reason behind IMS is to provide good network, reduce cost of communication and to use packet switching instead of circuit switching. Now a day's networks play an important role in communication. The Network is important at any place and any time. In other network such 2g,3g (edge) network people were facing many problems. Problem such loss of data, delay in communication. Video calling was also not possible earlier. In 2g,3g network, we able to communicate audio call, audio conference call, normal text message etc. IMS is used to provide fast network services everywhere and at any point of time by using user equipment (devices such as mobile phone, PNT). In many ruler area schools are not available, so it is very difficult for children to study, who will teach and how? The main reason behind IMS is to provide Quality of Service (QoS) service mms (multimedia service). We can provide smart class through video call. Edge networks have already facilitated a wide range of service.

IP Multimedia Subsystem (IMS) is an architecture framework (Fig. 1) for delivering IP Multimedia Services. IMS provided some service such as video call, audio call, voicemail, voice message service so that an operator can store the voice message, it also provides text-based messages to speech conversation service. Instead of text that voice service is useful for blind persons, anybody can send a voice version of the incoming text message to blind users. IMS is an access-independent service delivery network. IMS merges the cellular network to facilitate access and the internet to facilitate multimedia service (mms). 3gpp and 3gpp2 defined the subsystem i.e. Set of some specification and some requirements, IMS is defined by 3gpp and 3gpp2 together. 3GPP and 3GPP2 formed through Quality of service agreements that include a no. of specific standard telecommunication policy. IMS defines an associate architecture for IP-based services over both circuit and packet networks. It facilitates the convergence of different types of network- fixed network and wireless network access technologies for the communication, distribution and utilization of mms.

Test automation simply means creating automated tests. When we are testing software, test automation means developing software that support testing. A common misconception is that test automation is perceived as automated testing. In software development, testing is mainly analysis and problem solving, a creative activity requiring human brains. Testing is as impossible to automate as software development. Automated testing means unattended testing where no humans are involved. This means programmatically selecting the test scope, test target, test sets, expected results and actual test execution, test analysis and test reporting.

2. METHODOLOGY

Robot Framework is an Agile test automation system that makes it easy for a software project to: Collaboratively define and maintain automated tests, run those tests and see their results. Robot is a framework in which the test automation can be organized and developed. On top of the core framework, it contains a set of utilities, libraries and documentation that describe and facilitate development, documentation and use of tests cases. Robot is platform and application independent. While the core is written in Python, Robot can be extended with Java, C++, Python or Jython test libraries. Through test libraries it is also possible to integrate new or existing test tools, implemented in any language, with Robot. Robot makes it possible to create and maintain automated test without programming skills. Robot also isolate test engineers from the complexities of the test framework. Robot supports Acceptance Test Driven Development (ATTD) i.e. enables describing requirements as executable test.

IMS Architecture

Figure. 1 shows that IMS architecture. IMS subscriber registration procedures include different aspects, like public and private user ID handling, user authentication as described below, and load balancing and failover. During an initial registration, the appropriate S-CSCF is selected by the I-CSCF using information provided by the HSS. The S-CSCF authenticates the end-user device and pulls the necessary user profile from the HSS. Depending on the user profile configuration, several implicit public user IDs (IMPU) are registered at once in an implicit registration set. A single end-user device performs several independent registrations at once (multiple explicit registrations), and a single (shared) IMPU is also registered by several end-user devices at once. After a

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

successful registration, the S-CSCF provides its address to the HSS, and finally the HSS changes the subscriber's state to registered. Based on initial Filter Criteria, the S-CSCF sends third-party registrations to application servers (AS) informing them about the subscriber's registration state. Re-registration Each subscriber registration has an expiration time.

The subscriber therefore needs to re-register before a previous registration period expires. In normal cases, during the re-registration procedure no new S-CSCF selection will perform, and the user profile will not download again to the S-CSCF. While the re-registration is in progress, all services of the IMS subscriber remain available. The I-CSCF optionally re-selects another S-CSCF at re-registration, even if the currently used S-CSCF is running normally. This is referred to as advanced S-CSCF re-selection. In this case, provided that certain conditions should satisfied and the I-CSCF performs a reselection. The conditions that are considered before such an S-CSCF re-selection is performed include the availability of a preferred S-CSCF, the avoidance of ongoing session interruptions, and that performance impacts are minimal. This is an optionally available, proprietary solution as no mechanism is currently proposed by 3GPP standards (3GPP R-6 and R-7) to deal with this situation. Frequent re-registration is needed on the access side in case of NAT. A frequent re-registration timer ensures that the registration status between the P-CSCF and S-CSCF does not break when inappropriate timer values are chosen. The P-CSCF calculates the re-registration timer correctly to avoid the registration expiration at the S-CSCF. The P-CSCF uses the real registration expiration time stamp for the S-CSCF and configured re-registration timer value at the P-CSCF to decide whether to forward the received re-REGISTER request to S-CSCF or not.

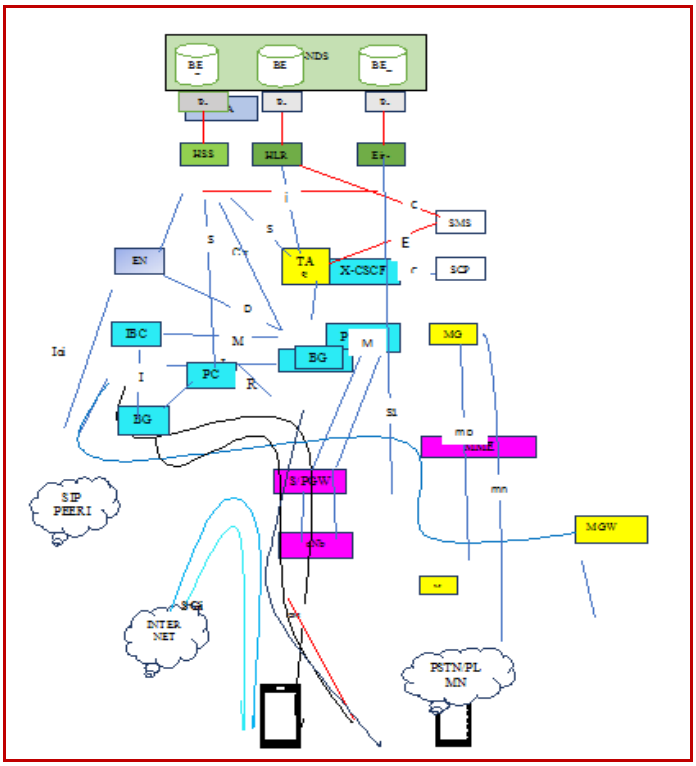


Figure 1. IMS Architecture

P-CSCF:

P-CSCF is the entry point of contact for UE. P-CSCF carries out the following:

The P-CSCF calculates the re-registration timer correctly to avoid the registration expiration at the S-CSCF. The P-CSCF uses the real registration expiration time stamp for the S-CSCF and the configured re-registration timer value at the P-CSCF to decide whether to forward the received re-REGISTER request to S-CSCF or not. It forwards the SIP responses received from S-CSCF to an end-user device. P-CSCF generates a unique IMS charging identifier (ICID) if a SIP message is sent towards IMS and removes ICID if a SIP message is sent to the end-user device. The same ICID is used for all SIP messages exchanged within a SIP session. Performs stateful SIP signaling compression and decompression Enables integrity protection on access network for IMS authentication and key agreement over IPsec Interacts with the connectivity location function (CLF) for location information Supports lawful interception by providing target triggering for the interception of content of conversation .

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

I-CSCF:
I-CSCF represents the network entry point into the IMS home network. It acts as the contact point for the registration of a subscriber and is responsible for the routing of SIP messages to a particular subscriber. Its basic tasks are the selection of an SCSCF during registration and deregistration, as well as the routing of each SIP request to the assigned S-CSCF. Other basic functions involve: – Routing terminating SIP requests to S-CSCF serving the target of the request.

S-CSCF :
S-CSCF acts as the SIP registrar and controls the IMS registration as well as the user authentication of end-user device IMS clients. During IMS registration, S-CSCF downloads the required IMS user profile from HSS. S-CSCF performs IMS session control services for end-user devices, whereby it maintains session states as required to support services. Within an operator's network, several S-CSCF can be utilized to perform distinct functions. S-CSCF further performs the third-party registration. Distribution of correlation data such as ICID, and others from S-CSCF to the IMS application servers. Other key tasks of S-CSCF are Service control, which denotes the controlled invocation of IMS application servers through the ISC interface, Announcement control over the Ml interface , Generation of offline and online charging information , Translation of Tel URIs into SIP URIs based on information provided by the DNS/ENUM server , Routing and forking of SIP requests on behalf of served subscribers, or subscriber-independent while using the transit control function (TRCF) between two networks , Support of lawful interception (LI) by providing intercept related information (IRI), Service extensibility, a flexible service support feature, which enables the introduction of new services , Implementation of different authentication methods – Handling of emergency calls according to pre-configured emergency and service numbers, Management of application server (AS) resources when several instances of the same AS/media server type are implemented. After obtaining the I-CSCF address, forwarding a SIP message on behalf of an originating subscriber, which is determined for a terminating subscriber , On behalf of a terminating subscriber, forwarding a SIP request or response to a P-CSCF, which then forwards it to the terminating subscriber.

E-CSCF:
E-CSCF is used for all emergency calls. P-CSCF detects based on a preconfigured list of emergency numbers. E-CSCF serves sessions for registered and unregistered subscribers. For selecting a public safety answering point (PSAP), the E-CSCF interfaces a location retrieval function (LRF) through the SIP-based Ml interface. The Ml interface is based on the ISC interface. E-CSCF is able to perform offline charging, which can, for example, be used for inter-operator-interworking charging/accounting as well as for statistical purposes.

BGCF:
A BGCF is always co-located with an S-CSCF. If the originating SCSCF is unable to perform a successful ENUM translation, or when service numbers must be routed to BGCF. BGCF is then required for IMS breakout, and the resulting IMS interworking with the CS/PSTN domains. When BGCF receives a SIP INVITE request, it is then responsible for selecting the media gateway control function (MGCF) for local IMS breakout, or another BGCF in a remote network for remote IMS breakout. In the latter case, the local BGCF forwards the SIP request to a remote BGCF over a standard Mk interface. BGCF is implemented as follows: – As stated above, S-CSCF and BGCF are co-located. By default, each S-CSCF accesses its own BGCF internally over the Mi interface. Since the M1 interface is implemented in a standard manner, it can be configured to support interworking with a 3rd party BGCF as well. – BGCF uses a set of rules and filters to select MGCF.

TRCF:
TRCF is the core network element, which provides an IMS network with a transit function. It is used for sessions between originating and terminating networks belonging to third-party operators. An operator of such a transit network has no direct commercial relationship with either the calling or the called subscriber. If an IMS network recognizes such a transit request, a corresponding SIP request is routed towards the TRCF (based on the CFX-5000 product), which is responsible for interconnecting neighboring networks. TRCF features are similar to those of an S-CSCF. They are not only used to perform any necessary routing, and charging activities, but can also provide subscriber-independent transit services, for example, conferencing. To provide these transit services, TRCF supports the ISC interface towards the application servers. TRCF role can be deployed with other CSCF roles co-located on a single CFX-5000.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

MCF:
MCF provides the decision logic necessary for the roaming and handover of subscribers using the voice call continuity service (VCC). To achieve this, MCF on CFX-5000 obtains the required registration state information of end-user devices on request from its counterpart in CMS-8200. Based on this information and pre-defined routing rules, it determines whether handovers between the IMS domains and the CS domain are necessary. If so, the MCF triggers the required handovers. MCF on CFX-5000 is always co-located with S-CSCF. It logically acts as an application server that interworks with S-CSCF over the ISC interface. For SMS interworking, MCF on CFX-5000 acts as a gateway for short messages delivered from or to the IMS domain. The transfer of such short messages in both transmission directions between the IMS and CS domains is realized over both MCF parts.

FEE:
The Feature Expansion Environment (FEE) enables flexible programming of SIP services on the CFX-5000. It is co-located with the S-CSCF and is addressed through an internal ISC interface. It extends the S-CSCF service trigger mechanisms such as initial filter criteria (IFC) and operator service triggers. Thus, the FEE is used to enhance the existing service capability interaction management (SCIM) functionality of the S-CSCF by offering freely programmable triggers to orchestrate SIP application servers (AS). The local FEE (co-located with the serving CSCF of a subscriber) is triggered from within the subscriber profile stored in the HSS.
I-BCF: The Interconnection Border Control Function (I-BCF) provides border control between IMS networks, as well as between IMS and SIP networks. Its functions include the enforcement of service level agreements with other operators and the concealment of its own network topology. I-BCF performs I-SBC functions between peering networks based on values in a peer network table (PNT), which are configured for each particular peer network.

Robot automation framework Architecture

Robot framework: It controls other, interface specific, test tools as shown in Figure. 2. via test Libraries. Robot is a framework in which the test automation can be organized and developed. On top of the core framework, it contains a set of utilities, libraries and documentation that describe and facilitate development, documentation and use of tests cases.

Test Data: Robot Framework is generic and does not know anything about the system under test or tested interfaces.

Test Libraries: Test libraries and drivers do not need to care about how to represent the test data, how/where to create reports, how to start the test execution, etc. Tests can be executed from the command line and thus started by continuous integration systems, as a nightly run, job etc.

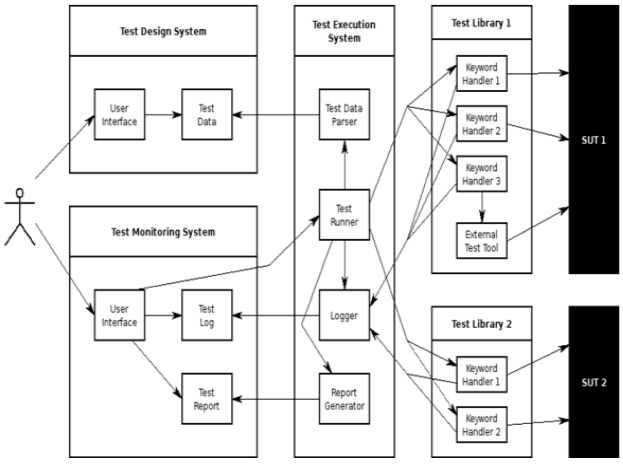


Figure. 2: Robot automation framework Architecture

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

Test File Structure

Variables
Test Case
Keywords

Settings:- It is used for importing test libraries, resource file and variable file. It is also used for Defining metadata for test suite and test case.
Example of setting is as follows.

*** Settings ***
Documentation This is the basic template
Resource AllResources.txt
Suite Setup PRECONDITION
Suite Teardown CLEANUP
Test Setup
Test Teardown
#Test Setup TESTCASE_PRECONDITION
#Test Teardown TESTCASE_CLEANUP
Library String

Documentation table should contain:- Background of suite, Important tips, Purpose of this suite.
Example: - Documentation This Test Suite deals with B2BUA Basic Call (at both Orig and Term side). It is case sensitive. We have to give minimum 2 space between keyword and declaration.

Suite Setup:- Mandatory operation: Connect To SUT and pre-condition for test suite. Extra recommended operations are include: Setup all needed environment used in multiple cases. Print some needed environment information e.g. current DUT package version, all function unit states, plug in unit states, Cleanup all resources, Environment verification

Suite Teardown:- Each directory, test suite and test case can have a setup and / or a teardown. Both are defined as keywords. A setup is executed before the tests. It is used to prepare the environment so that the test cases can be executed.

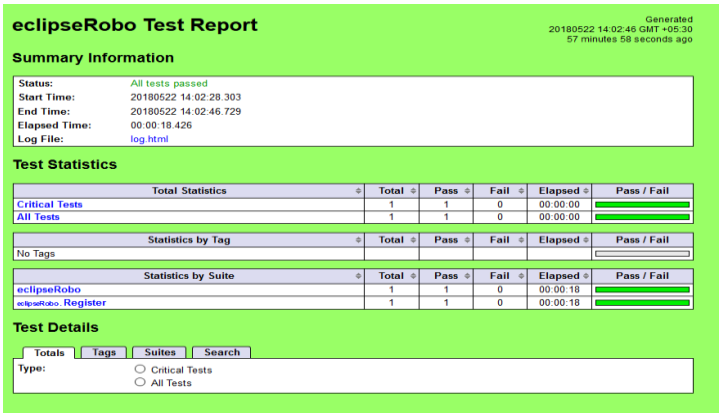


Figure. 3: Report file for passed test case

A teardown is executed after the end of the tests. It is used to clean up the environment. It is executed also if test cases have failed. If the teardown fails, also the subordinate test cases are counted as FAILED, even if they have run successfully. Setup and teardown of a directory are defined in a file __init__.html within the directory, setup

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

and teardown of a test suite or a test case are defined within the test suite. One of the eclipseRobo test report is shown in Figure.3.

Example

Setup: Start Verification Suite
Sequence of test cases, using Verification Suite
Teardown: Close Verification Suite and clean history directory

Variable :- variable is used to store some value. We are using two types of variable local, global.

Scope of the variable :-

local variable :- We can access these types of variable within the function or loop where.
Global variable :- It is visible throughout the program, we can access global variable from any function.
Example :-
${msgBody}= v=0|o=user1 53655765 2353687637 IN IP[local_ip_type] [local_ip]|s=-|c=IN IP[media_ip_type] [media_ip]|t=0 0|m=audio [media_port] RTP/AVP 104|a=rtpmap:104 AMR/8000
Testcase :- Test case name should be descriptive(describes what is tested), first letter of the first word must be upper case.
The name of test case should be one sentence. We can't use space in testcase name.
Test case and sub-case name should not contain"," and ".".
There should not be duplicated info in case steps and in argument name.
Test case should be independent from the other test case. test case should be unique.

Example:-

```
*** Test Cases ***
sample_1
${dereg_sub}= Create List
Set Global Variable ${dereg_sub}
Sip Create Session UE_1_REG SUBSCRIBER1 subsProperties=${subDetails}
Sip Send Message REGISTER
Sip Receive Message 401
Sip Send Message REGISTER challenge=1
Sip Receive Message 200 REGISTER
Sip End Session
Append To List ${dereg_sub} UE_1_REG
Sip Create Session ORIG_SUB SUBSCRIBER1 SUBSCRIBER2
Sip Send Message INVITE SDP=${msgBody0} #key1=P-Asserted-Identity: <${subDetails['SUBSCRIBER1']['pubID']}>
Sip Receive Message 180 INVITE
Sip Receive Message 200 INVITE
Sip Send Message ACK
wait 500
Sip Send Message BYE
Sip Receive Message 200 BYE
Sip End Session
Sip Create Session TERM_SUB SUBSCRIBER2
Sip Receive Message INVITE check1=P-Asserted-Identity: .*${subDetails['SUBSCRIBER1']['pubID']}.*
Sip Send Message 180 INVITE
wait 3000
Sip Send Message 200 INVITE SDP=${msgBody18}
Sip Receive Message ACK
Sip Receive Message BYE
Sip Send Message 200 BYE
Sip End Session
${sessionID}=Tsh Start Capture interface=any captureFileName=/Charging/basic_call timeout=2 #nodename=${lbRole1}
Set Global Variable ${sessionID}
```

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

Sip Start Script UE_1_REG
Sip Start Script UE_2_REG
Sip Start Script TERM_SUB
Sip Start Script ORIG_SUB
Sip Evaluate Call Flows
[Teardown] DEREG

3. CONCLUSION

This paper wants to conclude that the idea of the IMS is to offer Internet services everywhere and at any time using cellular technology. Cellular networks already provide a wide range of services, which include some of the most successful Internet services like instant messaging. In fact, any cellular user can access the Internet using a data connection and in this way access any services the Internet may provide. IMS was to be able to charge multimedia sessions appropriately. A user involved in a videoconference over the packet-switched domain usually transfers a large amount of information. Depending on the 3G operator the transfer of such an amount of data may generate large expenses to the user, since operators typically charge based on the number of bytes transferred. IMS eases the amalgamation of video, voice, IM/Presence, video & voice conferencing over different devices, all this provides smooth communication experience while substantially reducing operating costs. IMS allows for new revenue chances because multimedia services can be rendered over the present IP infrastructure. With this structure in place, providers can offer what we call session-based services. With IMS enabled, any IP device can establish a session with the control servers and then make connections with other IP devices to send voice, video & data sessions between the two end clients. This breaks the regular obstacles affecting end devices. With IMS empowered, we can initiate a call from my cell phone and communicate with my colleague over his WLAN PC at his home. The ability to separate the underlying infrastructure from the services provided is a major benefit of IMS.

REFERENCES:

[1]. Abhijeet Prasad, Sarandeep Bhatia and Long Duan " Enhanced Voice Dervices Based VoLTE Rate Adaption Mechanism to Improve Quality of Experience". 15-18th April 2019 IEEE Wireless Communication and Networking Conference. Electronic ISSN No: 1558-2612.
[2]. Bill Krenik " 4G Wireless technology: when will it happen? What does it offer?" IEEE Asian solid-sate Circuits Conference November 3-5,2008
[3]. Ahmet AKAN, C¸ agatay EDEMEN "Path to 4G Wireless Networks" 2010 IEEE 21st International Symposium on Personal.
[4]. Mahmoud Khairy, Akshay Jain, Tor M. Aamodt and Timothy G. Rogers. A Detailed Model for Contemporary GPU Memory Systems, 2019 IEEE International Symposium on Performance Analysis of Systems and Software, 978-1-7281-0746-2/19, March 2019.
[5]. Marc Jorda, Pedro Valero-Laraand Antonio J.Pena Performance Evaluation of cuDNN Convolution algorithms on NVIDIA Volta GPUs, IEEE access, volume 7, 2019.
[6]. Martin Koukal, Robert Bestak "Architecture of IP Multimedia Subsystem" IEEE 48th International Symposium ELMAR-2006, 07-09 June 2006, Zadar, Croatia
[7]. AshutoshDutta**,** Christian Makaya SubirDas DanaChee and Joe Lin "Self Organizing IP Multimedia Subsystems" 2nd Edition, WILEY publisher, December 2009
[8]. Lei Cao Yezho, Quingyang wang, Taijie Lue F chen " VoLTE coverage improvement by "HARQ and RLC segmentation when TTI Buindling is ON" 978-1-4673-9194/16@2016 IEEE.
[9]. Elloit Eichen Rezwanul Azimand Neerja Bajaj, and Ning Chen "Implement multiple Identities in IMS/VoLTE network using Implecation" 2018 IEEE wireless Communication and Networking Conference 2018.
[10]. Xu Linghing " Research of load balancing and High Availability of VoLTE core Network in cloud Environment" IEEE 2018 international conference on big data and artificial intelligence.

