

Biometric and rfid based authentication system for exam paper leakages detection using IoT technology

J. AnnRoseela, T. Godhavari

Department of Electronic and communication Engineering, Dr.M.G.R.Educational and Research Institute, India

Article Info

Article history:

Received Jan 12, 2020

Revised May 20, 2020

Accepted Jun 8, 2020

Keywords:

Examination paper

Fingerprint

Leakage system

Protection

Rfid

Security

ABSTRACT

Education is the soul of a community; it goes from one generation to another. Exam is the prime responsibility of an educational framework. The reason for an examination is to select talented applicants for multiple positions. Exam is an important aspect of the education system to test students' abilities online and in oral papers. Every year we receive deferred/canceled exam messages due to paper leakage. Therefore, we have come up with an affordable and concise outcome, and we have decided to design and implement the "Exam Paper Leak Protection Framework", which will be a much more secure structure depending on the controller. Together with RFID Reader, Fingerprints sensor, Buzzer, LCD, and Wi-Fi module. First, the university will send a selection sheet to an educational institution "electronic sealed box" known as the "electronic control box". Electronic control box is a prototype that can be proposed using controller, and the RTC to display the current date and time. If anybody tries to intrude the box the buzzer will beep and alert message will be sent to the university.

Copyright © 2020 Institute of Advanced Engineering and Science.
All rights reserved.

Corresponding Author:

J. AnnRoseela,

Department of Electronic and communication Engineering,

Dr.M.G.R.Educational and Research Institute,

Chennai, Tamilnadu, India.

Email: annroseela@gmail.com.

1. INTRODUCTION

Internet of Things (IoT) is a combination of digital-machines, computing devices, mechanical machines, objects with UID's and ability to transmit the information over a network without interference of human to human or human to computer interaction [1-2]. There are many other contribution factors which paved the way for this rapid development say embedded systems, control systems, building automation, home automation and wireless sensor networks [3]. There are various layers in IoT. They are Sensing Layer, Network Layer, Data processing layer, Application layer [4]. Radio frequency (RF) refers to the oscillation rate of electromagnetic radio waves between 3 GHz and 300 GHz and alternating radio signaling currents, the frequency band used for communication and broadcasting [5-8]. It is a process of transmitting a data or power between multiple points that are connected by an electrical device [9-11].

RFID is the use of radio frequency waves for transmitting data. RFID is a wireless non-contact wave. Tagging items with RFID tags enables users to identify inventory and assets automatically and uniquely RFID is a radio frequency-operated system which is used to auto-identify for the different items. The key components of the RFID system are two. There was an error. Whether the item with the RFID tag is beyond the range of this radio waves, otherwise this RFID reader would be returned with input. There's no control in passive RFID tags and RFID readers/antennas are powered by the RF Frequency Power. The readers and the antenna transmit the signal to control the tag and mirror the reader's energy back.

Biography is a means of calculating the physical assets of an individual in order to test their identification [12-15]. This may involve fingerprints and eyes or behavioral attributes such as a simple method

of complementing the protection authentication puzzle [16-19]. A biometric sensor is a transducer that transforms a individual in an electrical signal into a biometric test. Biometric therapies include primarily biometric fingerprinting, iris, ears, speech and so on. In general, light, temperatures, speed, electrical capacity and other energies are read or measured in the sensor.

The biggest concerns for the students involve the loss of question articles, which include the test being postponed or canceled. We read about the postponement/cancellation of the exam every year in the newspaper or on the television because of papers leaks. Even the institution itself does not realize whether knowledge on question papers is published. So, in less time and with minimum effort, some students get a decent rank and those who really merit the rank do not even get the limit despite hard working. This will adversely affect students and demoralize society's development. The major crisis goes over the world is exam paper leakage due to manhandle of the question paper [20-22]. It can leak over any parries or different organization. Existing system are proposed GPS, GSM and wireless sensor based tracking system [23-25]. In [26] arm based controller is proposed consisting of electromagnetic lock and also gives a valid OTP to the persons or users. This will monitor the question paper box and alert in stipulated timing. Active RFID tags are used in order to explore the indoor location of an object in [27].

