A Role of Wireless Communication in ATM

S. Ganesh kumaran
Assistant Professor,
Department of EEE,
Arunai Engineering College,
Tiruvannamalai,
Tamil Nadu, India.
ganeshphd4u@gmail.com

Dr. S. Singaravelu
Professor,
Department of EEE,
Annamalai University,
Annamalai Nagar,
Tamil Nadu, India.

C. Priya
PG Scholar,
Department of EEE,
Arunai Engineering College,
Tiruvannamalai,
Tamil Nadu, India.
Priyaece1092@gmail.com

***Abstract*— An automated or automatic teller machine (ATM) also known as the automated banking machine. In this paper deals about how wireless industry's creates tremendous growth and its impact in normal human banking activities. Nowadays more people use ATM without going to bank. More technologies involved in ATM with respect to wireless communication. The ATM was developed to facilitate cash availability to consumer (public) at any time. The main objective of ATM is to provide availability of cash very fast. The customers are very conscious about their funds and they afraid to use the machines.**

***Index Terms*— ATM, Biometric System, Communication, Bluetooth, Zigbee, WiFi.**

I. INTRODUCTION

Communication is the exchange and flow of information and ideas from one person to another. It requires a sender, a message, a medium and a recipient. Sender and receiver exchanges the message through medium is called communication. [1] The communication process is complete once the receiver understands the senders message.

Communicating with others have three steps:
Message: First, information exists from the sender.
Encoding : Next, a message is sent to a receiver in encrypted format (symbols or code).
Decoding : Finally, the receiver decrypted the codes or symbols to original message.

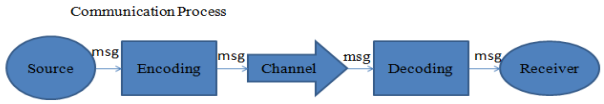


Fig. 1 Communication

There are two types of communication

- Wired communication[2]
- Wireless communication[3]

A. Wired communication

Wired communication is the transmission of data through wires. Example: telephone networks, cable television or internet access. It uses serial port communication, mainline communication and ethernet communication. It make use of underground communication cables, electronic signal amplifiers inserted into connecting cables at specified points and terminal apparatus of various types, depending on the type of wired communication. [2]

Fig. 2 wired communication

Disadvantages

i)cost:

In long distance communication more wires are needs. So cost is high and use complex structure.

ii)Equipment portability:

wired technology is not portable. The units must be plugged into power outlets and network ports inorder to function. So installing new electrical outlets and reconfiguration network port structures.

iii)Space:

wired technology products such a desktop computers take up more space.

iv)Mobility:

Users are restricted in their work location when using wired products.

v)Safety:

physical requirements of a wired technology products present some opportunities for damage. Cable can be damaged, it cause tripping hazards.

vi)Power:

Wired units must have power to operate. Sometimes power cut is happen the work will be stop.

So we are going to wireless communication.

B. Wireless communication

Wireless communication involves the transmission of information over a distance without help of wires, cables or any other forms of electrical conductors. [4] Transmitting distance is not a issue in wireless communication. Television remote control is the example of few meter wireless communication.[5] Radio communication is the thousands of km wireless communication refer to Rose Mary et al.

C. History of Wireless Communication

Momah Ego Nkiruka et al said that the first wireless networks transmitted information over line of sight distance. These early communication network replaced by telegraph network invented by Samuel morse in 1838 and later by the telephone. In 1895 after the telephone was invented , the radio communication was born. Radio was invented by Marconi, it transmits the information over 18 miles away with better quality and less power. [6] Marconi was Grandfather of wireless communication. Early radio systems transmitted analog signals. Today most radio systems transmit digital signals. Later type of radio is called a packet radio and is characterized by bursty transmission.

Advantages of Wireless

- To convey the information quickly at any distance.
- Access the internet anywhere and anytime without having cables or wires.
- It is cheaper to install and maintain.

Fig. 3 wireless communication

D. ATM

ATM is stands for Automatic Teller Machine. It is an electronic banking outlet, which allows customers to complete basic transactions without the aid of a branch representation or tellers. It was invented by John shepherd-barron Donald Wetzel.ATM is used for users withdraw the amount at any time and any place without go to the bank. [7]

There are two types of ATM

- Basic ATM
- Complex ATM

Basic ATM only allow the customer to withdraw money and receive report of the account's balance. But complex ATM will allow deposits credit card payments and report of the account's balance. To access the complex ATM only member of the bank are allowed.