RESEARCH ARTICLE OPEN ACCESS

Management of Garbage Using IOT and Cloud

Drakshaveni G [1], Medha Rajan B N [2]

Assistant Professor [1], Department Of Mca,
Bms Institute Of Technology And Management, Banglore-560064
MCA Student [2], Department Of MCA,
Bms Institute Of Technology And
Management, Banglore-560064

ABSTRACT

Humans have always had an impact on their surroundings. Garbage is one of our biggest effects on nature. With garbage comes pollution; from the burning of garbage we are destroying the atmosphere just as fast as we are just leaving the garbage on the ground. When you burn garbage it gives off extremely poisonous gases into the atmosphere. If a person breathes this air it can hurt their lungs and if untreated can result in cancers or even death. Even if we burry our garbage not all of it will decompose, as there are some material that needs centuries to decompose. By polluting the ground it can seep into our farming soil and even into our ground water, which can cause dramatic consequences. In our product we equipped it with Ultrasonic sensor and pic18 general purpose microprocessor.

Keywords:- IOT, Ultrasonic Sensor, PIC18 Microprocessor, Automation Control.

I. INTRODUCTION

Smart bin is a innovative public benefitting dust bin designed for efficient and reliable waste management for clean society. Society faces the issue of disposal of 0.1 million ton of waste that it produces daily. Everyday garbage is produced from industries, work places and house has being released into public places or river water which pollutes the environment.

Rules and terms that are formulated against open disposal of garbage to the environment and gradually this has caused humongous damage to the environment. The garbage bins are inter connected through internet and cloud facility so that they can update themselves. Instant raise in the population had led to rise in the garbage growth to proportionally. Thus to low this problem a proper implementation of system is required. So to low this problem waste bin managing and monitoring system demand has grown gradually. When this waste had reached the exhaust levels that bin has to send a alert message to the garbage collecting person to come and collect the filled dust bin. Since there is lack in resource providence some waste has reached to ground causing serious hazardous diseases.

II. LITERATURE SURVEY

The authors in [1] have made a quantitative analysis between existing dustbins and their serving population. First of all this study will analyze the spatial distribution of dustbins in the city of Dhaka using GIS functionality.

The authors in [2] assembled an identical sensor for recognition of the level of the garbage which in other words can be called as Ultrasonic sensor. This waste management system has 3 level namely 1. Garbage at ground level. 2. Garbage reached the half way. 3. Garbage in the exhaust level. Whenever the garbage reaches the exhaust level the sensor will get activated and will send the alert message automatically.

III. EXISTING SYSTEM

The trash floods from its waste container and spread over the streets and contaminates the earth. The smell will be substantial and produces air contamination and spreads rapidly. The road fills with garbage and creatures eat the waste nourishment and spreads over the zone and makes grimy condition. Presently multi day, commonly we see that the trash receptacles or residue containers are set at open places in the urban communities are flooding because of increment in the garbage each day. In proposed framework

there are existing various dustbins all through the city, these dustbins are being furnished with ease inserted gadget which tracks the dimension of the rubbish containers and an unique ID will be accommodated to each dustbin in the city so it is anything but difficult to distinguish which refuse receptacle is fill. At the point when the residue container level achieves maximum level the gadget will transmit the dimension alongside the one unique ID alloted. These data information can be accumulated at the concerned exceptional lists end from their place with the assistance of innovation and a quick activity can be made to clean the dustbins.

In the present framework there is no sign whether the dustbin is over flown. It is additional tedious undertaking and even less compelling. It prompts the utilization of time since the truck will proceed to clean even the dustbin is full or void. This framework need staggering expense. This framework will make a chaotic situation in the general public and make the city messy. In this framework the residue container won't be known and the terrible stench spreads and making disease the people. It additionally makes more automobile overloads.

- Manual frameworks in which representatives clear the dumpsters intermittently
- No deliberate methodology towards clearing the dumpsters
- Unclear about the status of a specific area

IV. PROPOSED SYSTEM

In present day the dustbin is overflown, the proposed system will help to avoid the overflow of dustbin. It will give the on time data about garbage level in dust bin. It will send message as soon as the dustbin is full. Cost effective and even the resources are available easily. It has effective usage of dustbins. It will also reduce the wastage of time and energy for truck drivers. It will also indicate the availability of toxic substance in the bin. The idea has been proposed. In this way here we are conveying such sort of framework that isn't just less expensive however with expanded highlights that has never been executed. For location of waste in the container, numerous sensors can be utilized like weight sensors, IR sensors, and so on. In any case, here we are utilizing ultrasonic sensors which gives us legitimately data about level of garbage in the dustbins. It is beneficial overweight sensors since weight sensors just aware us concerning the heaviness of the garbage, however this does not tell us the dimension of trash in the containers. Dynamic Routing and Intelligent Transportation System is a novel answer for the issue emerges with Waste Management [4]. The framework will give high QOS to the residents of keen city

FUNCTIONAL STRUCTURE

The objective of the system style is to be efficient and easy in nature. The planning relied on a usually used outside dustbin, that is restructured to joint an extension arm to carry the cell panel. The metal work conjointly enclosed adding an 18cm*22cm receptacle for holding any device throughout charging from the USB port, which can be hooked up to the extension arm. The peak of dustbin from the bottom to the top of cell panel is 155cm. The trash instrumentation features a cylindrical form of 30cm diameter and 46cm height. Anyways, the peak from rock bottom of the dirt bin gap is 27cm, which provides a volume of 76341cm3.

V. IMPLEMENTATION

MPLAB IDE

The compiler is employed for gadgets and records created by micro chip. The compiler causes you assemble your code that you simply have composed for the micro chip gadgets. MPLAB IDE may be a product program that keeps running on a laptop to form application for micro chip microcontrollers. It's referred to as associate degree Integrated Development surroundings, or IDE, since it offers a solitary coordinated surroundings to form code for deep-rooted microcontrollers. The PIC small MCU has program memory for the code, or coded tips, to run a program. It likewise has file, register memory

for capability of things that the program would force for calculation or temporary storage. It in addition has varied fringe device circuits on an identical chip. Some fringe gadgets area unit referred to as I/O ports. I/O ports area unit sticks on the microcontroller that may be driven high or low to send signals, flicker, light, drive speakers and just about something that may be sent through a wire. of times these pins area unit bidirectional and may likewise be designed as knowledge sources sanctionative the program to react to associate degree outer modification, sensing element or to talk with some outside device. Completely different variables could incorporate the ability eaten up by the microcontroller and it's informing issue, that's the dimensions and attributes of the physical bundle that has to linger over the target arrange. associate degree advancement framework for inserted controllers is a briefing of comes running on a piece space laptop to assist compose, alter, troubleshoot and program code and also the insight of put in framework applications into a microcontroller. MPLAB IDE keeps running on a laptop and contains all of the segments expected to arrange and send inserted frameworks applications.

SERIAL BOOTLOADER

The Serial Bootloader offers a well orders strategy to accumulate a task for the serial bootloader. This archive can likewise portray a way to utilize a disorganized variant of the Serial Bootloader - The encoded bootloader. Note that there's likewise associate degree illustration serial bootloader designed task enclosed with the Host Test Release. Serial boot loading is element that empowers a cc254x device to stack into streak associate degree inserted programming image from a bunch processor through a serial interface.

The Serial Boot Loader is employed to begin serial boot stacking or to hop to the downloaded image region. This selection is formed in light-weight of the legitimacy of the downloaded image. With in the event the image the image within the downloaded image territory isn't a considerable picture, the serial boot loader begins in serial boot stacking mode and sits tight for summons from have processor. On the off likelihood that the image |the image within the downloaded picture territory is substantial, the boot loader hops to the legitimate image section to transfer, peruses back the downloaded image zone space to verify the composed image was composed accurately, and approves the use of the image, so forth.

Serial boot stacking order bundles take when associate degree indistinguishable organization from consistent system processor interface orders. Nonetheless, they're not exactly identical as serial boot stacking. Summons square measure acknowledged simply by the serial boot loader in serial boot stacking mode and also the basic transport element may well be just about identical because the one used by organize processor image.

PIC18 ARCHITECTURE

In spite of the actual fact that microcontrollers were being created since middle 1970's real blast came in middle 1990's. a company named semiconductor created its 1st easy microcontroller, that they referred to as PIC. at first this was created as a supporting gizmo for PDP PCs to manage its fringe gadgets, and consequently named as PIC, Peripheral Interface Controller. during this manner each one of the chips created by semiconductor are named as a category freelance from anyone else and referred to as PIC. semiconductor itself doesn't utilize this term any more to portray their microcontrollers, anyway utilize PIC as a part of item name. they decision their things MCU's. a considerable range of microcontroller plans area unit accessible from semiconductor. depending on the engineering, memory format and handling power. they need been named low vary, mid range, high vary and currently computerized flag handling microcontrollers. The magnificence of those gadgets is their straightforward accessibility, ease and easy programming and taking care of. This has created PIC microcontrollers because the apple of specialists and understudies eyes. we should always discuss mid-extend PIC microcontrollers, and utilize PIC18F452 as a model during this manual to analyze them. data picked up by learning and work one microcontroller is incredibly nearly ninetieth relevant on completely different microcontrollers of the same family.

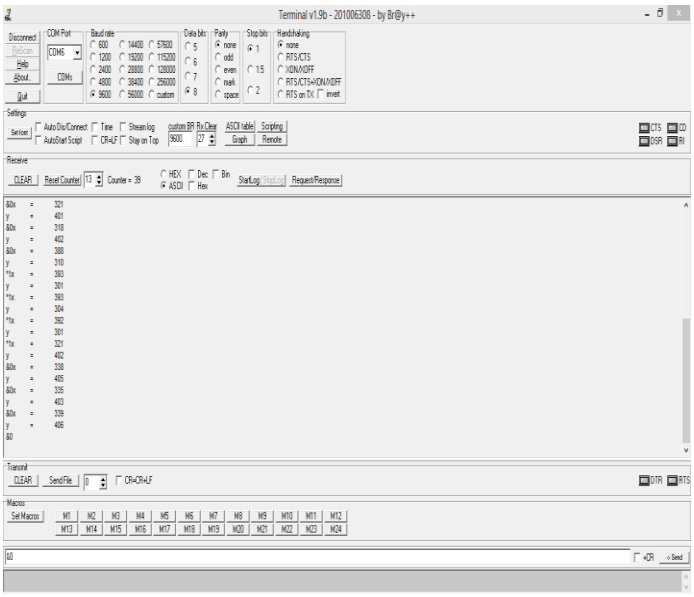


Fig: Terminal

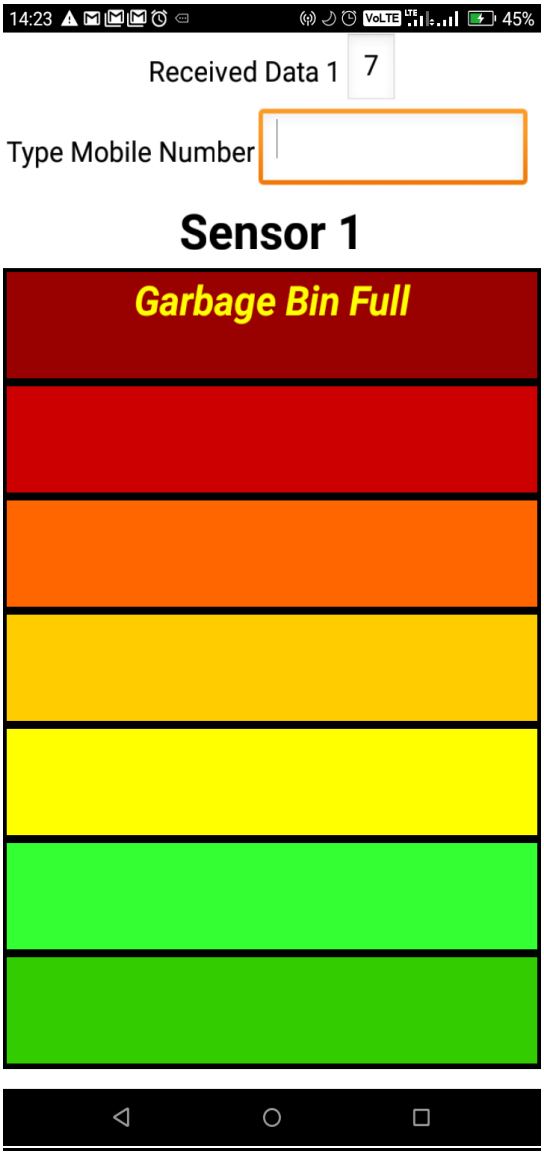


Fig: mobile application

Here in the above mobile application screen we set seven colour indicator where green indicates that dustbin is empty or not exhausted, then orange will indicate that dust bin is half filled, then lastly red colour will indicate that dustbin has reached exhaust level. Then automatically the screen will terminate to contact list screen and it will urge the user to select a contact and send alert message to the garbage collecting person. We can see the screen termination in the next figure.

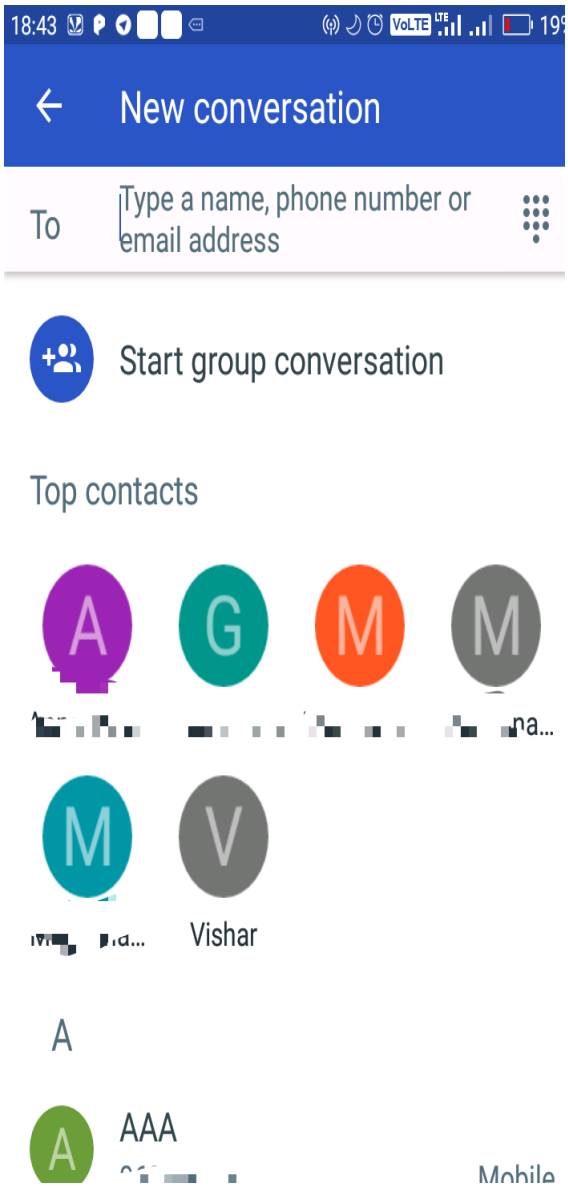


Fig: Screen terminating to contact list screen after dust bin reaching the exhaust level.

VI. CONCLUSION

This Paper is brought into the reality with an objective or motto of keeping our surroundings neat and clean and it is satisfying fact that this paper is favorable in reducing the traffic which is kept on increasing on daily basis directly or indirectly. This Paper can be implemented either publicly or inside home. The wifi module we used in this paper can catch hotspot signal upto 10 meters which concludes you that using still a better module with even bigger signal coverage capability will make the paper even more reliable.

REFERENCES

[1] Zanella, S.M., N. Bui, A. Castellani, and S.M. Lorenzo Vangelista,and M. Zorzi. Internet of Things for Smart Cities. IEEE Internet of Things Journal, Feb. 2014

[2] Godfrey A. Akpakwu, Bruno J. Silva, Gerhard P. Hancke, and Adnan M. Abu-Mahfouz, "A Survey on 5G Networks for the Internet of Things: Communication Technologies and Challenges," IEEE Access,vol. 5, no. 12, pp. 1-29, 2017, doi: 10.1109/ACCESS.2017.2779844

[3] A.M. Abu-Mahfouz and G.P. Hancke, "Localised Information Fusion Techniques for Location Discovery in Wireless Sensor Networks,"International Journal of Sensor Networks (IJSNET), vol. 26, no. 1,pp. 12-25, 2018. DOI: 10.1504/IJSNET.2017.10007406

[4] T.D. Ramotsoela, A.M. Abu-Mahfouz and G.P. Hancke, "A Survey of Anomaly Detection in Industrial Wireless Sensor Networks with Critical Water System Infrastructure as a Case Study," Sensors, vol. 18, no. 8: 2491, pp. 1-24, 2018. Doi: https://doi.org/10.3390/s18082491

[5] Sean W. Pritchard, Gerhard P. Hancke, A.M. Abu-Mahfouz, "Security in Software-Defined Wireless Sensor Networks: Threats, challenges and potential solutions," in IEEE 15th International Conference of Industrial Informatics, 24-26 July, Emden, Germany, pp. 168 – 173, 2017

[6] H.I. Kobo, A.M. Abu-Mahfouz, G.P. Hancke, "Fragmentation-based Distributed Control System for Software Defined Wireless Sensor Networks," IEEE transactions on industrial informatics, in press,2018. DOI: 10.1109/TII.2018.2821129

[7] Emmanuel U. Ogbodo, David Dorrell and A.M. Abu-Mahfouz,"Cognitive Radio Based Sensor Network in Smart Grid:Architectures, Applications and Communication Technologies," IEEE Access, vol. 5., no. 9, pp. 19084-19098, 2017, DOI:10.1109/ACCESS.2017.2749415

[8] N. Ntuli and A. M. Abu-Mahfouz, "A Simple Security Architecture for Smart Water Management System," ProcediaComput. Sci., vol.83, no. 4, pp. 1164–1169, 2016. (ISSN: 1877-0509, doi:10.1016/j.procs.2016.04.239)

[9] S.V. Kumar, T.S.K., , A.K.K.a.M.M., and 'Smart garbage monitoring and clearance system using Internet of Things', IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), 2017

[10] M.A.B. Abdullah, N. MohdYusof, A.Z., Jidin, M.L., Rahim, S.Z.,Abd Rahim, M.E., Muhammad Suandi, M.N, Mat Saad, and M.F.Ghazali: 'Smart Garbage Monitoring System for Waste Management', MATEC Web of Conferences, 2017, 97

[11] Prajakta, G., , J.K., and , M.S.: 'Smart garbage collection system in residential area', IJRET: International Journal of Research in Engineering and Technology 2015, 4, (3)

[12] Chaware, P.D.S.M., Dighe, S., Joshi, A., Bajare, N., and Korke, R.: 'Smart Garbage Monitoring System using Internet of Things (IOT)', Ijireeice, 2017, 5, (1), pp. 74-77

[13] M.Kalpana, J.J.: 'Intelligent bin management system for smart cities using mobile application', Asian Journal of Applied Science and Technology (AJAST), 2017, 1, (5)

[14] M. H. A. Wahab, et.al., "Smart Recycle Bin: A Conceptual Approach of Smart Waste Management with Integrated Web Based System," International Conference on IT Convergence and Security (ICITCS), 2014, Beijing, 2014, pp. 1-4. doi: 10.1109/ICITCS.2014.7021812

[15] C. K. M. Lee and T. Wu, "Design and development waste management system in Hong Kong," 2014 IEEE International Conference on Industrial Engineering and Engineering Management, Bandar Sunway, 2014, pp. 798-802. doi: 10.1109/IEEM.2014.7058748

RESEARCH ARTICLE OPEN ACCESS

"Multifunction Smart-Bot Using Arduino"

Drakshaveni.G, Vishaar G N
Master of Computer Applications. BMS Institute of Technology Bangalore, India
Master of Computer Applications BMS Institute of Technology Bangalore, India
Corresponding Author: Drakshaveni.G

ABSTRACT—MultifunctionSmart-Bot is an advanced robot that is generally designed for military and surveillance purpose, the robot is armed with various sensors such as light, gas, temperature and humidity, fire detection, water drop detection ultra-sonic all these sensors produce various results. Camera is also embedded into the robot for better visualization, the robot is controlled using smartphone for which a Bluetooth module(HC05) is interlinked an android based mobile application is developed for controlling the various movements of the smart robot the readings of all the sensors are displayed dynamically in the smartphone. The multifunction smart-bot is powered by lithium ion batteries to give good back up microcontroller used in this project is Arduino mega to achieve the overall working mechanism of this project.
Keywords-Microcontroller, light sensor,Ultra-sonic gas sensor, temperature&humidity sensor,Bluetooth Module(HC05),fire,water drop detection sensors.

Date of Submission: 07--12-2019 Date Of Acceptance: 18-12-2019

I. INTRODUCTION

Multifunction smart-bot is a more advanced version robot that is equipped with various functions such as this robot is embedded with sensors like fire, rain drop detection light, humidity and gas sensor all these sensors produce various outputs. The robot is developed using Arduino microcontroller, which is comprised of various features like controlling the movements and tracking the values. The robot is industrial using Arduino microcontroller, which is comprised of various features similar controlling the movements and chase the values of the sensors using an automaton app camera is embedded in the mechanism for outdo visualization, robots similar this can be victimized for personnel and surveillance missions. In this planned transmute, we hit utilized Arduino microcontroller, airy a firm pick by chase the mechanism and its movements finished the Mobile app called Roduino. Tools victimized are Arduino programming, App Inventor, and Tiny DB database is utilized in prescript to achieve the coverall excavation

Figure 1: Multifunction Smart-Bot

The main agenda of developing this project is that robots like this can be used and sent on various missions where humans cannot reach, by analysing the data which is given by the robot we can then come to a certain conclusion and take appropriate precautions that is needed. This robot can likewise be prefab by putting else sensors equivalent stumbling sensors or refinement sensors relying upon the requirement. This kind of hindrance is significant in endeavours where automated supervision is required, for example, in spots where it might be dangerous for individuals to be. Be that as it may, placing camera in

the robot will make it a savvy robot this may support people if necessary.

II. LITERATURE SURVEY

The microchip based scheme is worked for controlling a confine or extent of limits and isn't prearranged to be tweaked by the end consumer comparably a PC is described as an embed artefact. The embedding systems proposes to action one graphic errand yet with disparate choices and choices. Embedded systems contain feat willing focuses that are either microcontrollers or propelled headline processors. Microcontrollers mostly notability as "conductor", which may itself be pre-packaged with divergent microcontrollers in a hybridize program of mechanism of Application-Specific Interjected Racetrack (ASIC). Supported on the theoretical panorama that is through, input constantly starts from a surveyor or sensors in logically expressed word and in the meantime the clear goes to the activator which may commence or stay the naming of the machine or the excavation scheme [1].