In order to overcome the various flaws, combination of biometric and rfid authentication systems based storage box is proposed in this paper. Inside this implemented box we are keeping our question paper with a noted way. With a solid fingerprint and respected RFID the box can be open by proposing we can achive our problem statement positively. In this paper, biometric and RFID based authentication system based on IoT. These system consists the modules are Fingerprint sensor, RFID reader, buzzer, LCD, Piezo electric plate, motor. All of these modules are connected and controlled by NodeMCU. The rest of the paper is organized as follows: System implementation is discussed in section 2. In section 3 discussed the results of system. The conclusion is given in the last section.

2. SYSTEM IMPLEMENTATION

Figure 1 shows the overall block diagram of the system. The entire system is built using a microcontroller development board named NodeMCU, RFID reader, fingerprint scanner, RF transceiver, display, electric lock and WiFi transceiver.

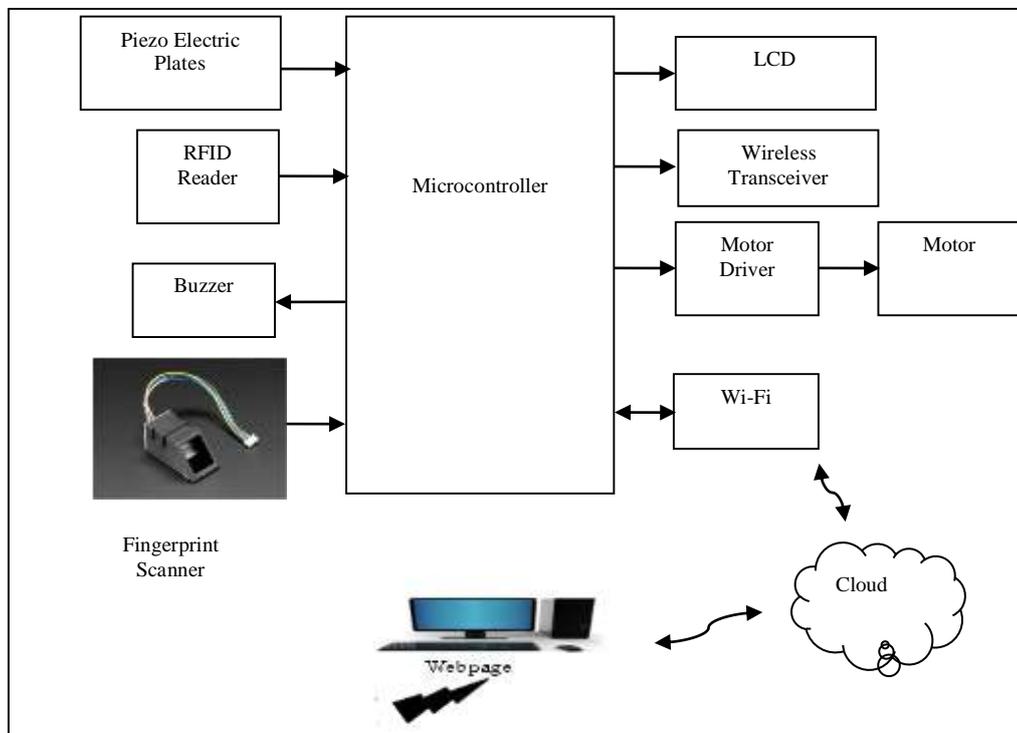


Figure 1. Block diagram of the system

2.1. NodeMCU

Access to various networks is given for a microcontroller via ESP8266. It is a Wi-Fi module which has an inbuilt TCP and IP protocol stack. This module is capable of hosting an application from another application processor.

2.2. RFID reader

Radio frequency detection (RFID) works on the principle of electromagnetic fields which uses radio waves to track and trace the objects which we need to monitor continuously. Tags generate radio waves and also data information. So whenever a tag detects radio waves some sort of data's are also passed to the RFID reader.

2.3. Buzzer

This is a transducer device, which alarms when an object is in search mode. It also converts electrical signals into sound signals.

2.4. Fingerprint sensor

Fingerprint scanner is a type of technology that detects and authenticates fingerprints of a person in order to allow or deny access to a computer device or physical facility.

2.5. (LCD) Liquid crystal display

LCD is an electronic display module that produces a clear image using liquid crystal.

2.6. Motor

Motor converts the electric energy into mechanical energy. In this system motor rotate in two direction one forward another one is backward direction. If water level low in soil, arduino switch on the motor with the help of relay.

2.7. Piezoelectric plate

A piezoelectric plate is a device that uses the piezo electrical effect to calculate friction, acceleration, strain or force by transforming it into an electric charge.