ATM card is a plastic card that contains a unique card number and security information such as expiration date. It has a 4 digit PIN number for authentication.ATM card is inserted into ATM machine enter the Personal Identification Number(PIN) number, machine identifies the customer and complete the transaction. Central Processing Unit(CPU), magnetic card, crypto-processor, display device, function key buttons, record printer, vault these devices used in ATM centre. We can use ATM for train tickets, movie tickets, shopping mall, hospital, school. Most ATMs are connected to inter bank network enabling people to withdraw and deposit money from machines not belonging to the bank where they have their account. This is a convenience, especially for people who are travelling: it is possible to make withdrawals in places where one's bank has no branches, and even to withdraw local currency in a foreign country, often at a better exchange rate than would be available by changing cash. ATMs rely on Authorization of a Transaction by the card issuer or other authorizing institution via the communications network refer to Yingxu Wang et al.

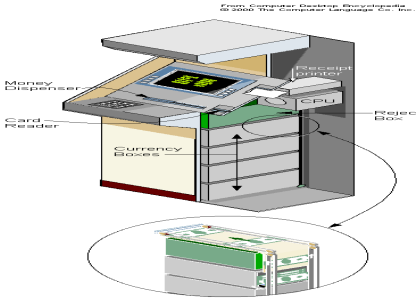


Fig. 4 ATM machine [8]

Using wireless in ATM following reasons:

- Cost saving
- Reliability
- Secure and fast transmission
- Simple installation

II. Wireless Communication With Respect To Range And Speed

In many ways the data transmission in wireless communication with respect to range and speed.

A. *Infrared Ray(IR)*

B. Jeffrey et al said that IR is Invisible Radiant energy.IR waves used to control the electrical applications through remote. It also used in industrial, scientific and medical application. [10] IR rays observe the changing blood flow in the skin and detect overheating of electrical appliances.

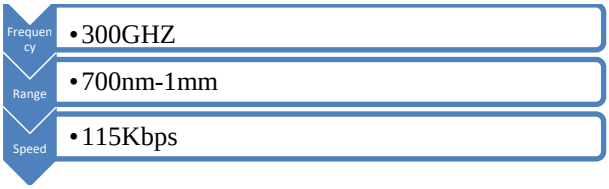


Fig. 5 infrared wireless communication

Disadvantages

- Invisible
- Line of sight

B. Ultra Wide Band(UWB)

It is used in short range and high speed communication.IEEE802.15.3a standard used in UWB. It is a wireless cable replacement of high speed serial bus such as USB. It is used multimedia applications such as audio and video delivery in home networking. [11]

Frequency	•3.1-10.6GHZ
Range	•10m
Speed	•110mbps

C. Bluetooth

Bluetooth is a wireless technology for exchanging data over short distances. It is also known as IEEE802.15.1 standard and invented by 1994 Telecom Vendor Ericcson. [12] It using UHF radio waves in the ISM band from 2.4GHZ.Frequency divided into 79 channels each has 1MHZ.Bluetooth uses personal area network. It was originally alternative to Rs-232 data cables. Connect several devices ,it overcomes synchronization problems. It also replace the cables for computer peripherals such as mice, keyboard, joystick and printer. It uses radio technology called frequency hopping spread spectrum. Structure of Bluetooth has picconet and scatternet. Picconet has one master and seven slaves it communicate one to one or one to many. collection of picconet is scatternet, one slave act as master it control more slaves. [15]

Frequency	•2.4GHZ
Range	•10m
Speed	•1Mbps

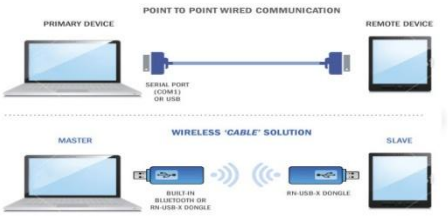


Fig. 6 Bluetooth communication

Advantages

- It is cheap and easy to install
- It connect different devices

Disadvantages

- Use short distance only
- Viruses transfer another device use of Bluetooth refer to B.A. Miller et al.
- It can connect only two devices

D. WiFi

WiFi stands for Wireless Fidelity include IEEE802.11a standard. It allows electronic devices to exchange data or connect to the internet .It uses LAN networks. Many devices can use WiFi for example personal computers, videogame consoles, smart phones.[14]

Infrastructure has two service sets

- Basic Service Set(BSS)
- Independent Basic Service Set(IBSS)

IBSS is a set of station that communicate directly with each other without AP(Access Point).BSS has a AP, stations connected through that. One mobile terminal is connected to other mobile terminal through AP. [16] WiFi uses DSSS(Direct Sequence Spread Spectrum) technique refer to Daniel Cams-Mus et al.