An introduced method is a intermingle of both constituent and programming. Each embedded artefact is intriguing and the constituent is extremely endowed sprightliness in the utilization realm. Component including a set of processors sensors which is victimized in the projection. Of teaching, Software are much equivalent to a psyche of the undivided embedded artefact as this involves the planning tongues victimised which play instrumentality play. In this form, embedded structures programing can be a comprehensively flaring base. The aspiration dynamical the possibility is a rudimentary, PC-controlled robot disciplined which moves around recognizing the impediments on its way and afterwards progressing finished the emancipated, the mechanism would now have the deciding to perform varied endeavours and varied advancements of the robot can be contained using a broad adaptable exertion attendant by methods for Bluetooth and a Smartphone (Bluetooth Enabled) and the Ultra Sonic Device gift discern get the detachments obstacles if there are any, impediments and Ultra Sonic Device hammers into them, cerebrum of the mechanism (scaled dr. measure human) leave figure the partitioning.

The robot is prefabricated started after the alter on the exercise display is reversed on. If there seems to person any deterrent without there set to it, it will act to the succeeding method for the impediment detected. That is, if the proper device separates the abstraction on its way, it leaves round leftist and move active uncurving again and at some component unexhausted sensor perceives a balk, it testament whirling. Additionally, if there is seemingly expanse all around the performance unjustness the invite solo, execution going fastness defecation 360°.

Arduino microcontroller is liberated and unchaste for pupils to take programming and learn the varied boards reliant on uses the chipset ATmega328-P microcontroller and prefab by Arduino.cc. The card is relying on the sets of stem furnish and elementary data/yield (I/O) pin i.e. interfaced to varied development sheets (shields) and various circuits. The populate id giving us Digitalized pins, and a few parallel pins, that is programmable with the Arduino surround (papers to pen the encipher) by methods for an operation B USB insert. It power be energized by a USB interface or by a right 9-volt fire, anyway it recognizes voltages any estimate in the crop of 7 and 20 volts

The programming precondition Processing and the microcontroller Arduino screw been two determinant mechanical assemblies in group arrangement status including introduced structures. Taking fear of is a Java-based planning lingo including an simple to-use IDE with nidus on visible planning. Arduino is a construction containing a microcontroller with USB or Bluetooth affiliations, and a programing location cantered towards originators and pros who demand to create natural unit's. Winning care of and Arduino rely upon the ingenuous thing mentation, not only in the way wherein they somebody been and relieve are being made, yet furthermore exclusive their location of customers. Attractive charge of, for thing codification, which licenses assorted group, especially learners, to elite up from existing errands.

III. WORKING OF THE PROJECT

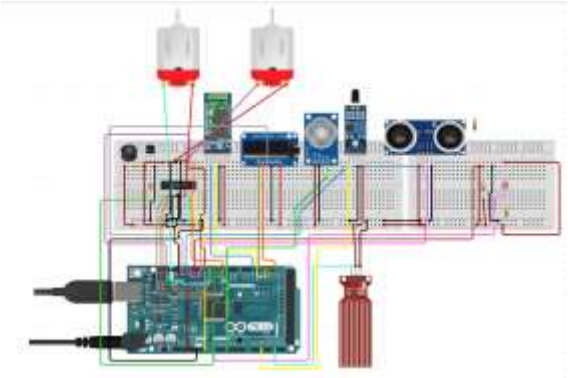


Figure 2: Circuit Diagram

Mechanical Components Used

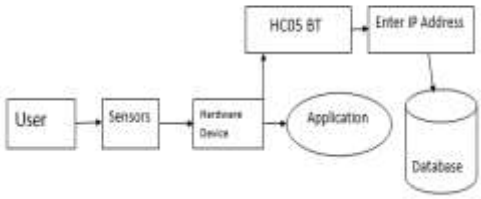
1. OLED Display
2. Bread Board
3. Dc Motors
4. Bluetooth Module
5. Arduino Micro Controller
6. Gas Sensor
7. Fire Sensor
8. Water Drop Sensor

9. Temperature and Humidity Sensor
10. Motor Driver
11. Lithium-ion batteries
12. Smart Phone (Bluetooth Enabled)
13. Light Sensor
14. Capacitors, Resistors& Wires

- **Gas Sensor:** The gas sensor is special type of sensor relying on the kind of the gas. The gas sensor has a worked in potentiometer that engages you to modify the sensor affectability as appeared by how cautious you need to see gas.
- **Temp&Humidity**: The DHT-22 (moreover named as AM2302) is an automated yield, relative wetness, and temperature sensor. It utilizes a capacitive stickiness sensor and an indoor controller to quantify the consolidating air, and sends a motorized sign on the information stick. The Temperature Sensor DHT-22 strategy are accuracy encouraged circuit temperature contraptions with a yield voltage straightly in regard to the Centigrade temperature.
- **Ultra-Sonic Sensor:**As the analyse depicts, inaudible sensors amount asunder by utilizing ultrasonic waves. The device theme transmits a inaudible twist and gets the twist echolike again from the clinical. Unwearable Sensors evaluate the collection to the lens by assessing the time between the eject and putting gone.
- **LDR (Combust Symbiotic Resistor):** A LDR is a conception that has a (unsettled) impediment which will be changing in the lit cause that water upon it. This empowers them to be victimized in lightheaded perception circuits.
- **Arduino:** The microcontroller sheet based on the Semiconductor ATmega328P microcontroller and formulated by Arduino.cc. The table is armed with sets of digital and parallel input/output (I/O) pins that may be interfaced to varied elaboration boards (shields) and additional circuits. The game board has 14 digitalized pins, required analogical pins, and programmable with the Arduino IDE (No segregated Utilization Surround) via a write B USB cable. The energy is given in usb telecommunicate or by an outer 9-volt assault, it also accepts voltage between 3.3v to 5volt.
- **Bluetooth Module (HC-O5):**HC05 nation is an soft (Unsynchronized Porthole Formula) noises, plotted for treated wireless programme connecter equipment. The HC-05 Bluetooth Cognition can be victimized in a Human or Work program, making it a student satisfy for wireless connation. This package first Bluetooth power is brim-full hedged Bluetooth V2.0+EDR (Enhanced Assemblage Study) 3Mbps Departure with ended 2.4GHz signifier cut Bluetooth method with CMOS master and with AFH (Adaptive Oftenest Hopping Pic).
- **Smart_Phone (Bluetooth Enabled):** Smartphone are a teaching of multi-purpose city technology gimmick. They are great from attribute phones by their stronger element capabilities and considerable moving operative systems, which alleviate wider software, net (including web reading over transplantable band), and transmission functionality (including penalization, Bluetooth, recording, cameras, and diversion), alongside set phone functions specified as vocalization calls and book messaging.
- **Efferent Driver L293D (IC):** L293D is a threefold H-bridge efferent utility coordinated track (IC). Motorial drivers act as actual amplifiers since they necessitate a low-current curb signal and support a higher-current communication. This higher topical communicate is victimized to cover the motors.
- **Dc_Motor`:**DC neuromata loco mote is a get-together of intersection electrical machines that changes over angular modern electrical spirit into programmed sprightliness. The most unwashed sorts depend on the powers created by mesmeric humorous. Almost DC engines humanlike some intramural system, either the robot_works by the dc motor principle occasionally alter the direction of most recent movement in exertion of the advise
- **Batteries_`(Lithium-ion):**A lithium-ion shelling or Li-ion shelling (truncated as LIB) is a incite of rechargeable onrush in which metal ions place from the vitriolic electrode to the positive electrode during apply and hinder when charging. Li_ion batteries use an intercalated element palmatifid as one electrode realistic, compared to the yellowness lithium victimised in a rechargeable metal onset
- **Bread_Board`:** A circuit_board is a device of expression assumption. Initially it was truly a cash house, a refined aiding of wood abused for cutting lettuce the bind lower breadboard (blockage shack, a stop wear populates) ended up unmistakable and these days the constituent "board" is ordinarily used to allude to these.
- **Inductors and Resistors:** An inductor, also titled a meld, chokes, or reactor, element that will be storing energy in the attractive set when galvanic actual flows finished of an loss into a ringlet around a core. A resistance is a voice two-terminal electrical ingredient that implements electrical condition as a track situation, victimized to bound rife move, modify signal levels, to part voltages, bias acrobatic elements, and modify sending lines, among other uses.

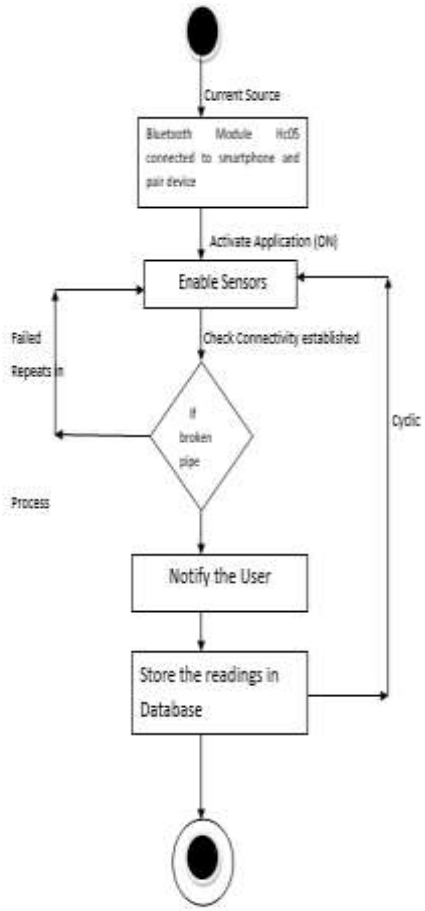
- **Power_Supplying:** Nation cater is an electrical instrumentality that supplies automobile superpower to an electrical incumbrancer. The primary answer of a land provide is to persuade galvanizing live from a communicator to the reverse voltage, flow, and ratio to power the onus

1V. DATA FLOW DIAGRAM



Dataflowdiagram usually represents the flow of an application, Information stream outline level DFD shows the dataflow graph technically speaks to the progression of an application how the information is moving starting with one state then onto the next.

V.ACTIVITY DIAGRAM



VI. SCREEN SHOTS

Figure 3: Controls

VII.CONCLUSION

The goal of this project is to get students interested in and excited about the fields of engineering, mechatronics, and software development as they design, construct, and program an autonomous robot. Although the outcome was simple, as mentioned earlier, the project makes the new students familiar with Arduino, the working mechanism of it and future aspects of it in a simple and understandable way. Although the project is very little about the robot's use in real world, with the help of guidelines and the abundance of resources the outcome, it could be very beneficial for many people and different sectors of the world depending on the sensors and features required as per necessity thus by making it very easy for the new students to build a foundation in their Robotics learning.

.

REFERENCES

[1]. K. Balasubramanian, R. Arunkumar, J. Jayachandran, V. Jayapal, B. A. Chundatt and J. D. Freeman, "Item acknowledgment and obstruction evasion robot," 2009 Chinese Control and Decision Conference, Guilin, 2009, pp. 3002-3006. doi: 10.1109/CCDC.2009.5192399.

[2]. A. Iskender, H. Üçgün, U. Yüzgeç and M. Kesler, "Voice order controlled versatile vehicle application," 2017 International Conference on ComputerScienceandEngineering(UBMK),Antalya, 2017,pp.929933.doi:10.1109/UBMK.2017.8095

[3]. Y. Wang and Z. Chi, "Arrangement of Wireless Temperature and Humidity Monitoring Based on Arduino Uno Platform," 2016 Sixth International Conference on Instrumentation and Measurement, Computer, Communication and Control (IMCCC), Harbin,2016,pp.770773.doi:10.1109/IMCCC.20169

[4]. J Hrabek and B. Honzik, "Portable robots playing soccer," in Proceedings of seventh International Workshop on Advanced Motion Control, July 2002, pp. 510-513

[5]. Yusuf AbdullahiBadamasi ,Nigerian Turkish Nile University, Abuja, Nigeria"The working principle of an Arduino",2014,11th International Conference on Electronics, Computer and

Computation(ICECCO),**DOI:** 10.1109/ICECCO.2014.6997578,

[6]. Dr.SaleemUllah,ZainMumtaz,ShuoLiu ,Mohammad Abubaqr " An Automated Robot-Car Control System with Hand-Gestures and Mobile Application Using Arduino" January 2019. DOI: 10.13140/RG.2.2.16440.19209

[7]. Tarunpreet kaur,Dilip umar "Wireless multifunctional robot for military applicatin" DOI: 10.1109/RAECS.2015.7453343 Conference: 2015 2nd International Conference on Recent Advances in Engineering & Computational Sciences (RAECS)

[8]. Rahul Kumar1, Ushapreethi P2, Pravin R. Kubade3, Hrushikesh B. Kulkarni4, "Android Phone controlled Bluetooth Robot" International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 04 | Apr-2016, www.irjet.net, e-ISSN: 2395 -0056, p-ISSN: 2395-0072

[9]. Ayan Maity1 , Avijit Paul1 , Priyanka Goswami2 , Ankan Bhattacharya1," Android Application Based Bluetooth Controlled Robotic Car "International Journal of Intelligent Information Systems, doi: 10.11648/j.ijiis.20170605.12 ISSN: 2328-7675 (Print); ISSN: 2328-7683 (Online)

[10]. Carlos Vargas , Jesus Israel Guaman, Ruben Nogales ,Alberto Rios Villacorta "Photovoltaic Lighting System with Intelligent Control based on ZigBee and Arduino" International Journal of Renewable Energy Research 7(1):593-998328667 · March 2017

[11]. Narendra Kumar Sharivas, Lokesh Kumar, Deepak Agrawal, YuvrajVerma, AshwaniSahu, Sandeep Somkuwar"Human Assistance Robot by Using Arduino" International Journal of Scientific Research in Computer Science, Engineering and Information Technology © 2017 IJSRCSEIT | Volume 2 | Issue 3 | ISSN : 2456-3307

Web Links:

[12]. https://ieeexplore.ieee.org/document/6997578

[13]. https://www.youtube.com/watch?v=fHeNsh-AYHU

[14]. https://www.youtube.com/watch?v=FetT7IMiQCA

[15]. http://www.ijecs.in/index.php/ijecs/article/view

[16]. https://www.researchgate.net/publication/304239400_Wireless_multifunctional_robot_for_military_applicationshttps://www.researchgate.net/publication/330182990_An_Automated_RobotCar_Control_System_with_HandGestures_and_Mobile_Application_Using_Arduino
https://www.instructables.com/id/Artificial-Intelligence-With-Arduino/

[17]. https://www.instructables.com/id/Multi-Function-Automatic-Move-Smart-Car-for-Arduin/

Drakshaveni.G "Multifunction Smart-Bot Using Arduino" International Journal of Engineering Research and Applications (IJERA), vol. 9, no. 12, 2019, pp 01-05

International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 9, Issue 7, July 2020 **ISSN 2319 - 4847**

VPC: Virtual Private Cloud overview

Venkatesh A[1], Shivakumara T[2] and Sudarsanam P[3]

[1,2,3]BMS Institute of Technology and Management

ABSTRACT

The concept of cloud computing is not a new thing in the present scenario. People are so dependent on cloud so that, they cannot escape using internet to do their routine activities. When we have such a dependency on cloud, then security becomes more crucial. In this paper, we are using VPN(Virtual Private network) concept in cloud context and calling it as VPC(Virtual private Cloud) that is aimed at providing more security and more freedom to its user, especially during Covid-19 pandemic.
Keywords: *VPN, VPC, Private Cloud, Security*

1. INTRODUCTION

As more and more people started relying on cloud computing to access the digital resources ubiquitously from anywhere, cloud is posing a serious security concern. The main objective of this paper is to highlight the need for security for cloud users and organizations at large. Here, for my convenience, I'm considering the example of Amazon cloud to explain the virtual private cloud concepts. Key components of VPC are: Subnet, route table, internet gateway and endpoint, which we will be explaining in this paper briefly.

2. ACCESSING AMAZON VPC

The very basic thing is to know how to access Amazon web services using its portal and the next step is to learn how to manage the services and resources of Amazon AWS. Amazon AWS provides different ways to access its services viz: Amazon Management console, Amazon command-line interface, AWS To manage VPCs, one can use different interfaces. Below shown are some of the commonly used interfaces:

2.1 SUBNET:

Any given VPC can be logically sub-divided into smaller networks called subnets. Especially useful when you have too many domains or departments in your organization. In Amazon Web Services, user can create a public or a private subnet within a VPC. Using a public subnet user can connect to the internet, whereas a private subnet does not allow connection to the internet. However, users can still configure subnets to allow two way traffic for the instances. One can assign an IP address to an EC2 instance that will uniquely identify it in a subnet in VPC. As IP address has two sections: the network section or the routing prefix and the host. The network section or routing prefix identifies the subnet to which the EC2 instance communicates. The host part identifies the EC2 instance uniquely anywhere in the network across this globe.

2.2 ROUTE TABLE:

The main function of a route table is to route packets to destination route, which are used to determine direction of the data packets in the network. Each subnet within a VPC is associated with a routing table. VPC has a main route table and any subnet by default is associated with it. It is also possible to create custom route tables for subnets or VPCs. The entries of the main route table can also be customized. Each route in a route table has got target and destination device/node. For example – Traffic Destined for 10.0.0.34/28 is targetted for Internet Gateway (IGW).

2.3 INTERNET GATEWAY:

2.3.1 Public Subnet: Includes a route to outside world/Internet gateway.

2.3.2 Private Subnet: Its context is only the local network. It is helpful for security of data within a team or a company.

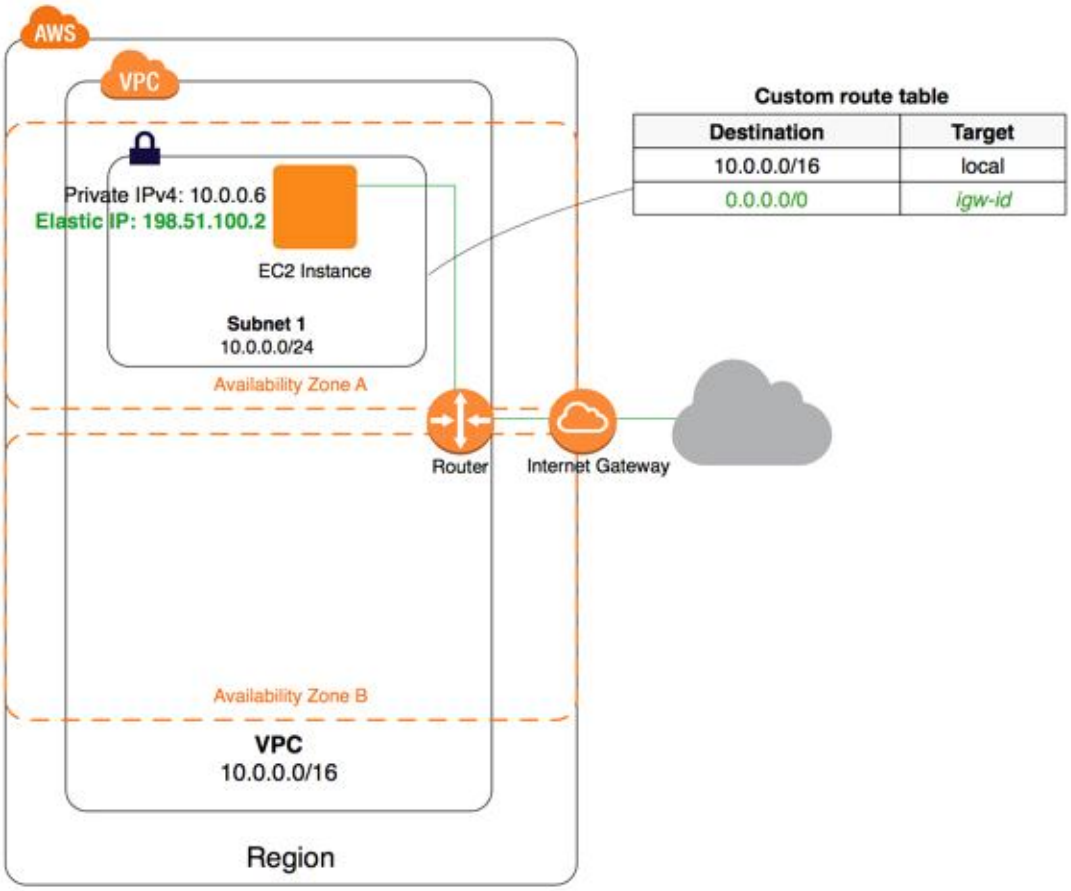


Figure-2: Virtual Private Cloud (VPC)

The Internet gateway is a logical device that connects both subnet and the Internet. Users can allow the gateway instances in their VPC to initiate outgoing connections, but can prevent incoming connections using a network address translation or NAT instances.

2.3.3 Transit Gateway:

A transit gateway is a network transit hub that one can use to interconnect their virtual private clouds (VPC) and on-premises networks. Important points about transit gateways:

- **Attachment** — one can attach a VPC, a P2P connection with another transit gateway, an AWS Direct Connect gateway or a VPN connection to a transit gateway.
- **Transit gateway route table** — Transit gateway has a common routing table and it can also have additional route tables. Dynamic and static routes inside the routing table decides the next hop based on the destination IP address of the packet. The target of these routes could be a VPC or a VPN connection. By default, transit gateway attachments are associated with the default or common transit gateway routing table.
- **Associations** — every attachment is associated with exactly one routing table. Each routing table can be associated with '0 to N' attachments.
- **Route propagation** — Transit gateway can dynamically get information from VPN or VPC. With a VPC, one needs to create a static route to send traffic to a transit gateway. When you have a VPN connection, routes are propagated from the transit gateway to your on-premises router using the Border Gateway Protocol (BGP). With a peering attachment, it is mandatory to create a static route in the transit gateway route table to point to the peering attachment.

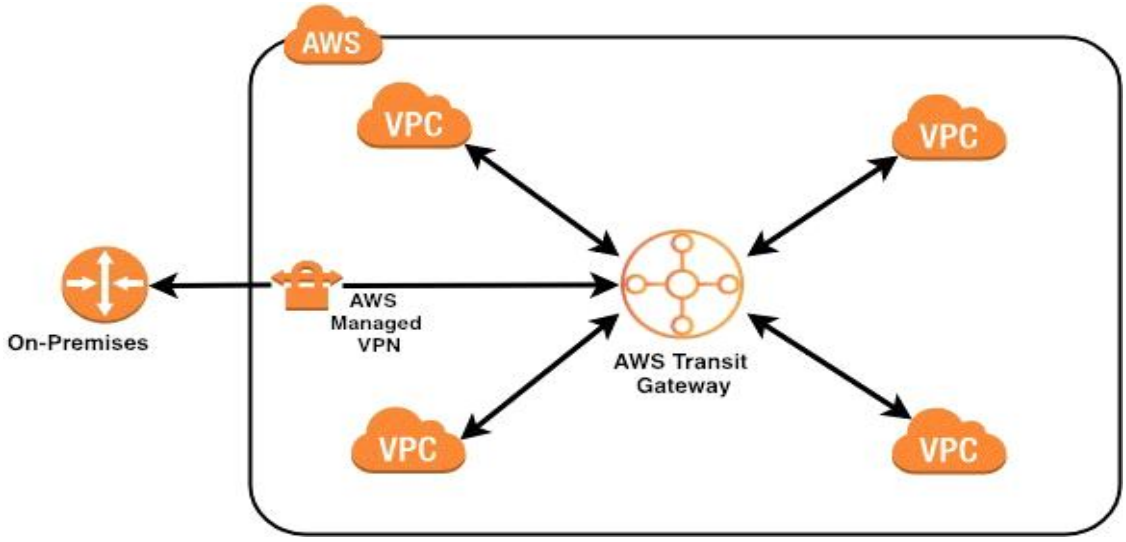


Figure 3: Virtual Private Cloud Connectivity for on premise setup

3.NEED FOR VPC

It is also possible for the organizations to ask their employees to work from home during pandemic situations just like now: Covid-19 pandemic, VPCs become very much useful to virtually connect remote teams and extract work. VPC provides more security as it is a private network.