2.8. Wireless transceiver

An RF transceiver module is (usually) a small electronic device used to transmit and/or receive radio signals between two devices.

2.9. Working operation

1. At first the power supply is given to the system.
2. The LCD displays a welcome message as "SMART EXAM SYSTEM".
3. Two notifications gets popped up
 - Add a new Fingerprint
 - Scanning process
4. If "a" notification is chosen below process gets carried out.
5. So in order to add or change a fingerprint in the sensor an approval or proper authentication from a senior authority is required (at first senior authority gets signed in through the portal only after scanning his/her fingerprint). Only after an approval from senior authority new fingerprint can be fused to the data base.
6. If "b" notification is chosen below process gets carried out.
7. Here scanning process of a user takes place. LCD notifies the user to share the ID. If ID gets matched LCD notifies an acknowledgement as "AUTHORISED ID" and forwarded to the next iteration. For an incorrect ID LCD notifies "UNAUTHORISED ID" followed by a beep sound and again looped back to notification "b".
8. After an authorized ID second set of authentication process is carried out, Here Fingerprint of a user is requested. If this authentication is also matched Coffor box can be opened through the motor mechanism. Otherwise LCD notifies "UNAUTHORISED ACCESS" followed by a beep sound and the Message alert "UNAUTHORIZED ACCESS THE BOX" sent to higher officials.
9. All the above mentioned steps are monitored remotely so for live monitoring system must be interfaced with data connection.
10. After interfacing process, user has to sign in www.iescloud.in through the browser. Figure 2 shows the login page of cloud server.