Frequency	•2.4GHZ,5GHZ
Range	•100m
Speed	•54mbps

Fig. 7 WiFi communication

Advantages

- It travel the signal over long distance.

Disadvantages

- Piggybacking refers to access a wireless internet connection by bringing one's own computer with in the range of another's wireless connection without subscriber knowledge.

E. Zigbee

Zigbee is used for Personal Area Network(PAN) and based on IEEE 802.15.4 standard. It has low power refer to Yask Patel et al, battery life time high. It used mesh networks with no centralized control, it is able to reach all of devices. [19] It requires low data rate applications and secure networking. Zigbee transmits the signal from input device or sensor. Applications include wireless switch, electrical meters with in home displays and monitoring and control applications is used PAN networks. [21]

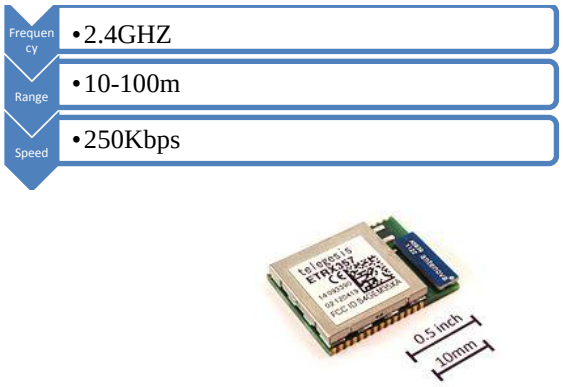


Fig. 8 Zigbee communication

Advantages

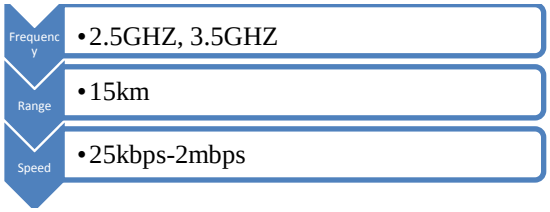
- Low power[20]
- Long battery lifetime
- Security for transaction

Disadvantages

- Short range communication

F. WIMAX

Shagun Batra et al said that WIMAX acronym meaning World Wide Interoperability for Microwave Access. It is an IP based wireless broadband access technology utilizing IEEE 802.16e standard. [17] It will provide broadband connectivity anywhere, anytime for any device and on any network. It used for online gaming, streaming video and video conferencing. It is the next generation of wireless broadband instead of WiFi. It is most suitable for home users, office. Who want to use internet want to only one connection use this facility. customers have no phone line connection at the location also use WIMAX. It is used in 4G technology. [18]



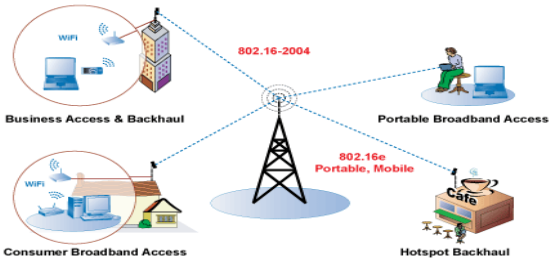


Fig. 9 WIMAX communication

Advantages

- High speed
- More security
- Set up and activation is easy

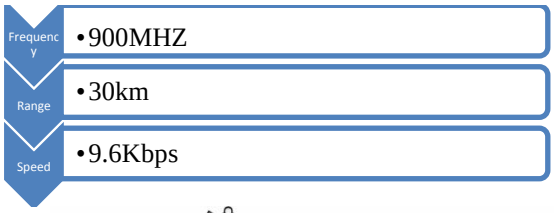
Disadvantages

- High cost
- Power consuming
- Data rate low

G. GSM

GSM stands for Global System for Mobile Communication is an open, digital cellular technology used for transmitting voice and data services.GSM developed by European Telecommunication Standard. It is a cellular network which connects number of cell phones in a network. Users transmit the data in cellular network. It uses 30km Range, 9.6kbps Speed and 900MHZ Frequency range. [22]

User call the one GSM number, first Mobile Switching Centre(MSC) receive call request and checks the authorized person or not. If it is analyze the number and initiates a call setup with Public Switched Telephone Network(PSTN) and these call is established to corresponding user. So users placed anywhere to contact other's by using GSM. [23] In emergency periods the GSM is very important.