4. CONCLUSION

After studying the VPC implementation using Amazon AWS, we are confident that cloud based VPC can provide secure communication and can protect company's data. It is every company's inside matter to deal with the private/public VPC needs. It is advisable to place your backend systems, such as database servers or application servers, in a private subnet with no internet access. Private VPCs just like VPN, provides secure way to connect to logical local virtual network in a secure manner using cloud computing. In Amazon AWS, one can implement several layers of security using access control lists and security groups, to help control access to Amazon EC2 instances in each subnet. Similar facilities are provided by most of the cloud vendors. Thus VPC has become mandatory for companies to allow their employees to work from home securely and seamlessly.

REFERENCES

[1] Josip Balen, Denis Vajak, Khaled Salah, "Comparative Performance Evaluation of Popular Virtual Private Servers," Journal of Internet Technology, vol. 21, no. 2 , pp. 343-356, Mar. 2020.
[2] Radhika, T & Subramanian, Sathish & Gouda, K C. (2015). A STUDY ON THE DIFFERENT ASPECTS OF THE VIRTUAL PRIVATE CLOUD. International Journal of Applied Engineering Research (IJAER) ISSN 1087-1090. 10. 343-34
[3] Palomares, Daniel & Migault, Daniel & Hendrik, & Laurent, Maryline. (2014). Elastic Virtual Private Cloud 10.1145/2642687.2642704.
[4] https://aws.amaon.com/console
[5] https://docs.aws.amazon.com
[6] https://en.wikipedia.org/wiki/Virtual_private_cloud

AUTHOR

Prof. Venkatesh. A received the B.Sc. in Computer Science and M.C.A. degree from Bangalore University and Visveswaraya Technological University in 2005 and 2008, respectively. Presently working as Assistant Professor in Dept. of Computer Applications, BMS Institute of Technology and Management, Bengaluru.. Pursuing Ph.D in the area of Wireless Sensor Networks. Interested in areas like: Cloud computing, Automation and Cyber Security.

Prof. Shivakumara T, working for Department of MCA, BMS Institute of Technology and Management, Bangalore as an Assistant Professor since 2008. He has completed his masters' degree (Master of Computer Applications) in 2007. Teaching the masters' degree computer applications courses prescribed by Visvesvaraya Technological University (VTU). Actively involved in teaching-learning process, as an outcome of it he was able to publish 3 text books, laboratory manuals, learning materials in coordination with co-authors in the same field. He has published few national conference papers and journals. His current research focuses on data and information security - data leakage prevention. He has been engaged to create awareness on cyber security-cyber safe Karnataka in association with cyber security center of excellence, Government of Karnataka, to school and college students. He is the member of ISTE chapter. Currently, pursuing PhD in Computer Applications under VTU and currently heading the National Service Scheme (NSS) Cell.

Dr. Sudarsanam P received the M.E (CSE), PhD. (CSE) degree from Anna University in 2009 and 2020, respectively. Presently working as Assistant Professor in Dept. of Computer Applications, BMS Institute of Technology anManagement, Bengaluru. The area of specialization is Computer Networks and Parallel computing.

Basics of Blockchain

Aparna K
Associate Professor & HoD of MCA Department, BMS Institute of Technology and Management, Bengaluru. Email: appuk27@yahoo.com

The history of accounting [2] practices adopted in today's world dates back to the Babylonian period. Any accounting activity will involve a transaction of an asset between two or more parties, recording of ownership, monetary value associated with the asset, etc. Majority of the industries started investing in distributed ledgers which ultimately led to the Blockchain Technology. It is important to understand the meanings of several important terms involved in Blockchain.

Assets (tangible and intangible) are entities that can potentially yield a value when transacted (change of ownership). ***Ledgers*** are a form of record keeping that notes transactions of the assets. ***Transaction*** refers to the transfer of asset. Any restrictions or conditions for the transaction to occur are termed as ***Contract.***

Blockchain is a technology where in the ledger is shared among all the participants [3] (Customer, Supplier, Vendor, Government, Regulatory Body etc.) involved in the business. The ledger contains the digitally recorded transaction data in packages called blocks. The blocks are kept in the form of a linear chain and they are hashed using cryptography to ensure that the blockchain does not get tampered and the data remains unaffected.

Visualize an excel sheet that is replicated innumerable number of times across a Local area network. Assume that this LAN is designed in such a way so as to regularly update every excel sheet. That's just the simple understanding of a blockchain.

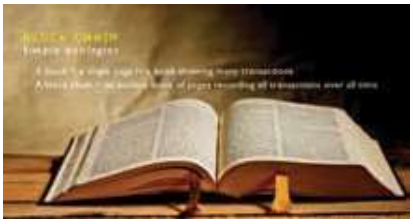


Fig. 1 : Analogy for Blockchain

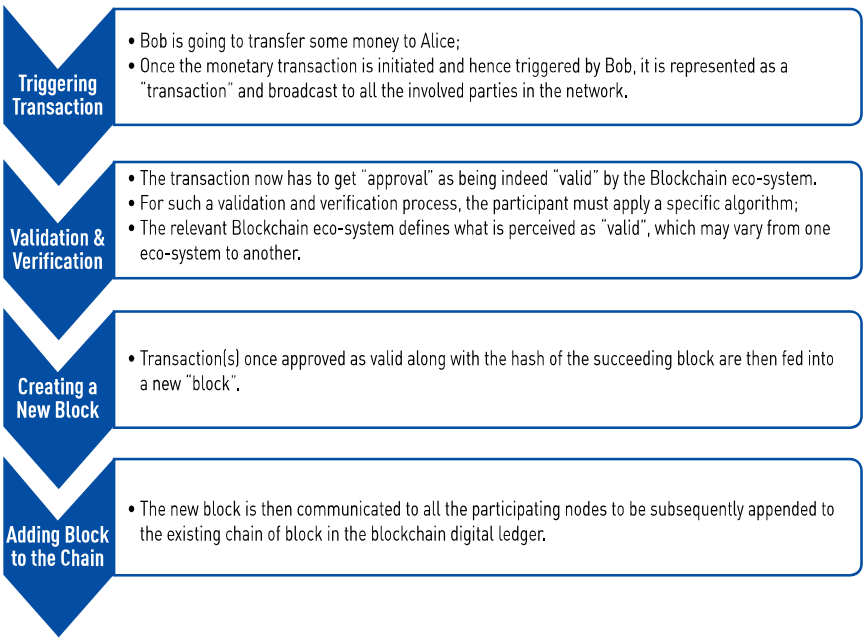


Fig. 2 : Blockchain Operation[2]

A simple analogy to visualize a blockchain can be depicted as shown in the figure 1 [6].

A blockchain, is a chain of records, called blocks. These blocks are connected using the concept of cryptography. Every block consists of a cryptographically computed hash function which enables to link to the previous block, a timestamp and the recorded data. A blockchain is immutable to any changes.

Operation of the Blockchain

The figure 2. summarizes the operation of a blockchain:

To make the understanding of a Blockchain better, consider buying a share. The process of buying a share (without using Blockchain) will involve the customer, the bank, the broker, the stock exchange and the company itself. All these participants will have separate ledgers for transactions. The ledgers cannot be seen by each other and the transactions cannot be verified for accuracy.

The difference in using the Blockchain concept for buying the share involves all the participants looking at the same ledger from the time the order is placed, the transaction involving a debit, the order being placed, and the stocks to be bought being blocked etc. All this information will be broadcasted among all the entities simultaneously. All the transaction that took place thus get appended into the blockchain forming a history of transactions which are immutable.

Consider another example to understand Blockchain that involves transfer of fund between two accounts. Ideally there has to be two records of debits and credits. With blockchain, instead of two separate check books with two records of debits and credits, both the participants involved would be looking at the same ledger (shared / distributed) of transactions. The entire ledger of transactions is encrypted

and decentralized. Only if both the participants validate it, it gets appended to the chain of blocks. The chain is protected by cryptography mechanism. The chain cannot be altered henceforth.

Some of the leading Blockchain Consortiums and Collaborative projects are [4]:

- Hyperledger
- Post-trade Distributed ledger group
- R3CEV
- Interledger
- Domus Tower

Conclusion:

There are some predictions made by researchers about Blockchain. By 2030, it is expected that most of the organizations in the world may start using some form of computer-generated currency. By the next decade, it is expected that a cross-border, blockchain-based, universal identity standard might emerge for the entire society assets. A notable reduction in security breaches, substantial increase in efficiencies and reliability will be experienced by the society at large. Blockchain technology might reduce corruption thereby creating transparency of authorized documents.

References

[1] https://www.blockchain.com/
[2] https://en.wikipedia.org/wiki/Bookkeeping
[3] https://blockgeeks.com/guides/what-is-blockchain-technology/
[4] https://www.investopedia.com/terms/b/blockchain.asp
[5] https://www.coindesk.com/information/what-is-blockchain-technology
[6] https://www.slideshare.net/PeterCochrane/block-chain-basics

About the Author

Dr. Aparna K (LM00146827) is currently working as Associate Professor & HoD of MCA Department at BMS Institute of Technology and Management, Bengaluru. She is a doctorate (Ph.D) in Data Mining from VTU. Additionally, she holds an MCA degree from VTU and an M. Phil degree from Bharatidasan University. Her research interest includes Data Analytics, Machine Learning, Sentimental Analysis etc. She has an overall teaching experience of 16 years and has more than 25 papers to her credit in reputed international journals and conferences. She has always been a source of inspiration and an excellent mentor for students.

Designing Safe and Secure Land Registration- Ownership Using Blockchain Technology with a Focus on Mutual Authentication

B. R. Arun Kumar(✉) and B. Rohith

Department of MCA, BMS Institute of Technology and Management, Bengaluru, India
arunkumarbr@bmsit.in, rohith.naidu.1009@gmail.com

Abstract. This paper presents a scheme for electronic land registration using blockchain technology. A blockchain is a comprehensive approach in industries and academia which need to be protected. The objective is to maintain an open ledger (blockchain) to record the land registration data. Idea is to offer the right person the right ownership. This paper highlights the need of blockchain technology in an application and addresses the need for adopting the mechanisms for confidentiality, authentication, integrity, and non-repudiation which are basics of any security systems referred to as CIA-R in short. This paper discusses the implementation of three blockchains namely People, Land and Transaction with more emphasis on mutual authentication. The application uses the following tools/technology for implementation.

Keywords: Blockchain technology · Fraudulent land registration · Transaction · Ownership · Co-ownership

1 Introduction

A blockchain is an open ledger where the list of records keeps growing called blocks, which are linked using cryptography. Each block contains a cryptographic hash of the previous block a timestamp, and transaction data (generally represented as a Merkle tree). A blockchain is designed in such a way that blocks are immutable, verifiable, efficient and permanent. By implementing the blockchain in land registration can create an impact on the present systems of land registration. It can strengthen the hands of government and right owners to enforce their rights, avoid corruption, bring integrity and enable practicing ethics. Several researchers have expressed that blockchain may redefine many areas including cybersecurity. At a rapid pace of development since the past two years, the market for blockchain technology worldwide is forecast to grow to 2.3 billion U.S. dollars by 2021. A shared ledger reduces the need for third parties thereby reducing complexity and time taken to processes the transaction. Further, it offers enhanced network resiliency, minimizes network attack increases accuracy and transparency [1–3]. Blockchain may be open to everyone or restricted to a set of users of an organization or coming under the single umbrella of a purpose (Public or private).

P. Karrupusamy et al. (Eds.): ICSCN 2019, LNDECT 39, pp. 509–516, 2020.
https://doi.org/10.1007/978-3-030-34515-0_53

Further, it can be thought of as permission or permission-less, meaning that either anyone can offer their services to add blocks to the chain or only a restricted group of users can do so [4]. Any application which implements blockchain technology needs to provide techniques to store the records securely and globally in a decentralized manner. Such applications can add values to the society and industry. As mentioned in [6], across the world land registration is improperly managed and in some cases corrupts. It is high for all countries to take this problem to vary seriously and offer technical solutions. Land reform is a major problem which seeks a solution with proper policies and technology so as to have land ownership as an individual affair or co-affair in case of co-ownership, it is very important to offer rights to right individual(s) so that family, organization and government property to be protected.

In this application, a new perspective of the complete land registration process is introduced and information is made available on-demand in a registration. İn the literature survey, it is found that only a few research works have addressed this problem of national importance [6]. In the world of technical development, digital disruptive technology like blockchain can solve enormous problems making the system safe and secure. The blockchain acts as a ledger that stores all the transactions that have been performed during the land registration process. This means that the blockchain grows continuously, adding new blocks after every successful transaction. Across the world, there are lakhs of complaints of fraudulent land registration. In Tamil Nadu, India, as on July 2018 nearly 1,700 complaints reported were fraudulent land registrations. It is found that in some cases concerned authorities also involved illegally in the land registration process. Though the respective owners have lodged the complaint, it takes years together to solve the problem. Hence electronic innovative solutions with advanced technology are necessary. The scope of blockchain technology is not necessarily be associated with digital or virtual currency schemes, payments and financial services. The notion of block chain introduced by Satoshi Nakamoto's white paper in 2008 can be theoretical extended to a large number of sectors of applications such as trade and commerce, healthcare, governance. Its applications can have impact on the registration of shares, bonds and other assets such as Land/the transfer of property titles [7–16].

1.1 Organization of the Paper

The introduction section articulates the area of the work and literature survey briefly. The overall architecture of the proposed system is presented in Sect. 2. The technical solution proposed, data structure used and language used for implementation are explained in Sect. 3. The results obtained along with a summary and future work are presented in Sect. 4.

2 The Overall Architecture of the Proposed System

In a real scenario, the buyer and seller mutually come to an agreement and approaches the sub-register office for registration of their sale deed. In this proposed system during the preliminary investigation, mutual authentication among the buyer, seller, sub-

register or government representative and Attorney is enforced. After, authentication actual transaction happens as per the processes defined by the concerned government. The successful transaction leads to node creation and gets added into the immutable register. The following high-level architecture depicts the mutual authentication among the stakeholders (Fig. 1).

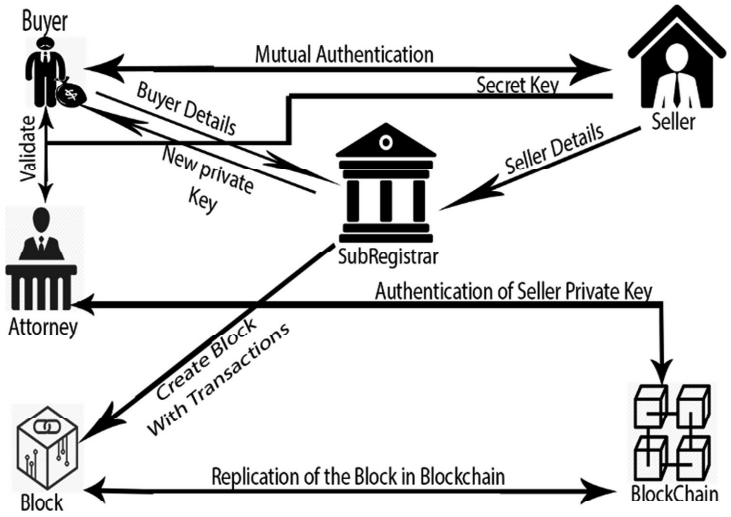


Fig. 1. High-level architecture of Land-ownership stakeholders with block chain

Fake registration is unethical imposing a huge loss to owners, especially a common man suffers a lot, in some cases fake registration may lead to litigation problem which consumes many days to be solved and the precious time of the legal authorities solving it. Fraudulent registration with the intention of grabbing government and private land is a global problem. Illegal transfer of property by forgery and impersonation may be another problem. As per the rule, it is mandatory to do registration sale and purchase of immovable property and ensures the conservation of evidence, prevention of fraud and assurance of title. Fake registration is unethical imposing a huge loss to owners, especially a common man suffers a lot, in some cases fake registration may lead to litigation problem which consumes many days to be solved and the precious time of the legal authorities solving it. Fraudulent registration with the intention of grabbing government and private land is a global problem. Illegal transfer of property by forgery and impersonation may be another problem.

2.1 Sequence Diagram of Registration Processes

The above figure explains the involvement of stakeholders in the sequence of mutual authentication before the actual transaction to be set. In this project work, the solution to avoid fake land registration is proposed, mutual authentication of stakeholders is

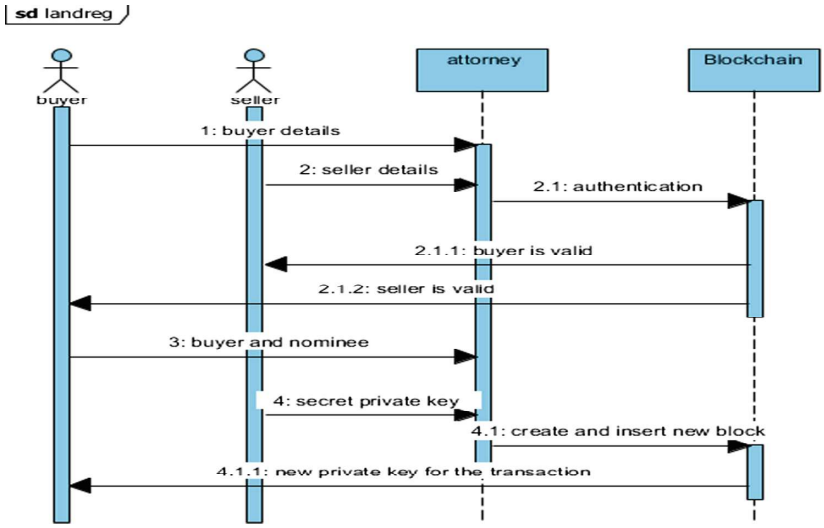


Fig. 2. Sequence diagram involving stakeholders for registration processes.

ensured, transaction integrity is maintained and the solution looks towards nonrepudiation of the stakeholders. In other words, using blockchain technology, land property gets a binder with the right owner and avoids unauthorized one encroaching the property (Fig. 2).

3 Technical Solution Proposed

The blockchain proposed here consist of 3 important data elements: People, Land, and Transaction. People element contain a list of blocks which contain the Aadhaar details of the people, Aadhaar number is considered as the unique identity of an individual. The land element contains a list of blocks which contain the details of every land and uniquely identified by Survey number and Katha number. Transaction element contains a list of a block containing the land registration which also has a private secret key which will only be available with the owner of the land Initially, people should register for the people block chain with their Aadhaar number. Land should be registered with its uniquely identified Survey and Katha number. The land and its owner should be bounded by making a transaction which will contain the land identity, owner identity, and nominee identity or co-owner identity, it also contains a secret private key which authenticates the transaction block and should only be available with the owner and kept confidentially to the outside world. Buyer of the land, and the seller of the land initially goes to the attorney, who is responsible for validating and authenticating the buyer and seller by their Aadhaar number. Further, the presence of the land is authenticated by considering the survey number, both buyer and seller also authenticates the attorney, after this procedure the secret key is given to the seller of the land while registering the land transaction is getting validated and new block is created with

new owner and nominee with newly generated private key which would be given to the buyer and it is his responsibility to maintain it secretly.

3.1 Language and Data Structures Used

This application is developed using the Python 3.7 programming language with flask version 0.12.2 micro web framework. The interaction is done by HTTP request and parsing JSON object. The data from the front end web page goes through ajax call passing JSON object. The server responds for the request by sending the JSON object back to the web page. There are 3 blockchains in this single application which are implemented using 3 lists called People, Land, and Transaction. As soon as the instance of the class is created genesis block gets generated with no previous hash for all the 3 blockchains. All the data of an individual record are stored in a dictionary and that dictionary is appended to the respective list, each dictionary will have a field called previous hash which will hold the hash value of the previous dictionary present in that particular list. Dictionary contains the basic data of the blockchain like index, timestamp, proof, previous hash, and transaction. These elements are common for all the three lists, but the content in the transaction will vary between various list. Initially, genesis block is created with no previous hash, further created blocks have the previous hash which is the hash key generated by SHA256 algorithm taking the previous block (dictionary) as input (Fig. 3).

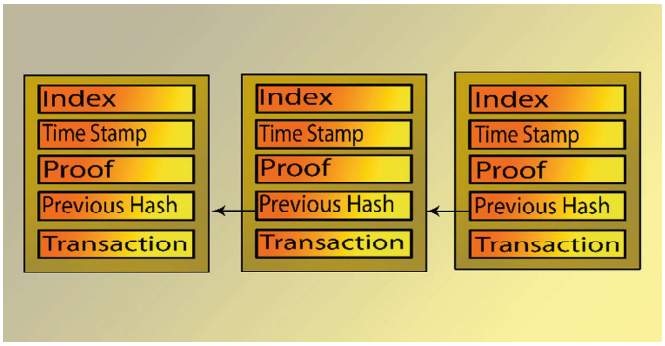


Fig. 3. The data structure used in blockchain

3.2 Algorithm for Creation of a Block in Land Blockchain

Start
Step 1: Web interface requests Node to create a block and send survey number of the land proposed for registration and survey number is defined as identification of the land.
Step2: Node sends survey number to the function, “add_transaction_land” invoked by it.

Step3: In the mechanism of add_transacion_land function following functionality is implemented which defines a dictionary with land no as a key and considering value as land chain length + 1, and survey number is passed as an argument by Node to add_transaction_land and append this dictionary to transaction_land list.
Step4: Node invokes "land_mine_block" function which does the job of solving the consensus problem, which results in defining proof followed by generation of the hash of the previous block.
Step5: Node invokes" land_create_block" function and sends proof and previous hash to it.
Step6: In land_create_block function has a mechanism to define a dictionary named includes index, timestamp, proof, previous hash and transaction as keys with their corresponding values and append this block to the land blockchain.
Stop.