11. User needs to provide proper information to bypass the home page. Figure 3 shows the home page of the system.

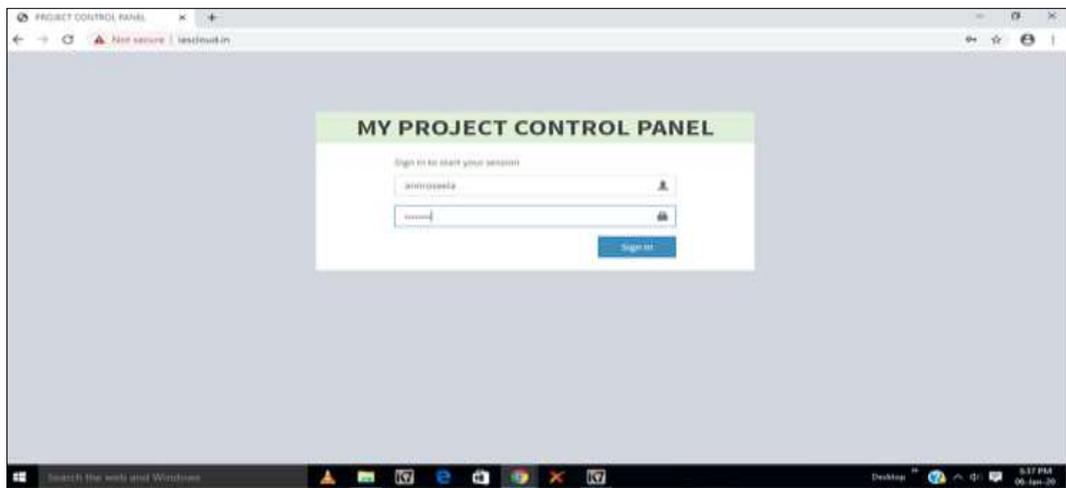


Figure 2. Login page of server

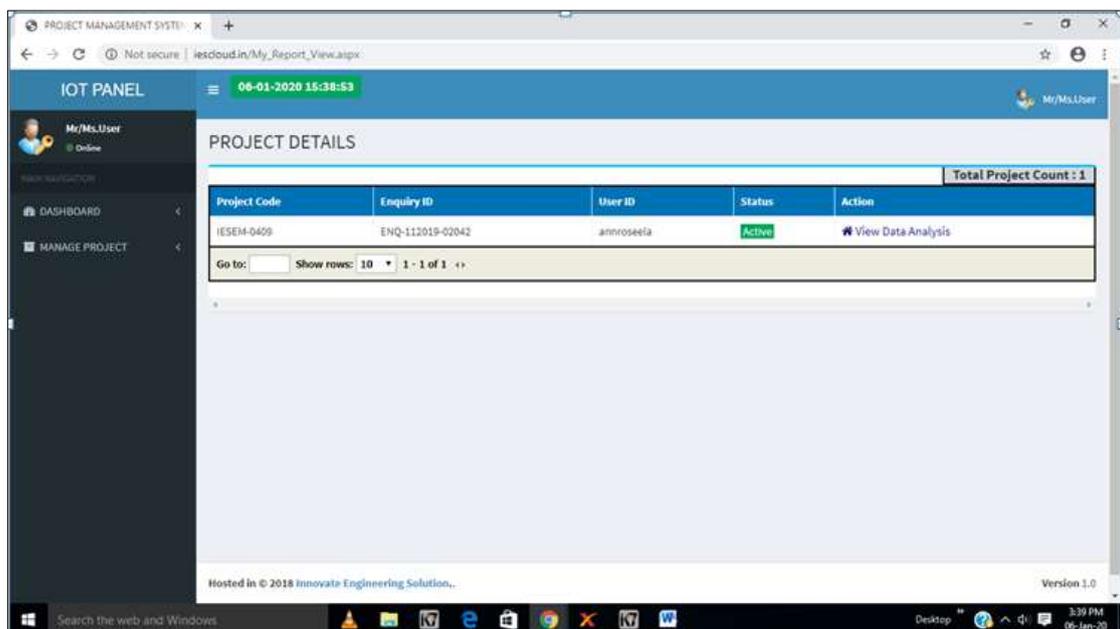


Figure 3. Home page of server

12. All the updated statuses are shown in the Figure 4. Each status includes User, Box status, threat detection using Piezo electric plate and Location of the copper box.

- User status includes the information regarding the user
- Box status defines the condition of the box.(i.e.) open/close
- Vibration status note down the manhandling status of the box.
- Location of the box is gathered through Location status (i.e.) Dept

SNo	Data Received On	USER	BOX	VIBRATION	LOCATION
1	06-01-2020 18:42:47	-	Close	Abnormal	Out_of_campus
2	06-01-2020 18:41:28	PERSON_1	Open	Normal	Out_of_campus
3	06-01-2020 14:53:54	PERSON_3	Open	Normal	ECE
4	06-01-2020 14:53:11	PERSON_3	Open	Normal	ECE
5	06-01-2020 14:53:08	PERSON_3	Open	Normal	ECE
6	06-01-2020 14:53:05	PERSON_3	Open	Normal	ECE
7	06-01-2020 14:53:02	PERSON_3	Open	Normal	ECE
8	06-01-2020 14:53:00	PERSON_3	Open	Normal	ECE
9	06-01-2020 14:52:58	PERSON_3	Open	Normal	ECE
10	06-01-2020 14:52:53	PERSON_3	Open	Normal	ECE
11	06-01-2020 14:52:50	PERSON_3	Open	Normal	ECE
12	06-01-2020 14:52:47	PERSON_3	Open	Normal	ECE
13	06-01-2020 14:52:44	PERSON_3	Open	Normal	ECE

Figure 4. Details of copper box

3. RESULTS AND ANALYSIS

The RFID reader sends the signal to the RFID tag, put the tag near it. The tag gets it and detects and sends back the signal Reader. The reader is digital and Send it to the microcontroller. The 12 V DC motor is used to open the lock Embedded system. The output voltage of microcontroller is a very low voltage; it is not good enough to drive the motor, so the motor drive is used. Piezo Electric Plate is used to send the alert to the board whenever anybody tries to open the box. Fingerprint sensor reads the data from user and sends the fingerprint data to the controller. Controller compares the data with stored data. Wireless transceiver will provide the exact location of the object but whereas GPS will not provide the exact location but it will provide latitude and longitude of certain boundary location. In security section, If anyone scan the wrong RFID tag or wrong Fingerprint in the system (Figure 5), then system will send the alert message to user from cloud, as shown in Figure 6.



Figure 5. Hardware setup

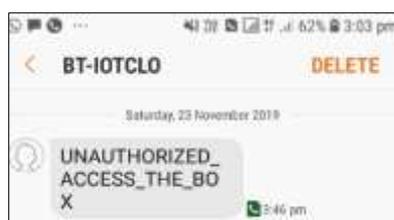


Figure 6. Message alert of unauthorized access

Advantages:

- Provide better security
- Remote Monitoring
- No need of manual Monitoring

Applications:

- This project can be extended to protect the answer sheets to send it to the university authorities.
- Used in bank lockers for security purposes.