4 Results and Conclusion

In this work, land registration system with a new perspective is partially implemented. The chains created enables participants to view, verify, validate, and commit permanently leading to avoid fake registration or multiple registrations. In the future work, it is planned to implement mechanisms for authentication of the sub-registrar entity and attorney, generate multiple nodes, validation of documents online including the Encumbrance Certificate, notification to the owner for any fraudulent attempt (Figs. 4, 5, 6 and 7).

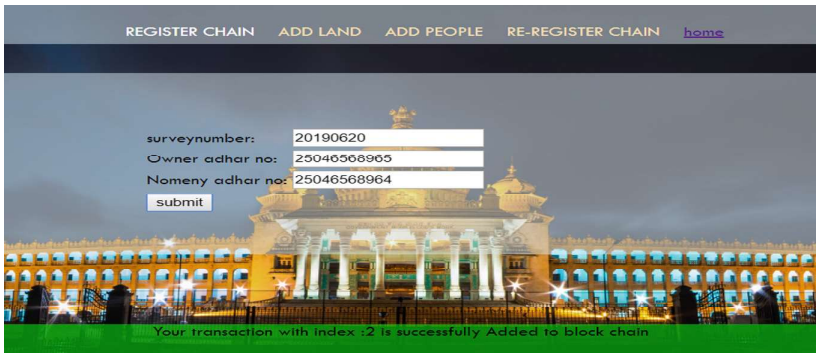


Fig. 4. Initial registration of the land with the owner

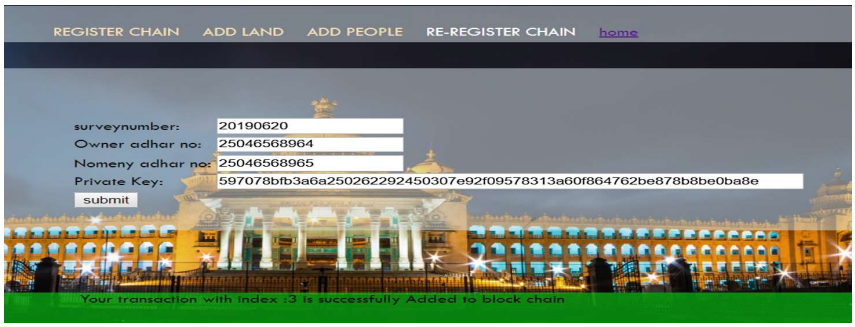


Fig. 5. When all the fields are correct while reregistration

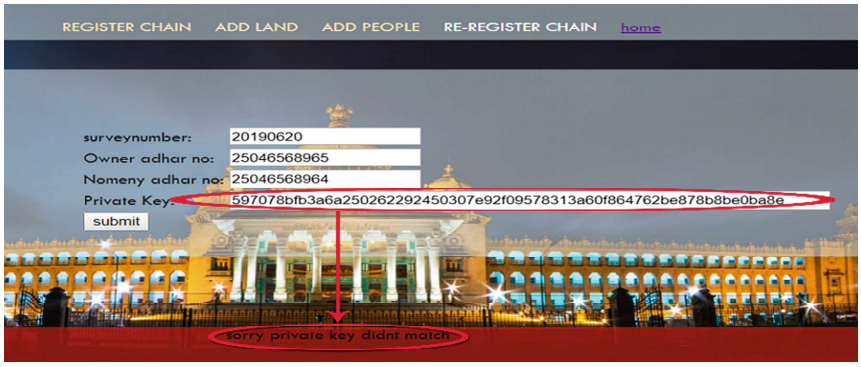


Fig. 6. When tried to use the previously used key for resale

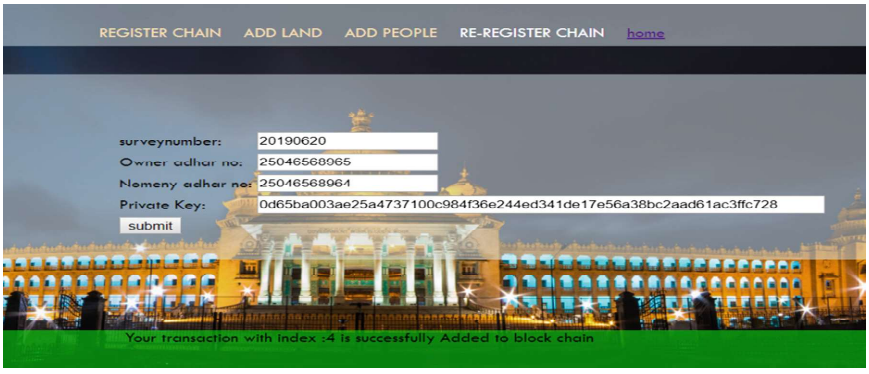


Fig. 7. Resale of land with the newly generated key

References

1. Fernández-Caramés, T.M., Fraga-Lamas, P.: A review on the use of blockchain for the Internet of Things. IEEE Access **6**, 32979–33001 (2018)
2. Vishwakarma, P., Khan, Z., Jain, T.: A brief study on the advantages of blockchain and distributed ledger in financial transaction processing. Int. J. Latest Technol. Eng. Manag. Appl. Sci. **VII**(I), 76–79 (2018). ISSN 2278-2540
3. https://housing.com/news/laws-related-registration-property-transactions-india
4. https://www.aciworldwide.com/-/media/files/collateral/trends/unlocking-benefits-of-blockchain-tl-us.pdf
5. http://www.cs.tau.ac.il/~msagiv/courses/blockchain/overview.pdf
6. https://www.elra.eu/wp-content/uploads/2017/02/10.-Jacques-Vos-Blockchain-based-Land-Registry.pdf
7. Houben, R., Snyers, A.: Policy department for economic, scientific and quality of life policies. http://www.europarl.europa.eu/supporting-analyses
8. http://www3.weforum.org/docs/WEF_Building-Blockchains.pdf
9. https://nvlpubs.nist.gov/nistpubs/ir/2018/NIST.IR.8202.pdf
10. Sagiv, M.: The block chain Technology. http://www.cs.tau.ac.il/~msagiv/courses/blockchain/overview.pdf
11. https://chromaway.com/papers/Blockchain_Landregistry_Report_2017.pdf
12. https://www.metropolis.org/sites/default/files/metobsip5_en_1.pdf
13. Saranya, A., Mythili, R.: A survey on blockchain based smart applications. Int. J. Sci. Res. (IJSR) **8**(1), 450–455 (2019)
14. Sravani, C., Murali, G.: Usage of blockchain-based provenance enabled technology to process and track land transactions. Int. J. Res. Advent Technol. Special Issue, 1–5, March 2019
15. Uzair, M.M., Karim, E., Sultan, P., Ahmed, S.S.: The Impact of Blockchain Technology on the Real Estate Sector Using Smart Contracts. https://mpra.ub.uni-muenchen.de/88934
16. Bocek, T., Rodrigues, B.B., Strasser, T., Stiller, B.: Blockchains everywhere - a use-case of blockchains in the pharma supply-chain. In: IEEE International Symposium on Integrated Network Management, IFIP, pp. 773–777 (2017). 978-3-901882-89-0

Big Data Analytics for Agriculture – Scope and Future

P. Ganesh
Associate Professor, Department of MCA, BMS Institute of Technology and Management, Bengaluru. Email: pganesh@bmsit.in

Aparna K.
Associate Professor & HoD, Department of MCA, BMS Institute of Technology and Management, Bengaluru. Email: appuk27@yahoo.com

Agriculture sector forms the basis of economic growth of India at large. Agriculture products feed humans to survive. Today, this back-bone is getting affected either due to climate changes, lack-of-interest among farmers, labour shortage, globalization, industrialization or migration of farmers from villages to cities etc. On the other hand, it is required to increase the rate of production of crops to meet the significant growth in the demand arising due to increase in population. Imagine a day, as a result, where farmers could not produce or harvest, which could affect the entire eco system and such a situation looks to be closer than expected. In contrast, in the current scenario, there is a requirement to increase the production in order to meet the increasing population given the constraint of shortage of fertile land. With technology, we can instil confidence in farmers and support them to get better yield and make it profitable so that farming activity continues as expected.

Big Data and Analytics is one such promising technological support system for agriculture domain that promises timely inputs to farmers on weather forecasting, irrigation practices, plant nutrient requirements, soil capabilities, crop selection, market demand, etc. In the field of agriculture, big data is considered to be a blend of technology and analytics that can assemble the required data and analyse them to process it in more informative and appropriate manner to help the farmers in decision making.

Big data combined with cloud supported apps can further direct the farmers precisely on how to balance their harvest in line with market demand and enhance their produce and thus maximize their profits. This technology enables the farmers to micromanage farming and its associated activities. The beauty of this technology is that farmers can gain insights and estimate their yield even before actual planting of crops. In this article let us try to find ways to boost agriculture produce with the support of cloud, big data and analytics.

Role of Big Data Analysis in Agriculture

Application of new and emerging technologies is need of the hour in agriculture sector. In this direction, many established organizations and upcoming companies are coming forward to lend required support [1].There is a definite need for Big Data in the agricultural sector as it has made significant advancement in the fields of IT, healthcare, education, sports etc. [2]. While majority of farmers could maintain and increase soil health through traditional and conservative practices, technology assisted tools might be influential in ensuring a viable farming for future. Data analysis tools can help determine if the changes incorporated in the traditional agricultural patterns will give the same or better yield to meet the increasing food demands of the population which is growing significantly while at the same time preserving the necessary natural resources. The final outcome of agricultural data analytics is to analyse and propose workable solutions with enhanced yield and outcomes. For instance, an image of an area of a land taken by the satellite has many levels of data giving us sensible information to analyse.

Scope and Effect of Big Data in Agriculture

Accomplishment in the farming domain has been fundamentally reliant on natural forces and resources, but not anymore in future [3].Technological evolutions and services such as IoT, big data, analytics and cloud computing are emerging as tools to counter the ill-effects of climate changes, global warming and to meet the increasing demand for food. IoT devices facilitate the direct and real-time data collection from the ground through sensors plugged in crop fields, soil and plants. Data analysts can integrate these large and real-time data collected along with other significant information accessible from the cloud, such as climate data and pricing models to identify the patterns. These identified patterns and insights help in monitoring the situation. They assist to identify prevailing concerns, like functional inadequacies and issues with the quality of the soil and develop predictive algorithms which can alert the occurrence of a problem. It is estimated that with adoption of analytics, the agriculture output can grow consistently with an annual compounded growth rate of 16% [4]. Thus big data, can surely revolutionise the agricultural sector,along with cloud based system coupled with appropriate tools and software to integrate data sources for making good decisions.

Advantages of Data Analysis in Agriculture

1. Data analysis facilitates farmers, seed companies, insurance agencies, bankers, fertiliser industries, machinery industry etc. with right input at right time for better outcomes.
2. Data analysis provides better awareness, more precise knowledge and helps to bridge the gaps in the supply chain market of the agriculture industry.
3. The agriculture industry will be guided with abundant information for more informed decision making.
4. Scope for developing new seed patterns and behaviors with access to the plant genome and new methods to quantify the same.
5. New era of precision farming can boom with Big Data. The outcomes of analytics, perceptions and better results can then be used through precision farming methods as shown in Figure 1.
6. Scope for Food tracking with the aid of sensors and analytics to prevent damage leading to wastage and food-borne diseases.
7. Significant impact on supply chain of seed, crop inputs and food.

Fig. 1 : The precision farming in place at Israel [6] - Samples

At present, the big data technology is in its nascent days and the potential for it create value addition is still a probable figure in agriculture sector. But it has put the industries on the pavement of creating a disruptive innovation. Countries like Israel have been using this data analytics and significant improvements in the farming sector are observed, as a result. Stakeholders with an urge to innovate new things will be the first ones to reap greater rewards in this direction. GODAN (Global Open Data for Agriculture and Nutrition) framework aims at bringing all the stakeholders together to leverage technology and solve global problems in agriculture industry [5].

The authors are hopeful of seeing this revolution happening in Indian agriculture sector for the benefit of its farmers, economy growth and survival of human race.

References:

[1] https://eleks.com/blog/practical-uses-of-big-data-in-agriculture/

[2] https://www.downtoearth.org.in/blog/agriculture/

[3] https://www.talend.com/resources/big-data-agriculture/

[4] https://www.analyticsvidhya.com

[5] https://www.searchtechnologies.com/blog/big-data-analytics-agriculture

[6] https://www.futurefarming.com/Tools-data/Articles/2019/7/4-ways-big-data-analytics-are-transforming-agriculture-450440E/

■

About the Authors

Dr. P. Ganesh is currently working as Placement Officer and Associate Professor at BMS Institute of Technology and Management, Bengaluru. He has obtained Ph.D. in Cloud Computing from VTU. His research interests include Data Analytics, Cloud Computing, Software Performance Engineering etc. He has an overall teaching experience of 17 years and has published 7 research papers in reputed international journals.

Dr. Aparna K. (LM00146827) is currently working as HoD of MCA Department at BMS Institute of Technology and Management, Bengaluru. She is a doctorate (Ph.D) in Data Mining from VTU. Additionally, she holds an MCA degree from VTU and an M. Phil degree from Bharatidasan University. Her research interest includes Data Analytics, Machine Learning, Sentimental Analysis etc. She has an overall teaching experience of 16 years and has more than 25 papers to her credit in reputed international journals and conferences. She has always been a source of inspiration and an excellent mentor for students.

An Game Theory Approach for Supplier selection

By Nagabhushan sv

This book contains an approach for selecting the supplier in the manufacturing industry. This book gives detailed analysis of game theory and insight of supply chain. This also contain case study. More

Download: pdf txt

Category: Essay » Business
Published: April 8, 2020
Words: 1,630
Language: English

Tags: supplier selection

Supplier Selection Model using Game Theoretical Approach

Abstract**:** The purchasing function has gained importance in supplier selection of procurement. As the evaluation of the supplier depends on various non-price attributes, formulating the strategy is very important .Every supplier tries to play tactical game in order to win the contract under uncertain situations .In our paper we propose a model through case study to select best supplier using game theoretical approach by applying simplex algorithm.

Keywords: Game, payoff matrix, Supplier invitation, Supplier selection, Game theory model.

I. INTRODUCTION

The objective of study in game theory formal model of an interactive situation between the suppliers. It typically involves several *players*; a game with only one player is usually called a *decision problem*. The formal definition lays out the players, their preferences, their information, and the strategic actions available to them, and how these influence the outcome. Game theory is the formal study of conflict and cooperation. Game theoretic concepts apply whenever the actions of several suppliers are interdependent. These suppliers may be individuals, groups, firms, or any combination of these. The concepts of game theory provide a language to formulate, structure, analyze, and understand strategic scenarios.[1]

Game theory and mechanism design offer an important tool to model, analyze, and solve decentralized design problems involving multiple autonomous agents that interact strategically in a rational and intelligent way. In the past decade, game theory and mechanism design have emerged as an important tool for solving numerous problems in computer science and Internet economics problems. Examples of these problems include design of decentralized algorithms involving selfish agents, design of sponsored search auctions on the web, design of procurement markets in electronic commerce, design of robust communication protocols, design of resource allocation mechanisms in computational grids, analysis of social networks, etc. An emerging discipline, algorithmic game theory, which is concerned with design and analysis of game theoretic algorithms, is now an active research area.

Basic elements of a Game:

- **Players**
  - Everyone who has an effect on your earnings
- **Strategies**
  - Actions available to each player
  - Define a plan of action for every contingency
- **Payoffs**
  - Numbers associated with each outcome
  - Reflect the interests of the players

II. ANALYSIS

The objective is to select the best supplier from numerous suppliers with respect to various parameters. In this method, the payoff values are considered for each of the supplier with respect to the parameters and the payoff matrix is obtained from those values. The maximum and minimum values are obtained for the payoff matrix and the value of the game is obtained. Based on the value of the game, the objective function and the constraints are identified and are solved using the simplex method. The values for each supplier are calculated using the ? model and the supplier with the optimal value is considered to be the best supplier.

III.METHODOLOGY

Algorithm:

The steps for the computation of an optimum solution are as follows:

Step-1: Check whether the objective function of the given L.P.P is to be maximized or minimized. If it is to be minimized then we convert it into a problem of maximizing it by using the result Minimum Z = - Maximum(-z)

Step-2: Check whether all right hand side values of the constrains are non-negative. If any one of values is negative then multiply the corresponding in equation of the constraints by -1, so as to get all values are non-negative.

Step-3: Convert all the in equations of the constraints into equations by introducing slack/surplus variables in the constraints. Put the costs of these variables equal to zero.

Step-4: Obtain an initial basic feasible solution to the problem and put it in the first column of the simplex table.

Step-5: Compute the net evolutions Zj – Cj (j=1,2,…..n) by using the relation Zj – Cj = CB Xj – Cj.

Examine the sign

i) If all net evolutions are non-negative, then the initial basic feasible solution is an optimum solution.
ii) If at least one net evolution is negative, proceed on to the next step.

Step-6: If there are more than one negative net evolution, then choose the most negative of them. The corresponding column is called entering column.

If all values in this column are ≤ 0, then there is an unbounded solution to the given problem.

If at least one value is > 0, then the corresponding variable enters the basis.

Step-7: Compute the ratio {XB / Entering column} and choose the minimum of these ratios. The row which is corresponding to this minimum ratio is called leaving row. The common element which is in both entering column and leaving row is known as the leading element or key element or pivotal element of the table.

Step-8: Convert the key element to unity by dividing its row by the leading element itself and all other elements in its column to zeros by using elementary row transformations.

Step-9: Obtain the optimal value by the value in the XB column with respect to the suppliers is basic variable column.

Mathematical Terms

Symbols	**Description**
Si	No.of suppliers
v	Value of the game
Yj ,yi	Represents supplier

Table II : symbols and description.

Assumptions in the Proposed Work

- Player(Supplier)
  - It is assumed that each player knows everything about the structure of the game
  - Player don't know about another's decision
  - Each player knows the rules of the game
  - Players are rational and expert

- Strategy
  - Each player has two or more well-specified choices
  - Each player chooses a strategy to maximize his own payoff
  - Every possible combination of strategies available to the players leads to a well-defined end-state (win, loss, draw) that terminates the game
- Payoff
  - Everything that a player cares about is summarized in the player's payoffs

- Mixed Strategy
  - A player is guessing as to which activity is to be selected in any particular occasion.
  - Probabilistic situation is obtained and the objective is to maximize the gain.

- Payoff Matrix
  - Contains the payoff values of the players with respect to the parameters.

IV. CASE STUDY

An Automobile company is intending to procure tyres .There are 4 suppliers and 4 parameters as price, Quality, Delivery and Warranty. The supplier is selected based on the game theoretical method for mixed strategy game using simplex method with the following constraints.
Let us consider four suppliers and four criteria's namely-

Suppliers = {S1, S2, S3, S4}

Criteria's = {Price, Quality, Delivery Time, Warranty}

Let us define pay-off values as-

S1=[3,3,4,0]

S2=[2,4,2,4]

S3=[4,2,4,0]

S4=[0,4,0,8]

This can be represented as follows:

	S1	**S2**	**S3**	**S4**	**Min**
Price	3	2	4	0	0
Quality	3	4	2	4	2 minmax
Delivery	4	2	4	0	0
Warranty	0	4	0	8	0
max	4	4 maxmin	4	8	

Table I :Payoff matrix for the suppliers with respect to parameters.

→The above game has no saddle point, so solve the above matrix in LPP form

→The maximin is 2 and minimax is 4, therefore the value for the game is 2≤4{ i, e lies between 2 and 4} Hence v>0

→ To find the optimal value for suppliers considered as y1,y2,y3,y4 subject to constraints

3y1+2y2+4y3≤v

3y1+4y2+2y3+4y4≤v

4y1+2y2+4y3+0y4≤v

4y2+8y4≤v

and y1+y2+y3+y4=1 $\forall yj \geq 0$ j=1,2,3,4

since ‘ v‘ is greater than 0 dividing the above equation by ‘v’ and putting yj/v=Yj, j=1,2,3,4

$$Y1+Y2+Y3+Y4=1$$

Subject to constraints

$3Y1+2Y2+4Y3 \leq 1$

$3Y1+4Y2+2Y3+4Y4 \leq 1$

$4Y1+2Y2+4Y3+0Y4 \leq 1$

$4Y2+8Y4 \leq 1$ yj/v=Yj, j=1,2,3,4

→In order to minimize ‘v’, maximize 1/v=Y1+Y2+Y3+Y4(objective function)

The Standard LPP can be written as follows:-

Max 1/v=Y1+Y2+Y3+Y4+0.S1+0.S2+0.S3+0.S4

Subject to constraints:

$$3Y1+2Y2+4Y3+S1=1$$

$$3Y1+4Y2+2Y3+4Y4+S2=1$$

$$4Y1+2Y2+4Y3+S3=1$$

$$4Y2+8Y4+S4=1$$

The simplex table is written for the above SLPP as follows:-

1 1 1 1 0 0 0 0

Basic Variable	C_B	X_B	Y1 S4	Y2	Y3	Y4	S1	S2	S3	Max ratio X_B/Xk		
S1	0	1	3	2	4	0	1	0	0	-		
S2	0	1	0							1/4		
S3	0	1	3	4	2	4	0	1	0	-		
S4	0	1	0							1/8		
			4	2	4	0	0	0	1			
			0									
			0	4	0	8	0	0	0			
			1									
	1/v=0		-1	-1	-1	-1 ↑	0	0	0			
			0									
S1	0	1	3	2	4	0	1	0	0	1/4	1/4	1/4
S2	0		0							1/4	0	1/2
S3	1/2		3	2	2	0	0	1	0	- 1/4	0	0
S4	0	1	1/2							-	-	-
	0		4	2	4	0	0	0	1			
	1/8		0									
			0	1/2	0 ↑	1	0	0	0			
			1/8									
	1/v=1/8		-1	-1/2	-1	0	0	0	0			
			1/8									
S1	0	0	-1	0	0	0	1	-4	2			
S2	0	1/4	2									
S3	0	1/4	1	1	0	0	0	1	-1/2 -			
S4	0	1/8	1/2									
			1	1/2	1	0	0	0	1/4			
			0									
			0	1/2	0	1	0	0	0			
			1/8									
	1/v=3/8		0	0	0	0	0	0	1/4			
			1/8									

Y1=0, Y2=0, Y3=1/4 , Y4=1/8 , 1/v=3/8 ,v=8/3

Y1=y1/v

=>y1=Y1.v

=>y1=0.8/3

=>y1=0 similarly y2=0,y3=2/3 and y4=1/3

Since y1 and y2=0, Supplier 1 and 2 are out of the game

Supplier 3 (y3) =2/3 Supplier 4 (y4) =1/3

Since supplier 4 is having the minimal value, 'S4' is considered to be the best supplier

V. CONCLUSION

The game theoretical method allows selecting the best supplier in an effective way where the selection is done based on the strategies of the supplier used in the model. The model can be considered effective as it uses the mixed strategy game technique where the activities of another supplier are a guess and objective is always to maximize the gain.

REFERENCE

[1] Theodore L. Turocy, Bernhard von Stengel "Game Theory ",CDAM Research Report LSE-CDAM-2001-09October 8, 2001.

[2] Yun Huang, George Q. Huang, Xianan Liu "Cooperative Game-theoretic Approach for Supplier Selection, Pricing and Inventory Decisions in a Multi-level Supply Chain", ISBN: 978-988-19251-9-0

[3] Y. Narahari "Game Theory", Department of Computer Science and Automation Indian Institute of Science Bangalore, India July 2012

[4] Frederick S.Hillier & Gerald J.Lieberman: Introduction to Operations Research: Concepts and Cases,8th Edition, Tata McGraw Hill, 2006.

Chapter 18
Raitha Bandhu

G. V. Dwarakanath and M. Rahul

1 Introduction

A farmer is a person engaged himself in agriculture by growing crops. They are the backbone of Indian economy. They produce crops which are consumed by all the people, they get up early in the morning go to fields to harvest their crops in the olden days they used to cultivate through oxen and now they are using cultivators. They go to farm sows seeds and water their crops regularly. They have to protect their crop from various pests. They face a lot of problems like financial issue, harm to crops from pest and some farmers does not know which crop to grow on their land based on climate and their soil. So to help farmers with all these issues we are developing an application called "Raitha Bandhu".

These days everyone is familiar with smartphones. "Raitha Bandhu" is an android-based application created to help farmers to cultivate crops with the help of scientific methods instead of traditional methods. This application will help farmers regarding cultivation of crop, pest control tips from agricultural experts and insurance to their crops.

"Raitha Bandhu" is an android-based application whose main aim is to help farmers. Here the farmers will able to know what are the climatic condition that is suitable to grow a particular crop and which crop is suitable to for their soil using this information the farmer can grow their crops accordingly if they have any issue to their crops regarding pest they can upload the photo of that crop and the agricultural experts will suggest what are the necessary steps that need to be followed in order to grow with pest management. And the farmer can register themselves for crop insurance by providing necessary information which will by later inspected by the insurance company/bank and will be approved if all the information is correct.

G. V. Dwarakanath (✉) · M. Rahul
Department of MCA, BMS Institute of Technology and Management, Bangalore 560064, India
e-mail: dwarakanathgv@bmsit.in

V. K. Gunjan et al. (eds.), *Cybernetics, Cognition and Machine Learning Applications*,
Algorithms for Intelligent Systems, https://doi.org/10.1007/978-981-15-1632-0_18

Agricultural expert will analyze the issue of farmers and then they provide solution to their problem. The farmers will get tips and solution from various agricultural experts which they can adopt in their cultivation to increase the yield of their crops. The farmers can know the status of their status of the insurance for their crop whether it is approved or rejected and if it is approved they will be able to know what amount of money is approved for their crop.

2 Literature Survey

Raitha Bandhu is an application that helps farmers to solve their agricultural related issues. Farmers do not find a single app where they can get crop growing tips, a forum and insurance portal in single application. Farmers have to download a separate application to get the features like agricultural forum, crops cultivating tips, and insurance. By downloading a separate application, the storage on their smartphones increases. To solve this issue we have developed an application named "Raitha Bandhu" where farmers can get the above-mentioned features in a single application and save storage space. This application is a discussion forum for farmers and agricultural experts supported in two languages, i.e., Hindi and English language. The main aim is to help farmers to grow crops more effectively which will help to increase their yield, income using the latest technology. It helps the farmers understand how to grow crops effectively [1].

This application will help farmers to find solution the queries regarding agriculture. It provides information about pesticides that need to be used, information about seeds, fertilizer, and dosage that needs to be used for farming crops. It allows farmers to buy agricultural products and equipment using the application [2].

This application is a team of agricultural-doctors and experts who helps farmers by providing tips for better cultivation of the crop. It also gives information about weather forecast. It has a discussion forum, agricultural shop where farmers can buy agricultural products. This is mainly developed to help farmers of Gujarat, Maharashtra, and Rajasthan [3].

This application gives information on pests, diseases and weeds that are affecting crops and pest management that need to be taken care. It provides agriculture web links, i.e., that is the information that is collected from online resources like agricultural department, market price, pest management tips, etc. [4].

This application will provide information on more than 100+ crops and this application is supported in seven languages, it provides suggestions like how to cultivate crops using latest techniques, crop that need to be grown based on seasons, climatic conditions and provide irrigation information. It helps farmers to gain information on their crops that they are growing. It gives latest news regarding agricultural and it has videos in local language and it also has a discussion forum where the farmers can interact with agricultural experts [5].

This is an application developed by Gujarat agricultural organization especially for the agricultural community. It has audio and video that helps farmers to know

about latest techniques of agriculture. The video is supported in two languages, i.e., Gujarati and Hindi languages. The main goal of this application is to provide necessary information to farmers for regarding cultivation and providing pest management tips using videos [6].

This application is India's number one agricultural shopping app where farmers can buy the necessary things for agriculture. It gives description of the products by agricultural experts and specialist. It has a facility of delivering the product on cash on delivery [7].

This application will give information on production of crops, how to protect crops. It allows users to interact with agricultural specialists and scientists. This app will allow users to share audio and video and then the experts will analyze the issue and give a solution [8].

This application will help farmers to buy, sell, and exchange agricultural related products without the interference of middleman. Farmers can post ads by entering the details and submit, this will be viewed by other farmers. It has a open discussion forum for the users [9].

3 Working

The android application Raitha Bandhu consists of the following users, i.e., three modules

- Farmer
- Forum
- Banker

Farmer: Here the farmer will verify themselves with OTP and register, then they can check how the crops can be grown effectively they can send a request to bank or insurance company.

Forum: It is interactive forum where the agricultural experts and farmers can interact. If the farmers are having any issue they can post that issue to the forum then the various pest experts will take a look and try to give a solution to their problem.

Banker: Here the banker/insurance company will go through the request for insurance that is submitted by the farmers. They can approve and reject the request of the farmers insurance request.

4 Implementation

This part includes all the information about technology that is used and control flow of the project. This project is implemented using java, xml which is written in Android Studio IDE which is easy to understand by the developer and can be implemented easily.

- Install android studio.
- Create a project by giving the name of the project.
- Design front-end using XML.
- Code the backend using java
- Create database in Firebase.
- Build the Apk file and run the Apk.
- The output is displayed.

Android Studio
Android Studio is an open-source mobile application development platform for creating applications in android. It is official IDE for the development of application in android. Here the application can be written using java and kotlin. It has Android Virtual Device (Emulator) which is used to debug and run the application. It supports gradle-based build support. It has a template-based wizard with basic design and components. User can use drag-and-drop to create a user interface. Android wear application can be developed using this IDE.
Firebase
It is a platform which is built to develop mobile and web application. Firebase we can store the data of user in cloud. It supports various features like Authentication, real-time database, storage system, testing, analytics, cloud messaging, etc. It is also used for web hosting services.
XML
In this project, we are utilizing XML language for front-end structure of the application. XML depicts that Extensible Mark-up Language. It is a language that is understood easily by computer and user. Here the code is organized and kept simple which is easy to understand.
Java
Java is a programming language which will allow the developers to write once run anywhere (WORA). Once a code is compiled, it can run on all platform of java with compiling it again. Java is used in android studio because it builds the packages very quickly. Java is a robust and secure programming language (Figs. 1, 2, 3, 4, 5, 6).

5 Conclusion

The “RAITHA BANDHU Android App” is designed in order to make the farmers acquire more knowledge about agriculture. The application is very easy to use as it is having a good user interface and users can interact with the application without any difficulties.

Fig. 1 Home page

Fig. 2 Main page

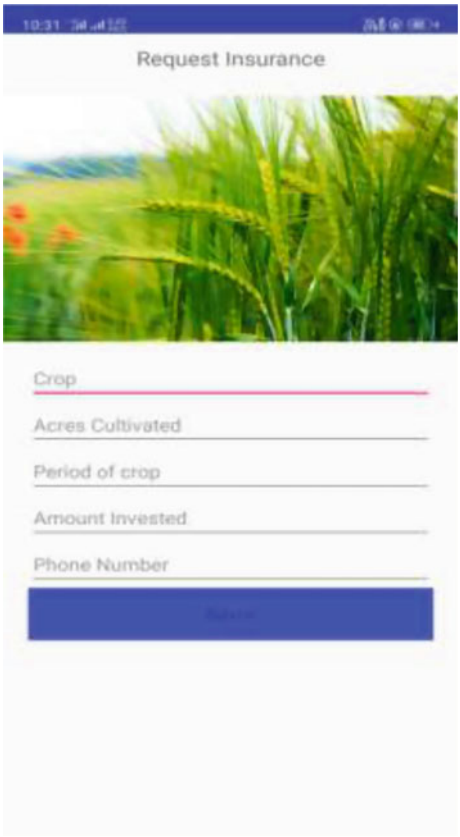


Fig. 3 Insurance request page

The application was has fulfilled the following objectives.

- It helps Farmers to know which crop to grow on which season and based on the soil content of their farm.
- It will allow farmers to request for crop insurance from the bank/insurance companies that are registered.
- It has a forum where the farmer and pest experts can interact, here the farmers can ask the pest experts any queries regarding the crops and it will be solved by various pest experts.

The bank/insurance companies will view the request for crop insurance that is produced by the farmers they process the request form and then decide whether to approve or reject the requests.

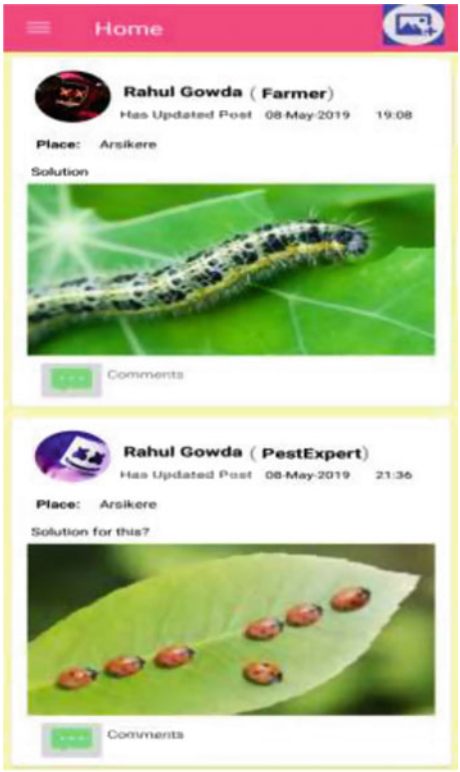


Fig. 4 Forum home page

Fig. 5 Crop growing tips

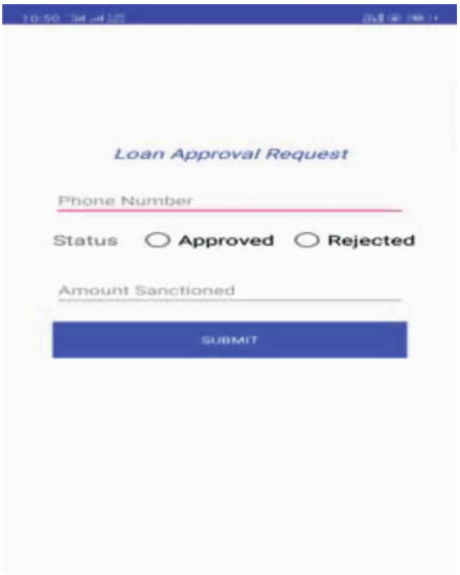


Fig. 6 Process insurance

References

1. My Agri Guru developed by MyAgriGuru, February 2017. Available in Google Playstore
2. Agro-Medix developed by AgroMedix AgriTech Solutions, January 2018. Available in Google Playstore
3. AgroStar Agri developed by AgroStar, May 2016. Available in Google Playstore
4. CropInfo India developed by Arun Gulbadher, February 2016. Available in Google Playstore
5. KrishiHub developed by KrishiHub, November 2017. Available in Google Playstore
6. AgriMedia Video App developed by Digital AgriMedia, September 2017. Available in Google Playstore
7. FarmKey developed by FarmKey, developed by FarmKey-Agriculture Shop, December 2018. Available in Google Playstore
8. AgriApp developed by AgriApp, September 2014. Available in Google Playstore
9. FarmBazaar developed by FarmBazaar Agri Solutions, October 2017. Available in Google Playstore
10. Kisaan Helpline developed by Ample eBusiness, January 2015. Available in Google Playstore
11. IFFCO Kisan developed by IFFCO Kisan, September 2015. Available in Google Playstore

Mr. Dwarakanath, G. V., MCA, Assistant Professor, Master of Computer Applications, BMS Institute of Technology and Management, Bangalore, Karnataka, India, 2013–2014 has published nearly 3 research papers in National/International Journals and published 16 papers in National/International Conferences, wishes to place on record his sincere gratitude to BMS Education Trust, BMS Institute of Technology and Management, Bangalore and expresses thanks to all those who helped in bringing out this paper.

Mr. Rahul, M., MCA Student, Department of MCA, BMS Institute of Technology and Management, Bangalore-560064, India, wishes to place on record his sincere gratitude to Guide Dwarakanath G V., Dept. of MCA staff, BMS Education Trust, BMS Institute of Technology and Management, Bangalore and expresses thanks to all those who helped in bringing out this paper.

Investigation of the Temporal Evolution in Patient Networks Related to Chronic Diseases on Social Media

Sridevi Mutyala(✉) and B. R. Arunkumar

VTU Research Centre, Department of MCA,
BMS Institute of Technology and Management, Bengaluru, India
{sridevim, arunkumarbr}@bmsit.in

Abstract. The paradigm shift in the healthcare domain due to the advent of social media usage by healthcare seekers, practitioners and providers led to interdisciplinary research, which results in a completely new stream coined as Psychology Informatics. The study of structural dynamics of patient networks would reveal interesting results with respect to their social ties and the disease characteristics. The current work has attempted to study the temporal evolution in the patient networks related to chronic diseases viz. Alzheimer's and Diabetes on social media by using two important graph measures Entropy and Eigenvector centrality. Proctor controlled and transient patient networks are not under the purview of this research work.

Keywords: Patient networks · Social media · Entropy · Eigenvector centrality · Alzheimer's · Diabetes · Chronic diseases

1 Introduction

Social networks have gained importance in the recent years as they help to connect people across the globe to share their thoughts and experiences to overcome geographical isolation. Social media has brought drastic and unbelievable changes in the way people interact with each other. It is a fact that these days people are trying to interact more, digitally rather than directly to suffice their tendencies to maintain durable social relationships. Technology has changed this process, but it did not have a significant impact on the basic need to build supportive bonds with their counterparts [1]. When it comes to the context of health and healthcare, patients feel it comfortable to communicate with their peers online to seek informational and emotional support irrespective of their geographical location. Health related social networking increases awareness of healthcare facilities available and sensitizes the healthcare seekers about their need for healthcare [2]. Moreover, the patient networks discuss on patient-centric treatment in the scenario of life-style and chronic diseases like Alzheimer's and Diabetes which require prolonged care and customized treatment strategies. Besides, these

S. Mutyala—Research Scholar.
B. R. Arunkumar—Research Supervisor.

A. P. Pandian et al. (Eds.): ICICCS 2019, AISC 1039, pp. 637–644, 2020.
https://doi.org/10.1007/978-3-030-30465-2_70

persistent diseases can be managed and dealt with, by maintaining better social relationships which motivate the patients as well as the caregivers to stand strong with good emotional support that helps in prolonged survival. Viewing these relations from the network perspective, we can study the patterns of relational structures that focus on the characteristics of the network as a whole. The regularities and patterns in the interactions between the participants of the network gives rise to interesting structures which help us to study the social behavior of patients/caregivers dealing with certain diseases. This section is followed by the extensive review of relevant literature, description of the datasets, measures used for structural analysis of patient networks followed by discussion of experimental results and conclusion.

2 Literature Review

Social media provides us a treasure trove of data we never anticipated before and we can use this information to understand the pulse of the online community and bring drastic changes in population health and policy making in the healthcare domain. One-third of the 200 million daily Tweets and 55 million daily Facebook updates are health-related as per the survey made by University of Utah [3]. The usage of social media for healthcare information seeking and sharing is increasing day by day. During this process, the distribution of relational properties, understanding individual actions in the context of structured relationships or directly studying the structures themselves would unveil interesting results about the individual as well as group level behavior of the participants. The study of impact of the structure of network on the dynamics of the group and its influence on individuals within the group would open new avenues and insights into the healthcare domain.

Bronfenbenner (1943) and Jennings and Moreno (1945) were the first to make a quantitative study of the network methods that include tendencies towards mutuality of relationships, transitivity and structural balance. The authors of [4] presented a technique for analyzing a social network by using Shannon's entropy measure. Centrality measure entropies are utilized to perform the sensitivity analysis of the system employing the entropy changes of the participants in a social network.

In [5], a study was made on the entropy of weighted networks with the degree-based topological indices such as Zagreb index and Randic Index as weights. Topological indices serve as numerical parameters of a graph which characterize its structure or layout. A very important class of measure depends on Shannon's entropy to characterize and understand the graphs by deciding on their content of structural information. The research by [6] presented a graph-based entropy index which measures the diversity of events with respect to their distribution to the parts of a co-occurrence graph to detect signs of structural changes in the network that explains the potential dynamics of the participant behavior.

The work in [7] evaluated network measures, which are information-theoretic, on publication networks. The graph entropy measures discussed can be considered as measures of graph complexity that evaluate the structural complexity depending on the corresponding concept. In [8], the authors proposed a novel way to measure the graph entropy. They focused on the usage of event based entropy to find which are the

influential nodes in a network. Tong et al. [9] introduced a new type of centrality measure that decomposes a graph into subgraphs and entropy calculation of neighbor nodes. It outperformed the famous measures including betweenness centrality, degree centrality, closeness centrality and Eigenvector centrality.

The literature reviewed so far discussed about the application of entropy as a graph measure to study complex networks. The application of this measure along with Eigenvector centrality for performing patient network analysis is a new approach in the current work. Patient network analysis can also be used to understand the process of change within a group over time which may lay ground for further analysis by the healthcare researchers. The social network approach thus has a different orientation in which structures, their effect, and evolution becomes the main focus [10].

Social network theories can be specified in terms of patterns of relations, representing a group or a social system as a whole. Approaches that do not have network measurements are not feasible to investigate theories about structural properties. In the current work, an attempt is made to study the patient groups on Facebook related to two chronic diseases namely Alzheimer's and Diabetes. These patient/caregiver networks are formed to discuss and share information related to specific diseases regarding the symptoms, diagnosis, treatment, diet, life style, progress of the disease and caretaking. The structural dynamics of these networks would be of interest to understand the social behavior of patients and their caregivers, and how they collaborate in a group to overcome geographical and emotional isolation. A comparative study of the measures viz. Average Degree, Entropy, and the Eigenvector centrality of the patient networks and their changes over one year period is visualized. This helps the healthcare researchers to understand the graph heterogeneity and the diversity of link distribution in the networks to study the social connections of the patients and caregivers. The correlation between the heterogeneity of the network and the percentage of influential nodes in the network is presented which exemplifies the relation between the entropy of a graph/network and the percentage of nodes with high Eigenvector centrality.

3 Description of the Datasets and Data Preprocessing

The data of the patient and caregiver networks related to two chronic diseases namely Alzheimer's and Diabetes was collected from Facebook by becoming a member of the above said groups. As Alzheimer's is a neuro-degenerative disease, the networks formed to discuss about it consist of caregivers as members rather than the patients directly involving in discussions. For each of the diseases considered, 3 patient support groups data over the period of 1 year taken quarterly was stored in the 'edgelist' format saved as .csv files. The data that is collected was sampled to maintain evenness among the data taken for analysis as the groups were actually differing in the total members in each group. The network is modeled in such a way that a member posting some content and the other members responding either by comment/reply or by like/emojis will have an edge between them. Redundant edges were removed and duplicate data was eliminated. Python programming language, equipped with large number of libraries to perform data analysis and visualization was used for experimenting with the datasets and obtain the results.

4 Measures Used for Structural Analysis of Patient Networks

4.1 Eigenvector Centrality

Eigenvector centrality Ev(x) is a measure of a vertex's influence in a network. This measure assigns corresponding scores to every vertex or node in the network based on the point that relationships with high-scoring vertices add more value to the score of the vertex being considered than the same number of connections to low-scoring vertices. For a node x, the Eigenvector centrality can be represented as [11]:

$$\mathrm{Ev(x)} = \frac{1}{\lambda_{\max(A)}} \cdot \sum_{i=1}^{n} a_{ix}.v_i \tag{1}$$

where $v = [v_1, v_2, \_\_\_, v_n]^T$ denotes an Eigenvector for the maximum Eigenvalue $\lambda_{\max}(\mathrm{A})$ of the adjacency matrix named A.

4.2 Entropy

Rashevsky, Trucco and Mowshowitz defined a graphs topological information content based on their investigation on Shannon entropy of graphs. The n vertices of a given graph were partitioned into k classes of equivalence vertices based on their degree distribution. Then, the patitions were assigned a probability obtained as the number of vertices in this particular partition divided by the total number of vertices/nodes.

For a given graph G, the entropy can be defined as [12]:

$$\mathrm{H(G)} = -\sum_{j=1}^{d_i} P_{ij} \log(P_{ij}) \tag{2}$$

where P_{ij} is the probability of a node belonging to a particular partition.

High entropy indicates that many vertices are equally important whereas low entropy indicate that only a few vertices are important. So, this Shannon's entropy measure can be used as a measure of structural characteristics of a network.

5 Experimental Results and Discussion

The entropy values of three groups for each disease (Alzheimer's and Diabetes) over one year period were calculated. The Eigenvector centrality of the nodes for each group over the same period was calculated which gives a node level measure. A threshold of 0.5 was fixed and all the nodes having Eigenvector centrality greater than 0.5 are considered influential in the network. Percentage of thus obtained influential nodes in the entire network is calculated. Now, the correlation between the average degree of the network, entropy and the Eigenvector centrality is studied to understand the structural

properties of the network with respect to the diversity of the link distribution and the highly influential nodes in the networks. The extent of correlation between the measures being considered was depicted as shown in the Figs. 1, 2, and 3 for Alzheimer's support groups 1, 2 and 3, respectively.