4. CONCLUSION

NodeMCU-based prototype in electronic security for avoiding the question paper spillage is achieved using cheap design, economic power consumption, minimal yard Interfaces, high portability. Thus, the systems response is validated at all stages of the system specified in the system operation. A concise and cost effective solution to the exam sheet spillage was achieved by NodeMCU. This system can be expanded to ensure the response sheets that are sent to university officials. This proposed method not only has an application in educational field but also in various fields where disclosing of any data or information is termed to be violent. Once the design of the layout selection is completed one can close the coffer box or electronic box.

REFERENCES

- [1] Ullah, Kaleem, Munam Ali Shah, and Sijing Zhang. "Effective ways to use Internet of Things in the field of medical and smart health care." *2016 International Conference on Intelligent Systems Engineering (ICISE)*. IEEE, 2016.
- [2] Gutiérrez-Madroñal, Lorena, et al. "Test event generation for a fall-detection IoT system." *IEEE Internet of Things Journal* (2019).
- [3] Meneghello, Francesca, et al. "IoT: Internet of Threats? A Survey of Practical Security Vulnerabilities in Real IoT Devices." *IEEE Internet of Things Journal* 6.5 (2019): 8182-8201.
- [4] Noor, B.M., Shukri, A., Atoom, M.N.Y. and Mamat, R., 2019. A review of cloud oriented mobile learning platform and frameworks. *International Journal of Electrical & Computer Engineering* (2088-8708),
- [5] Nalajala, Paparao, et al. "RFID based security for exam paper leakage using electromagnetic lock system." *International journal of pure and applied Mathematics* 117.20 (2017): 845-852.
- [6] Hunt, V. Daniel, Albert Puglia, and Mike Puglia. *RFID: a guide to radio frequency identification*. John Wiley & Sons, 2007.
- [7] Ni, Lionel M., Yunhao Liu, Yiu Cho Lau, and Abhishek P. Patil. "LANDMARC: indoor location sensing using active RFID." In *Proceedings of the First IEEE International Conference on Pervasive Computing and Communications*,. IEEE, (2003): 407-415.
- [8] Jia, Xiaolin, Quanyuan Feng, Taihua Fan, and Quanshui Lei. "RFID technology and its applications in Internet of Things (IoT)." In *2012 2nd international conference on consumer electronics, communications and networks (CECNet)*, IEEE, 1282-1285; 2012.
- [9] Ouldzira, H., Mouhsen, A., Lagraini, H., Tabyaoui, A. and Chhiba, M, Smart monitoring information system based on RF 433 Mhz (SMIS). *International Journal of Electrical & Computer Engineering*. 2088-8708, 92019.
- [10] Abdulkader, Omar, Alwi M. Bamhdi, Vijey Thayananthan, Kamal Jambi, and Muasaad Alrasheedi. "A novel and secure smart parking management system (SPMS) based on integration of WSN, RFID, and IoT." In *2018 15th Learning and Technology Conference (L&T)*,. IEEE, 2018: 102-106.
- [11] Bashir, Ubaid, Kumud Ranjan Jha, Ghanshyam Mishra, Ghanshyam Singh, and Satish Kumar Sharma. "Octahedron-shaped linearly polarized antenna for multistandard services including RFID and IoT." *IEEE Transactions on Antennas and Propagation* 65. 7 (2017): 3364-3373.
- [12] Jain, Anil K., Arun Ross, and Sharath Pankanti. "Biometrics: a tool for information security." *IEEE transactions on information forensics and security* 1. 2 (2006): 125-143.
- [13] Jani, Abhishek B., Ravi Bagree, and Anil K. Roy. "Design of a low-power, low-cost ECG & EMG sensor for wearable biometric and medical application." *2017 IEEE SENSORS*. IEEE, 2017.
- [14] Ramli, Sofia Najwa, Rabiah Ahmad, Mohd Faizal Abdollah, and Eryk Dutkiewicz. "A biometric-based security for data authentication in wireless body area network (wban)." In *2013 15th International Conference on Advanced Communications Technology (ICACT)*, IEEE, (2013):998-1001.
- [15] Prabhakar, Salil, Sharath Pankanti, and Anil K. Jain. "Biometric recognition: Security and privacy concerns." *IEEE security & privacy* 1.2 (2003): 33-42.
- [16] Kukula, Eric P., Mathias J. Sutton, and Stephen J. Elliott. "The human-biometric-sensor interaction evaluation method: Biometric performance and usability measurements." *IEEE Transactions on Instrumentation and Measurement* 59.4 (2010): 784-791.
- [17] Tsuchiya, Mio, Yuta Kurashina, and Hiroaki Onoe. "Stimuli-Responsive Structural Color Hydrogel Microbeads for Wearable Biometric Sensors." *2019 20th International Conference on Solid-State Sensors, Actuators and Microsystems & Eurosensors XXXIII (TRANSDUCERS & EUROSENSORS XXXIII)*. IEEE, 2019
- [18] Jain, Anil K., Arun Ross, and Umut Uludag. "Biometric template security: Challenges and solutions." In *2005 13th European signal processing conference*,. IEEE, (2005): 1-4.