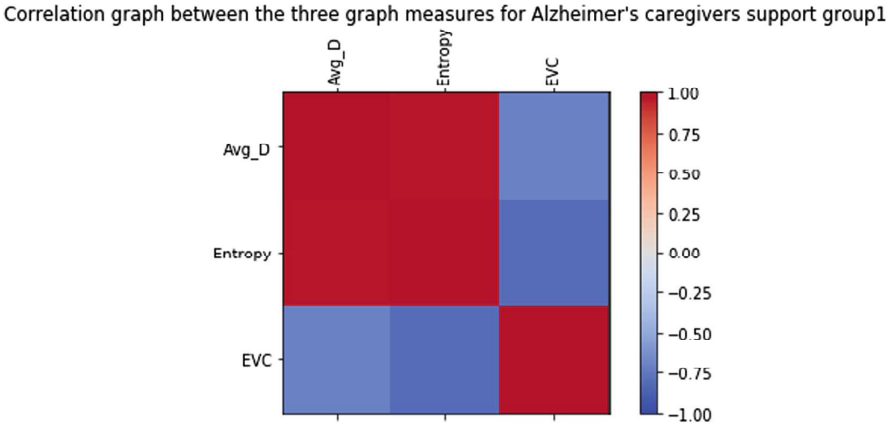


Fig. 1. Correlation graph for Alzheimer's Support Group 1

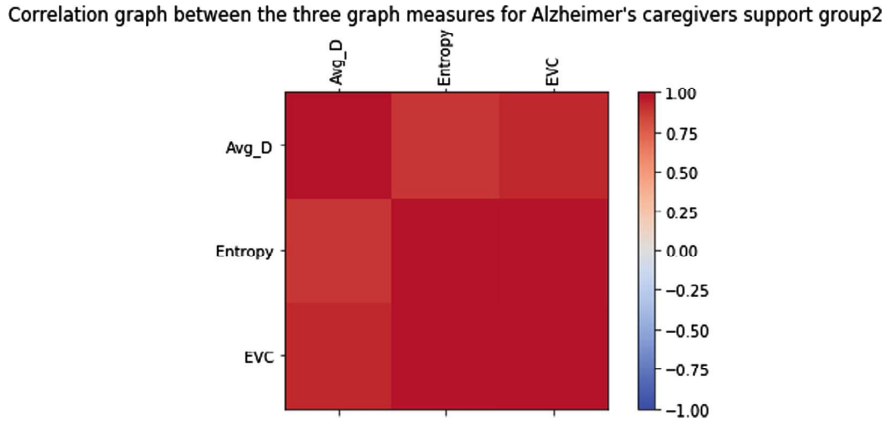


Fig. 2. Correlation graph for Alzheimer's Support Group 2

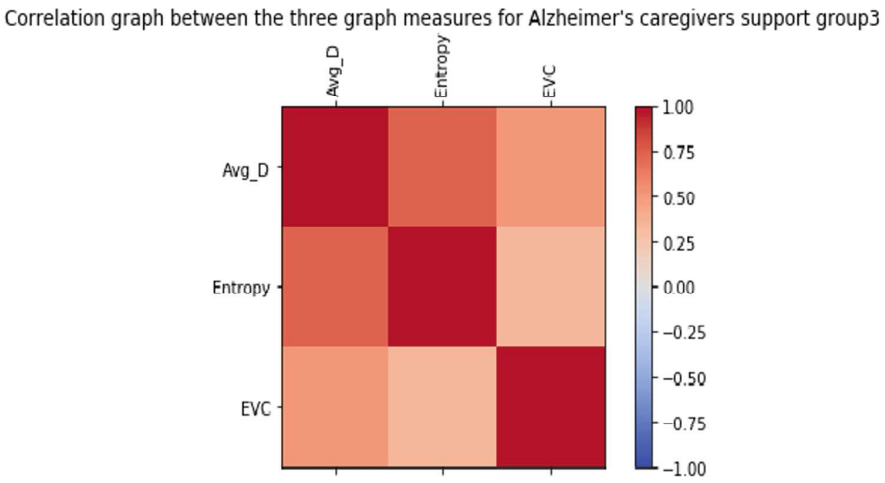


Fig. 3. Correlation graph for Alzheimer's Support Group 3

From the Fig. 1 visualizing the Alzheimer's support group 1, we can infer that Entropy and Eigenvector centrality are negatively correlated indicating that the diversity in the link distribution didn't positively affect the influentiality of the nodes in the network. This means that more number of diverse connections between the participants reduced the number of influential nodes over one year period indicating that many nodes are playing equally important role in the network.In all the three groups presented by Figs. 1, 2 and 3, average degree and the entropy are positively correlated strengthening the basic notion of entropy. The correlation between average degree and Eigenvector centrality varies from group to group indicating each patient group has a different structural behavior though they are formed with a common focal point. The same analysis can be applied to the results derived from the Diabetes groups also.

The Alzheimer's groups, as visualized in Fig. 4 show that the average degree and entropy go hand in hand in all the 3 groups over the one year period whereas, in except one group, the Eigenvector centrality varies irrespective of the average degree and entropy values. This is in contradiction to the Rich-Get-Richer phenomenon of the real-world networks as the influential nodes in these groups are not stably maintaining their influentiality and their percentage in the network kept changing. This can be related to the fact that Alzheimer's is a progressive disease [13] that gradually reduces the cognitive capabilities of the patient leading to final stage and thus the percentage of influential nodes in the network keeps changing as and when the so far influential participants (caregivers) exit from the group or remain passive or latent.

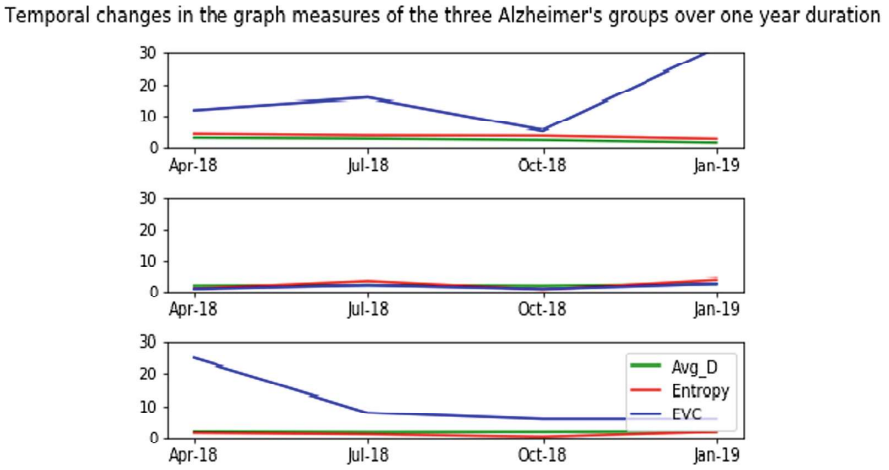


Fig. 4. Temporal changes in graph measures of Alzheimer's groups considered

The Diabetes support groups shown in Fig. 5, in contrast, exhibit a good synchronization and minimal variation between the graph measures indicating that most of the time, the influential nodes are stably maintaining their importance complying with the Rich-Get-Richer phenomenon of the real-world networks. This can be correlated to the characteristic of the disease as a manageable one with lifestyle changes and disciplined diet [14] thus resulting in the stability of the influential role played by the participants of the group.

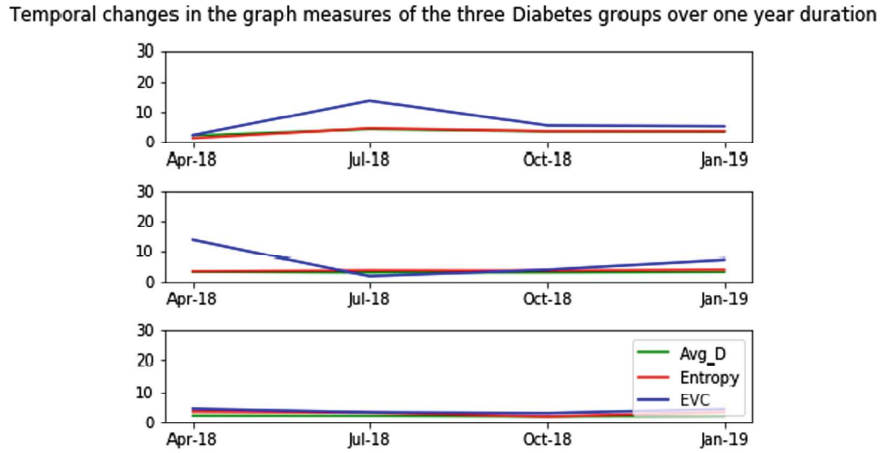


Fig. 5. Temporal changes in graph measures of Diabetes groups considered

6 Conclusion

The present work focuses on the structural analysis of the patient networks related to chronic diseases on social media. Two important measures namely Entropy and Eigenvector centrality are taken to understand how the structural dynamics of the patient networks and their social connections are related to the specific disease characteristics. Proctored patient networks are not considered for this research as they are formed to take up particular surveys and are transient. Seasonal disease networks were also not considered as they do not have well-defined patient groups on social media due to their inherent nature of short-term prevalence. Future enhancements of this work will head towards finding the highly collaborative patient networks related to chronic diseases on social media that would lay foundation for further analysis by the healthcare researchers.

References

1. Psychology Today – Social Life. https://www.psychologytoday.com/us/basics/social-life
2. Helzner, E.P., Scarmeas, N., Cosentino, S., Tang, M.X., Schupf, N., Stern, Y.: Survival in Alzheimer's disease: a multi-ethnic, population-based study in ıncident cases. Neurology **71**, 1489–1495 (2008). https://doi.org/10.1212/01.wnl.0000334278.11022.42
3. Algorithms for Innovation – Social Data Genius. https://uofuhealth.utah.edu/innovation/algorithm/2014/data/socialdatagenius.php
4. Ekrem, S., Selim, B.: Entropy based sensitivity analysis and visualization of social networks. In: IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (2012). ISBN: 978-1-4673-2497-7, https://doi.org/10.1109/asonam.2012.189
5. Ramin, K.: Entropy of weighted graphs with the degree-based topological indices as weights. In: MATCH Communications in Mathematical and in Computer Chemistry, vol. 76, pp. 69–80 (2016). ISSN 0340-6253
6. Yukio, O.: Graph-based entropy for detecting explanatory signs of changes in market. Rev. Socionetw. Strat. **12**, 183–203 (2018)
7. Andreas, H., et al.: On graph entropy measures for knowledge discovery from publication network data. In: 1st Cross-Domain Conference and Workshop on Availability, Reliability, and Security in Information Systems (CD – ARES). Lecture Notes in Computer Science. LNCS, vol. 8127, pp. 354–362. Springer (2013)
8. Jitesh, S., Jafar, A.: Discovering ımportant nodes through graph entropy – the case of Enron email database. In: Proceedings of the 3rd International Workshop on Link Discovery, pp. 74–81 (2005). https://doi.org/10.1145/1134271.11342282
9. Tong, Q., Wei, S., Chang, Z.: How to identify the most powerful node in complex networks? A novel entropy centrality approach. Entropy **19** (2017). https://doi.org/10.3390/e19110614
10. Stanley, W., Katherine, F.: Social Network Analysis – Methods & Applications. Cambridge University Press, Cambridge (1994)
11. Bonacich, P., Lloyd, P.: Eigenvector-like measures of centrality for asymmetric relations. Soc. Netw. **23**, 191–201 (2001)
12. Bromiley, P.A., Thacker, N.A., Bouhova, T.E.: Shannon entropy, Renyi entropy, and information: Tina-memo No. 2004-004. The University of Manchester (2010)
13. Alzheimer's Disease Fact Sheet - National Institute on Aging, U.S. Department of Health and Human Services. https://www.nia.nih.gov/health/alzheimers-disease-fact-sheet
14. Diabetes Type 2 is Serious but Manageable – NIH MedlinePlus, vol. 9, pp. 12–13 (2014)

Springer

CERTIFICATE OF PRESENTATION

This is to certify that

Arun Kumar B. R.

has presented a paper entitled

Impact of Cyber Attacks on Electronic Patient Health/Medical Records

in the ***3rd International Conference on***

Computer Networks and Inventive Communication Technologies (ICCNCT - 2020)

organised by RVS Technical Campus, Coimbatore, India on 23-24, July 2020.

ICCNCT 2020

Session Chair

Dr. S. Smys
Conference Chair

Dr. Y. Robinson
Director, RVS Technical Campus

Impact of Cyber Attacks on Electronic Patient Health/Medical Records

Arun Kumar B.R.

Dept. of Master of Computer Applications
BMS Institute of technology and Management
Doddaballapura Main Road, Avalahalli, Yelahanka, Bengaluru-560064
(Affiliated to Vivesvaraya Technological University, Belagavi)
Karnataka, India.
arunkumarbr@bmsit.in

Abstract. Digital health offers several benefits from different perspectives. Therefore the transition from paper to meaningful cost-effective electronic health records (E-HR) is the focus of several countries. In the literature, E-HR functionalities are discussed extensively. It may be noted that security measures to curb potential cyber-threats in E-HR needs further attention. The working of health monitoring needs a transformation from a reactive mode to a proactive and predictive mode using contemporary technologies. While implementing the E-HR security/privacy perspective is essential since the safety of the medical records is key to the safe life of the patient. This paper highlights security/privacy issues, cyber-threats to E-HR, the pros, and cons of contemporary technologies such as IoT networks, and discusses meaningful E-HR so that patients and society significantly benefit as believed by experts and policymakers.

Keywords: Electronic health records, health information technology, HITECH, DISHA, privacy, cybersecurity attacks.

1 Introduction

Cyber-attacks are threats to the growing health care industry. As of now, implementation of security measures is not enough to give counter attacks to curb the cyber-attacks. The health care industry /hospitals that implement an electronic health records system should take significant and relevant steps in protecting its main stakeholder ie, patients. The study discloses that hospitals do not prove the required capability to avoid cyber-attacks. Some of the hospitals are not ready to share the patients' medical records due to their business profits [9]. At the other dimension, contributions of contemporary technologies such as IoT and sensor networks added additional patient care and monitoring but added security

vulnerabilities. Hence health care industry, in general, need to add one more dimension of cybersecurity in terms of technology, internal policies and regulatory aspects in compliance with that of a national policy such as, " The Health Information Technology for Economic and Clinical Health (HITECH) Act and " "Digital Information Security in Healthcare (DISHA)" in case of the United States and India respectively.

Today, the ubiquitous nature of digital technologies and their adaptations have made human life digital, and hence humankind is blessed with both abundant opportunities and equally challenges which cannot be ignored but need serious significant attention. Capabilities of translational researchers have empowered by healthcare analytics. Nevertheless, healthcare analytics comes with a lot of challenges of combating data coming from various sources, complying with government regulations, and implementing security technologies. Contributions of big data analytics are significant in analyzing E-HR including critical data handled by IoT devices and biomedical research [5]. Data analytics can uncover hidden risk factors of health and customize individual care. In other words, the implementation of E-HR using data analytics can make the health care industry "meaningful" [5],[13]. Due to digital technological developments, healthcare industry processes may have to be redefined and best practices may be implemented to work more effectively and protect the life of thousands of patients across different countries. However, at the same time, it is to be noted that privacy, security issues are to be addressed in maintaining electronic health records since its contents are targets of cybercriminal which contains personal identity, financial information, and debit/credit card numbers [6],[15].

Patient protection, national policies, acts such as HITECH/DISHA are encouraging the healthcare industry to work on legislative grounds [8]. Healthcare providers to integrate all the expected services and demonstrate "meaningful use". As mentioned in the NITI Aayog report, India suffers from inadequate and fragmented healthcare services [4]. Health organizations have their own formal and informal rules, no coordination exists, harmony among them is not seen, and willingness to implement a national health network system needs improvement and should be based on DISHA. Since the world always works as a global village Indian digital health need to work under a single set of rules for patient protection, efficiency, and quality, otherwise, highly fragmented systems tend to severely underperform and face severe cybersecurity problems too.

According to the Goldman Sachs report [18], the young urban Indian consumer spends more on fresh food than his or her Chinese and American counterparts. However as observed India's per capita expenditure on health care is less compared to other countries marked in the national health profile, 2018. Today, due to the multidimensional benefits of a digital health system, E-HR is the need of the hour. Nevertheless, digital technologies and distinctive tools have brought

unique security and privacy issues that most translational researchers need to address otherwise may result in disruption. E-HR enables proactive continued care which is especially required while treating patients with allergies or abnormal responses to certain medicines.

1.1 Advantages and challenges of E-HR

E-HR can alert the physician treating the registered patients proactively to the prospective issues such as aversions or intolerances to certain medicines. This is useful especially for remote patients who stay outside certain physical distances or not able to travel or not in a situation to travel or crucial if the patient is unresponsive. The potential issues may be identified more effectively with the advent of sensor technology and more prone to threat too. For example, wireless real-time monitoring could strengthen the relationship between diet and health with increased precision, sensors developed by scientists can track what patients eat, report on patients eating habits, and further kind of bacteria that is being developed and possible health issues [19].

Sensors developed and at the Tufts University School of Engineering mounted directly on a tooth as mentioned in can communicate information about glucose, salt, and alcohol intake wirelessly with a mobile device [7][19]. Wearable sensor devices enable proactive health care [7]. In these applications, it is required to address privacy and security issues from a cyber perspective. An EHR system safeguarding patients and records has to follow certain design guidelines such as mentioned in [8].

1.2 Challenges to E-HR

In principle, implementation of E-HR leads to better tomorrow, however, the reality is not just what we dream. The researcher's awareness of cyber situations is no longer a sufficient condition, it is a fundamental requirement in combating both the elite and highly organized adversaries on the internet. Further, the administrative cost is driving healthcare spending. This complex network of all stakeholders is to be taken into confidence while implementing E-HR with transparency, privacy, and various elements of security including non-repudiation. E-HR which is expected to be making simple, paperless, and effective may turn into complex, expensive, and unsecured. Incentives may be given by federal to vendors of E-HR to make them integrate with other health IT as expected [16]-[26].

As known, Patient health record (PHR) gets updated by different stakeholders in the chain including nurses, technicians who are generally responsible for data entry into a central, digitized system. Medical billers and coders update PHR and may be subsequently referred by Insurance companies and or by government

authorities in implementing health schemes such as the "Ayushman Arogya scheme" of govt. of India. At the click of a button patients may get their records from anywhere, at any time but at the same time, it is necessary to ensure that data is maintained with privacy, safety, and security.

1.3 The objective of this paper

The objectives are to focus on challenges in managing patient health records electronically (E-HR), threats due to cybercrimes, and awareness of necessary legal and technical preparations required. The second most important issue this paper address is the potential cyber-attack/crimes that can create an adverse effect in the digital medical field.

This paper addresses the following questions: a) What are the different benefits of electronic patient health record management systems (E-PHMR)? b) What are the different types of threats and their impact on (E-HR)? c) What are the contributions of contemporary technologies such as IoT and Sensor networks and scope for potential cybercrimes? d) Implementation of application-level security.

The paper has been organized into four sections: Section-1 presents the introduction, advantages, and challenges of E-HR. The Section-2 describes various Cyber- threats to E-HR. Some of the contributions and scope for cyber crimes/attacks due to contemporary technologies are analyzed in the Section-3. The privacy issues in healthcare/IoT and security implementations are discussed in Section 4 and 5 respectively. Some of the findings and conclusions are presented in Section 6.

2 Cybersecurity threats to E-HR

An immense amount of sensitive information contents in E-HR is the prime motive to verities of cyber-attacks which forms the cyber-threat space including the followings:

2.1 Phishing Attacks

According to the "2019 Mid-Year Data Breach Barometer" report 31,611,235, healthcare records were breached during the period January 2019 to June 2019 which is double when compared to 14,217,811 records breach occurred in 2018 [21]. Cybercriminals target to illegally access IP on research works/medicines using phishing attacks through different means such as e-mail. For instance, phishing attacks through email had hit hardly the $1.2 trillion pharmaceutical

industry [1]. The study in [1] reveals that 14.2% of emails out of 2.9 phishing emails are clicked by employees of US healthcare institutions in six years. The case of hospitals is even worst and hence a phishing attack can play nearly 69% of the role in overall breaches. In the US, costs associated with a data breach per incident in the healthcare sector are roughly 60% more than the global average across all industries apart from the cost of the penalties that may be imposed by legal bodies. Therefore, the industry has to ensure that healthcare professionals can identify and handle even sophisticated phishing attacks. Further while sharing any information, it is necessary to implement mutual authentication among users of the data participated in data/file sharing [21].

2.2 Malwares

Malware access networks/medical records to do malicious activities. Especially malware such as adware and riskware through malvertising strategy infects the healthcare system. A healthcare system's IT network may also get affected by malware such as ransomware, Trojans, bots, and several other different knowns and unknown attacks [20]. Trojan installed on a phone through remote access can work as key loggers to collect interesting information, control the operation of files/processes. Botnets such as Gh0st RAT are capable of controlling the victim machine, log keystrokes, log webcam and microphone data, and more. In addition to it, Bladabindi alias njRAT can also steal stored credentials such as usernames/passwords and other PII.

2.3 Cloud Threats

To reduce or optimize the cost and improve patient care healthcare organizations may seek the advantages of cloud computing. it is extremely critical to ensure that private data is secure and software in compliance with ACT such as DISHA [20].

2.4 Employees' ethical responsibilities

Cyberlaw, security responsibilities, and ethical awareness are required for health care staff. Healthcare organization has to evolve with cybersecurity strategy and policy which are understood, followed, and enforced by its employees [20].

2.5 Hacking of Healthcare Data

FireEye [3], a US-based cybersecurity firm reported that 68 lakh E-HR records [22] are hacked from the Indian website with the purpose of selling in underground markets. As observed by FireEye multiple Chinese persistent threat groups are interested in cancer patients' health and medical records from Indian websites as well as US health centers using malware such as "EVILNUGGET". As per the Cyber Threat Report of 2019, 69% of firms face cyber-attacks in India

[9] [20] [23]. According to a source, there was a 22% rise in cyber-attack in India on IoT deployments.

2.6 Cyber-attacks and COVID-19

he COVID-19 pandemic has put front several security challenges in cyberspace too. Health care systems that take care of patients and supported by labs are more vulnerable today when compare to the pre-COVID-19 period. Spike of criminal activities during the crisis is common and impacts on the target/victims, especially COVID patients. Government funding in many countries has attracted cybercriminals to get access to health record credentials. Anti-phishing, anti-malware, anti-ransomware defense solution powered by AI/ML technologies are needed to be an integral part of the Health care IT solutions to reduce the criminal activities and protect the lives of the patients [12].

E-HR has to ensure the cybersecurity implementation in point of view of the attacker, defense, research, and automation. As per the WHO report, the importance of health care is recognized and realized by all 194 members [29]. All countries need to devote the attention to implementing E-HR effectively from the perspective of patients, analytics, privacy, and security in health care. It is to be appreciated that WHO/ countries have taken measures in curbing diseases such as – HIV/AIDS, Tuberculosis (TB) [30], and malaria. Now, it is high time to look at E-HR encashing advances in technological developments. Implementation of all-dimension E-HR needs suitable design guidelines evolved in discussion with experts, evolved standards are to be followed, to comply with relevant Acts and national policy. Several middle-income countries need the support of external funding [31] since the health care industry needs huge capital investment even in medical infrastructure as well as in E-HR implementation. The new WHO report recommends policymakers, health professionals, and citizens to work cooperatively to evolve meaningful health systems.

Healthcare organizations if attacked by ransomware may end up with operational problems where all crucial files get encrypted, systems go down, valuable time wastage and patients face severe problems. While healthcare organizations facing severe budget lacking, they decide to pay the ransom demand. Technological advances should enable them to focus to offer the medical service. An effective E-HR implementation needs to be in line with the law, technology, sustainable with societal concern while it addresses cyber threats, safeguard the life of patients, improve quality of life and hence “meaningful” [31][32]. Meaningful adoption will significantly benefit patients and society leading to stable growth of the national development. The complete effective implementation of E-HR can become a game-changer in the medical field to all the stakeholders. Its industry-wide implementation assists all professionals including registered nurses to registered patients.

In case of an attack, medical critical activities such as surgeries and other procedures need to be canceled or postponed. In the case of an emergency, patients may be moved to the nearest hospital. Such a situation is disastrous and calls to have proper planning and disaster recovery techniques and protocols in health care organizations [36].

From the survey analysis, we can note that Phishing and Malware were the elementary attack vectors that health organization/ hospital offices face, see Fig.1.

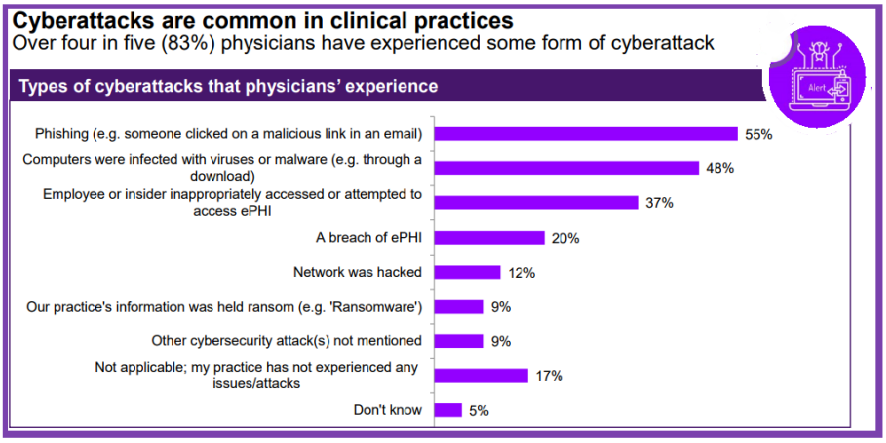


Fig. 1 Types of attacks that physician' experience (source [37])

3. Contributions of IoT/Sensor networks and scope for cybercrimes

Due to the high probability of pandemic infecting the health of citizens', the economy of the countries across the globe goes down badly. In such cases country such as India having an average age of 29 years may not be useful in uplifting the country from different perspectives [25]. To face such challenges contemporary technologies can play a vital role in monitoring the persons affected by the unexpected, unknown, new diseases/viruses, especially which are chronic. The appropriate technologies are being used to support patients both mentally and physically, keep continuous track in monitoring, and educating the youths or addicts of certain bad food practices and prohibited items consumption along with digital/cyber addicts.

In this connection, remote sensing and monitoring of health by minute-minute tracing and recognizing of routine activities have been a promising, challenging solution. Implementation of technologies such as IoT and sensor networks is enabling patients and health care sectors to face different facets of the challenges.

It may be observed that under the IoT framework body area sense networks (BASN) have been widely applied for one-to-one health care ubiquitously [26]. IoT architecture for real-time personal health monitoring such as in paper [26] presented as a novel system, offers benefits of digital technologies and tough challenges too in administration and maintenance of E-PHMR. The increased demand for data accessibility resulted in a violation of privacy, decreased data security, and a health care domain, and its allied activities are a new target for cybercriminals [8].

However,the framework shown in Fig. 2 needs to be modified to curb cybercrimes by implementing cyber privacy and security solutions. In order to implement cyber privacy and security, any application development needs to ensure privacy implementation on the application layer and cybersecurity in all the layers of the OSI reference model otherwise optimal security cannot be achieved [27].

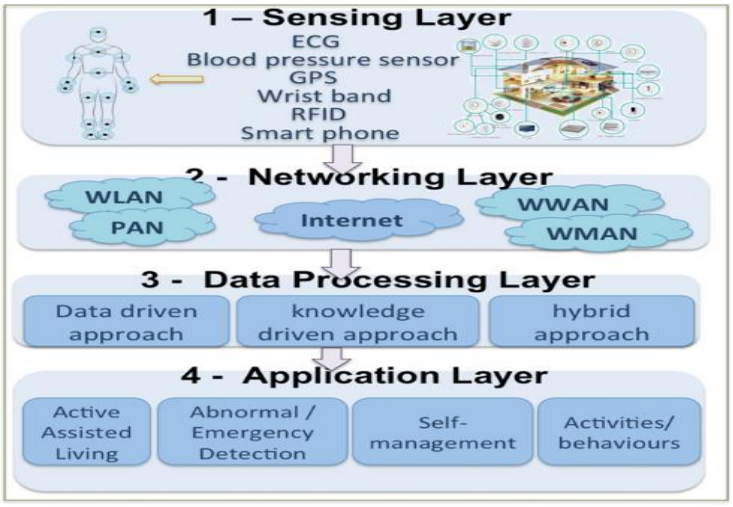


Fig. 2 IoT architecture for real-time personal health monitoring (Source [27], P.2).

4. Privacy issues in healthcare and IoT

Security is about the safeguarding of data, whereas privacy is about the safeguarding of user identity [24]. Security refers to protection against unauthorized access to data. As per [24] "the Office of the National Coordinator for Health Information Technology" safeguarding of health records is safeguarding the life of patients. The Healthcare industry has to adapt major ethical and safety measures on top priority while implementing E-HR: they are privacy, confidentiality, integrity, availability, and non-repudiation [15].

Data generated by sensors is enormous and securing patients‘ data without violating privacy from objects having the ability to communicates is practically a difficult and necessary task. The health care IoT must contain effective security features for all objects right from naming, identification to the provision of services, data acquisition, to infrastructure governance [2] [22]. At the same time, a very large number of unsecured devices manufactured without adopting security standards adds further difficulties in implementing the security in IoT to preserve privacy.

It is worth noting that all the layers in IoT are vulnerable to different attacks. Since the data is communicated through wireless links unauthorized users can eavesdrop affecting accuracy and delivery time. Eavesdropping enables attackers to get confidential information of a patient and encroach privacy whereas devices password hacking allows accessing sensitive information leading to affecting financial aspects as well as privacy. IoT based health network system is the potential to distributed denial of service attack keeping the patient’s life endangered. It is high time to recall a major DDoS attack on a DNS provider, the Dyn Network, the US in 2016. In the attack, data was constantly flooded at the rate of 1 terabytes /sec leading to a denial of service. As a result of the attack websites like Airbnb, Reddit, etc. were carried down and approximately 150,000 IoT devices including smart cameras, home routers were affected [2][10]. Such attacks on IoT devices used for the implementation of health care can severely affect devices' and patients' life. This message calls for the realization of the privacy and security of health care IoT.

5. Implementing security with reference to the OSI model for an application

Due to the drastic increase in high profile hacking any application development has to implement privacy and cybersecurity measurements to offer a quality of service. Cyber Privacy and security measurements are an integral part of any quality of service (QoS) of application/ network especially in the case of the medical field. In fact hacking of E-PHR leads to consequences of crimes that one cannot imagine. Therefore, it is necessary to delve into cyber aspects and realize complete application protection

Regarding OSI, layer-a, layer-b, layer-c are media layers where security is extremely crucial. In the physical layer, an exception that arises due to removing the power card or network cable can cause the denial of service attack. To overcome such attacks, biometric security surveillance can be enhanced, electromagnetic protections and advances locking mechanisms may be implemented [28]. Layer-b – Data Link Layer –network layer functionality gets hampered if data link layer malfunctions or faults happen. General vulnerabilities

found in this layer are MAC address hoaxing and VLAN evasion [3][11]. The general solution includes filtering of MAC address filtering and adapting suitable encryption and authentication techniques [28].

Layer-c-network layer- Most of the cyber-crimes can happen on this layer using IP Address Spoofing, packet-sniffing, and DoS attacks. Intelligent knowledgeful, efficient machine learning algorithms may enable the implementation of techniques for anti-spoofing and route /packet filters along with the suitable configuration of firewalls [28].

In a network, the transport layer focuses on secure HTTP based web transactions. Applied cryptography techniques can add values to this layer of security implementation. It is highly important to design security mechanisms/ techniques which should not restrict only to TCP but UDP. Strong authentication techniques using efficient effective encryption algorithms need to be implemented on a session layer otherwise may lead to a brute-force attack.

6. Some findings and conclusions

All the industries, areas, and domains in which software applications are to be used need on network/internet to take cybersecurity as a major issue and not to be ignored at this point. Since all domains have cybersecurity domain on top of them, vulnerability analysis and implementing security measures accordingly is a prerequisite. Applications developed, databases proposed/used and website in which other applications are to be integrated such as payment gateway are to be analyzed for vulnerability. In the case of electronic health records, business organizations are major stakeholders because of making the system user need to frame certain policies concerning vulnerability analysis and ensure the implementation of them technically to protect patient records and patients. Policy for example may be to encrypt /hash records using particular algorithms/technology before storing in a particular database and apply for restricted access at various levels. Further implement privacy policies in the complaint with the law or information technology Act, etc. After the vulnerability analysis, penetration testing to be carried out before start using IT health care applications in the real scenario.

The application developer can explore the vulnerabilities by taking the help of CVE® for example which is a dictionary of publicly disclosed cybersecurity vulnerabilities and exposures that is free to search, use, and incorporate into products and services (available online at https://cve.mitre.org/cve/). An example snapshot shown in Fig. 3 indicates the use of such an instance.

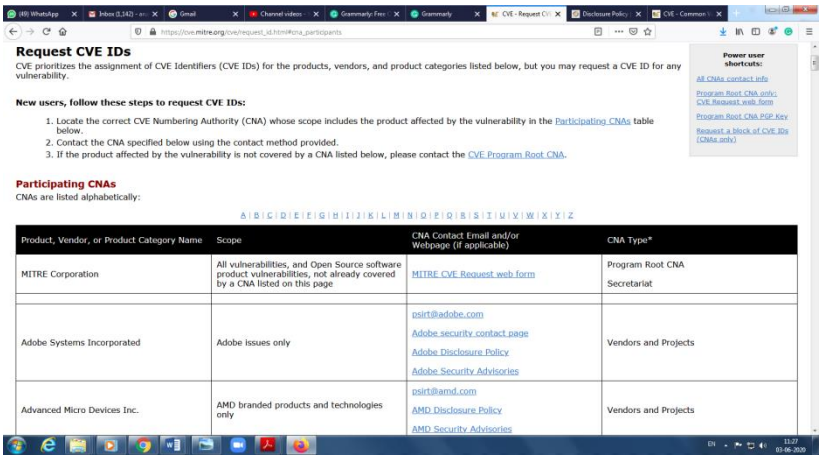


Fig. 3 Illustration of use of Common Vulnerabilities and Exposures (CVE) tool

here are lots of open source tools are available which can help to make your devices at different layers more secure than before. Open-source software is beneficial to reduce cost, useful in learning, experimenting on the new situation, provides transparency as all codes are available and free to whatever is required and need not to lock-in with a particular vendor/ supplier. Due to these reasons when compared to commercially available software open source is the best. Any data/file is to be checked and end-users are to be educated to verify for the known virus using software such as virustotal (https://www.virustotal.com/gui/home/url). This tool enables us to primarily investigate suspicious files and URLs and detect malware.

Any e-mail id account holder needs to aware of the tools such as “Have I Been Pwned” which enables us to know whether the particular e-mail address has been compromised across multiple data breaches. For instance, the snapshots in Fig. 4 shows that an email having a breach is identified.

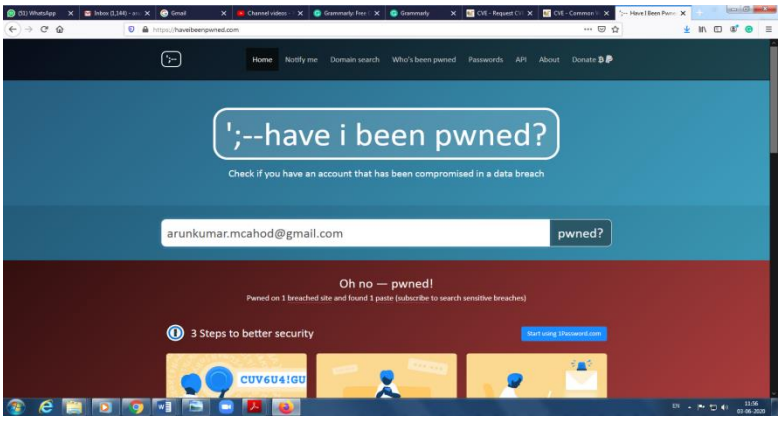


Fig. 4 An e-maid where breach and paste are found

Online fraudsters hide their IP addresses through proxies, Tor nodes & VPN connections to maintain the secrecy of location and true identity. IP Quality Scores (IPQS) is the intelligent and free proxy detection service which can prevent fraudsters with anonymized or spoofed IP addresses from accessing critical pages of the particular site, creating hurdles to credit card fraud & chargebacks., It provides the following features namely a) proxy detection b) Email verification c) Device Fingerprinting solutions and D) Anti-Fraud tools (available online at https://www.ipqualityscore.com/proxy-vpn-tor-detection-service).

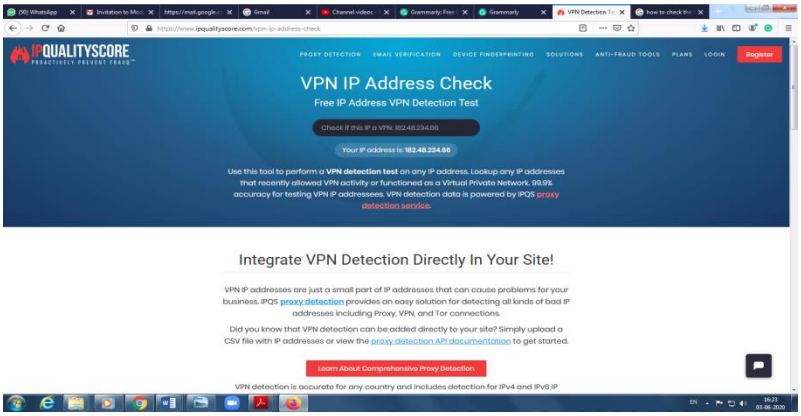


Fig. 5 VPN IP Address Check using IPQS

Even for the development of secure E-HR implementation, organizations or business organization in the particular supply chain need to have some standard policy for using open source/commercial softwares. Concerning devices such as

filters there is some mechanism required to ensure that the devices used do not collect and transmit the data without the organization knowledge. Netfilter and openbsd may be used with necessary modifications. Server monitoring is easy using softwares such as Nagios. It is necessary to keep continuously analyzing the E-HR software like a honeypot and keep strengthening it always. An E-HR if it works using intrusion detection system along with firewalls and creates network visibility connecting various components such as users, internet, servers, datacenters, and workgroups will lead to effective system development.

It is necessary to have cyber security consultation center in every organization including health/ hospitals which may be physical or online which constantly educate employees and equip them with several tools available to do preliminary investigation and arrive at the conclusion regarding gravity of the problem and the way it can be handled. This is required because some fake news may simply threaten even actually not having access to some credentials and targeted databases. For example employees of any organization can use the tools available at Viewdns.info, urlscan.io and fake news may also be verified using online free tools (https://reverse.photos , https://fotoforenscis.com). Similarly intrested photo may be analysed for some details including privacy and copyright issues (https://snapwonders.com).

If cyber security problems are ignored then healthcare organizations will end up in danger and threats will threaten them daily. During the attack data loss results in loss of productivity. Hospitals may return to pen paper mode to record the details of the patients and monitor the patient progress.

In the rapid pace Technological innovations are seen in healthcare for example discoveries in the field of genetics have led to life-extending treatments for cancer patients. In phase with that cyber security implementations should go at right and running. IoT has brought revolutions in health care along with several vulnerabilities. Contemporary technologies such as Artificial intelligence (AI), block chain, and virtual reality are expected to redefine health cybersecurity and privacy at new heights.

Acknowledgements.

The Author, Dr.Arun kumar B.R. acknowldges the direct/indirect support extended by the Principal and BMS Trust/Management in publishing this paper.

References

1. Armen Najarian : Phishing Attacks: Top 3 Reasons Healthcare Employees Are Prime Targets : https://www.agari.com/email-security-blog/phishing-attacks-healthcare-employees/, 2020 .
2. A. Riahi, E. Natalizio, Y. Challal, N. Mitton, and A. Iera : “A systemic and cognitive

approach for IoT security," : Int. Conf. Comput. Netw. Commun. ICNC 2014, pp. 183–188, 2014.
3. Brian Cusack; Raymond Lutui : Innovating Additional Layer - 2 Security Requirements for a Protected stack, 2015: https://pdfs.semanticscholar.org/791f/64bb5e5e4f0a0b2bb65cfab0e7e31e3fdf25.pdf
4. Clemens Scott Kruse, Benjamin Frederick, Taylor Jacobson and D. Kyle Monticone Texas State University, San Marcos, TX, USA : Cybersecurity in healthcare: A systematic review of modern threats and trends, 1–10 1,DOI 10.3233/THC-161263,IOS Press, 2017.
5. Dash, S., Shakyawar, S.K., Sharma, M. et al.: Big data in healthcare: management, analysis and future prospects. J Big Data 6, 54, https://doi.org/10.1186/s40537-019-0217-0, 2019.
6. Laurinda B. Harman, Cathy A. Flite, and Kesa Bond, Electronic Health Records: Privacy, Confidentiality, and Security American Medical Association Journal of Ethics, Volume 14, Number 9: 712-719, September 2012.
7. Mark Lukaszewski : A history of health information technology and the future of interoperability, , https://bulletin.facs.org/2017/11/a-history-of-health-information-technology-and-the-future-of-interoperability/,2017.
8. Mayra Rosario Fuentes, Forward-Looking Threat Research (FTR) Team : Cybercrime and Other Threats Faced by the Healthcare Industry, https://documents.trendmicro.com/assets/wp/wp-cybercrime-and-other-threats-faced-by-the-healthcare-industry.pdf
9. Mohammad S Jalali, Jessica P Kaiser : Cybersecurity in Hospitals: A Systematic, Organizational Perspective, https://www.jmir.org/2018/5/e10059/pdf, 2018.
10. M. M. Hossain, M. Fotouhi and R. Hasan : "Towards an Analysis of Security Issues Challenges and Open Problems in the Internet of Things", Proc. - 2015 IEEE World Congr. Serv. Serv. 2015, pp. 21-28, 2015.
11. Preeti Sinha, Dr. V. K. Jha , Amit Kumar Rai and Bharat Bhushan : Security vulnerabilities, attacks and countermeasures in wireless sensor networks at various layers of OSI reference model: A Survey, , International Conference on Signal Processing and Communication (ICSPC'17) – 28th & 29th July 2017, page no.288-293.
12. Rachel McArthur : Cyber-attacks on healthcare facilities 'growing threat' during coronavirus pandemic : https://www.healthcareitnews.com/news/europe/cyber-attacks-healthcare-facilities-growing-threat-during-coronavirus-pandemic, 2020
13. Sandra Kogan , Qing Zeng , Nachman Ash , Robert A. Greenes : Problems and Challenges in Patient Information Retrieval: A Descriptive Study , https://www.researchgate.net/publication/11535490_Problems_and_challenges_in_patient_information_retrieval_A_descriptive_study, (2001).
14. Sonia Arista , CISM, National Healthcare Lead, Fortinet : Cyberattack Threats to Watch For in Healthcare So Far in 2019, avaialble on line at : https://www.idigitalhealth.com/news/cyberattack-threats-to-watch-for-in-healthcare-so-far-in-2019.
15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4859641/.
16. https://niti.gov.in/sites/default/files/2019-11/NitiAayogBook_compressed.pdf.
17. https://www.accenture.com/us-en/insights/health/cost-cyber-crime-healthcare.
18. https://www.itnonline.com/content/blogs/greg-freiherr-industry-consultant/protecting-patients-hackers.
19. https://m.hindustantimes.com/india-news/indians-eat-healthier-than-americans-but-spend-less-on-healthcare/story-AZExIl6VT6bPestHPJlG7M_amp.html.
20. https://www.sciencedaily.com/releases/2018/03/180322103058.htm?fbclid=IwAR1Upb

Il5hO.
21. http://integracon.com/top-5-cybersecurity-threats-to-electronic-health-records-and-electronic-medical-records/.
22. https://www.hipaajournal.com/category/hipaa-breach-news/.
23. https://english.lokmat.com/national/hackers-attack-indian-healthcare-website-steal-68-lakh-records/.
24. https://www.kratikal.com/blog/5-biggest-cyber-attacks-in-india/.
25. https://www.hiv.gov/blog/difference-between-security-and-privacy-and-why-it-matters-your-program.
26. https://en.wikipedia.org/wiki/Demographics_of_India.
27. Wan, J., A. A. H. Al-awlaqi, M., Li, M. et al. (2018) , Wearable IoT enabled real-time health monitoring system. J Wireless Com Network, 298, https://doi.org/10.1186/s13638-018-1308-x.
28. https://www.checkmarx.com/2016/02/04/application-layer-security-within-osi-model/.
29. WHO report, https://www.who.int/whr/2008/whr08_en.pdf
30. A report on Management of Tuberculosis and HIV coinfection, http://www.euro.who.int/__data/assets/pdf_file/0004/78124/E90840_Chapter_4.pdf.
31. https://specimen-news.com/2019/02/21/countries-are-spending-more-on-health-but-people-are-still-paying-too-much-out-of-their-own-pockets/.
32. https://cybersecuritynews.co.uk/network-vulnerabilities-and-the-osi-model/.
33. https://www.asianage.com/amp/life/health/230318/this-tiny-tooth-mounted-sensor-to-track-what-you-eat.html
34. 2019 –IBM security report, https://www.ibm.com/security/data-breach
35. 2019 Internet crime report, https://pdf.ic3.gov/2019_IC3Report.pdf
36. Cybercrime Tactics And Techniques:the 2019 state of healthcare, https://resources.malwarebytes.com/files/2019/11/191028-MWB-CTNT_2019_Healthcare_FINAL.pdf
37. https://blog.rsisecurity.com/medical-cyberattacks/

Editorial Committee

Adversity prompts us to question, to seek, to grow, and to evolve

This is how we tackled the pandemic

www.bmsit.ac.in