- [19] Buhan, Ileana, Jeroen Doumen, and Pieter Hartel. "Controlling leakage of biometric information using dithering." In *2008 16th European Signal Processing Conference*, IEEE, 1-5: 2008.
- [20] Imran, Mohd, Azeem Uddin, Farha Rafath, Mohammed Osman, Ayesha Sultana, and K. Srikanth. "Real Time Application of Advanced Exam Paper Leakage Detection and Alert System with Theft Protection." In *2020 4th International Conference on Trends in Electronics and Informatics (ICOEI) (48184)*,. IEEE, 421-427, 2020.
- [21] Gaikwad, Smita, Namrata Kenjale, Apurva Bagade, Bahubali Shiragapur, and U. G. Scholar. "Electronic Protection for Exam Paper Leakage." *International Journal of Engineering Science*. 3699, 2016.
- [22] Srikanth, K., Mohammed Osman, Ayesha Sultana, Mohd Imran, and Azeem Uddin. "A Review on Smart Question Paper Leakage Detection System." In *2020 Fourth International Conference on Computing Methodologies and Communication (ICCMC)*,. IEEE: 1009-1012, 2020.
- [23] Wankhade, Pravada P., and S. O. Dahad. "Real time vehicle locking and tracking system using GSM and GPS technology-an anti-theft system." *International Journal of Technology And Engineering System (IJTES)* 2.3 2011.
- [24] Jabeen, F., A novel and integrated architecture for identification and cancellation of noise from GSM signal. *International Journal of Electrical & Computer Engineering*; 2088-8708, 9, 2019.
- [25] Godavarthi, Bhavana, Paparao Nalajala, and L. R. Teja. "Wireless sensors based data acquisition system using smart mobile application." Internet of things, "*International Journal of Advanced Trends in Computer Science and Engineering* 5.1): 25-29. 2016
- [26] Nalajala, Paparao, et al. "RFID based security for exam paper leakage using electromagnetic lock system." *International journal of pure and applied Mathematics* 117.20 2017: 845-852.
- [27] Ni, Lionel M., Yunhao Liu, Yiu Cho Lau, and Abhishek P. Patil. "LANDMARC: indoor location sensing using active RFID." In *Proceedings of the First IEEE International Conference on Pervasive Computing and Communications*, IEEE, 2003: 407-415.

BIOGRAPHIES OF AUTHORS



J. AnnRoseela received the B.E (2003) and M.E (2005) in process control and Instrumentation from Annamalai University. She is currently working as Assistant Professor, ECE Department in Dr. M.G.R. Educational and Research Institute (University), Chennai. She published International and National Journals and also in Conferences. she has been participating in Ph.D Program at Dr. M.G.R. Educational and Research Institute (University) in area of IOT. Her major research interest are Internet of things, Wireless sensor networks, and Communication systems.



T. Godhavari is currently working as Professor and Head ECE Department in Dr. M.G.R. Educational and Research Institute (University), Chennai. She obtained her Ph.D. from Sathyabama University, Master's degree with honors in Communication System from Dr. M.G.R. Educational and Research Institute (University), Chennai and Bachelor's degree in Electronics and Communication Engineering from IRT Tech, Erode, affiliated to Bharathiar University, Coimbatore. She has published 20 papers in International and National Journals and 18 papers in national Conferences. Her areas of interest include Quantum Information Systems, IoT, Network Security, Communication Security, Cryptography, Wireless Communication. She has 20 years of teaching experience. She has attended 10 short term courses, attended 30 seminars, workshops, and FDPs, organized Seminar and workshops related to her area of research. She is a Life Member in ISTE and CRSI (Cryptology Research Society of India), and Member in IET.