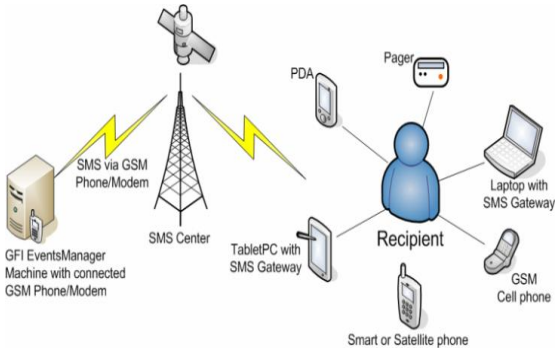


Fig. 10 GSM communication

H. Sensors

Sensor is a wireless technology is used to monitor the environmental conditions such as temperature, pressure, sound and etc. Sensors convert a physical parameter to an electric output. Sensors measures small changes which is happened in the system with accuracy in measurement. It sense all metals. The exact point at which a target will be detected by the type of metal, its size and surface area. [24] It also used in smart grid technology to monitor and control the equipment conditions refer to S. Welsby et al. Any equipment has a fault, that is automatically detected by sensors. [27] Infrared sensors also used in counting the humans in many places. In airport and temples sensors used to check the luggages. In ATM centers they also use sensors for security purpose. [25]

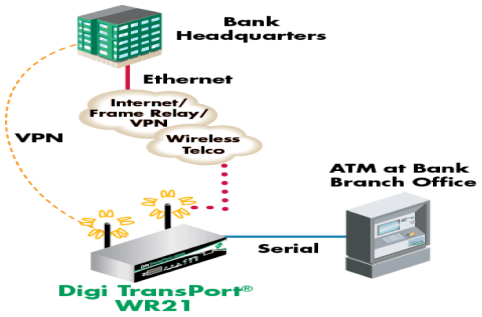


Fig. 11 sensor

I. Scanner

Scanner is a device that scans images, printed text, handwriting or an object and converts it to a digital image. These scanners used in offices where the document is placed on a glass window for scanning. 3D scanners also used for industrial design. Modern scanners use a Charge Coupled Device(CCD) or a Contact Image Sensor(CIS). M. Aijaykumar et al denoted that in ATM centre they also use the scanner for scanning the retina, image and fingerprint for more security. [28] Colour scanners typically read RGB(Red, Green, Blue) data from the array. Colour depth varies depending on the scanning array characteristics but is usually S have atleast 24 bits.


Fig. 12 scanner

COMPARISON FOR WIRELESS DEVICES RANGE, SPEED AND FREQUENCY[13]

Type	Range	Speed	Frequency
Infrared ray	700nm-1mm	115kbps	300GHZ
Ultra wide band	10m	110mbps	3.1-10.6GHZ
Bluetooth	10m	1mbps	2.4GHZ
WiFi	100m	54mbps	2.4GHZ, 5GHZ
Zigbee	10-100m	250kbps	2.4GHZ
WIMAX	15km	25kbps-2mbps	2.5GHZ, 3.5GHZ
GSM	30km	9.6kbps	900MHZ

III. TECHNOLOGIES INVOLVED IN ATM

ATM has more technologies for security. [9]

A. Encryption technology

ATM transactions are used in DES(Data Encryption Standard) algorithm for more security. [31] Because there are also many "Phantom withdrawals" from ATM'S. [34] Criminals used fake machines, or fake keypads or card readers to access ATM machines. [29] These fake machines are used to record the customers PIN numbers and account details. So Ross Anderson implementing the encryption technology the original information is converted into coded format. These coded information only understand by receiver(ATM machine) not by criminals.DES algorithm used 56 bit key encrypt the original data refer to Shun Wong et al. So it is more secure. [30]

Disadvantages

- Criminals apply the assumption method to decrypt and find PIN number.

B. SMS technology

SMS stands for Short Message Service. If any one uses the ATM card for withdraw money the information and account balance and time is send to user's mobile for security. The ATM card is missing or theft by third person, if he/she withdraw the amount means that information is send to user's mobile. So we can identify the criminals very fast and these type of SMS technology is implemented by using GSM wireless technology. [26]

Disadvantages

- User's only know the third person access their account. Withdrawing of money can't be stopped.

C. One Time Password technology

To secure the bank transactions from unauthorized person's we use two factor authentication. Two factor authentication combines the use of PIN and One Time Password(OTP). [32] In two factor authentication the customer enter the card and PIN, if the PIN is validated the bank computer generates and sends an OTP to customer's mobile via SMS. The customer enter the received OTP, if it is valid the customer is authenticated and transaction is permitted refer to U. Onwudebelu et al. In these method also GSM wireless technology is used . [33]

Disadvantages

- Customer should use mobiles.
- If customer forgot to take his mobile they can't make transaction via ATM.

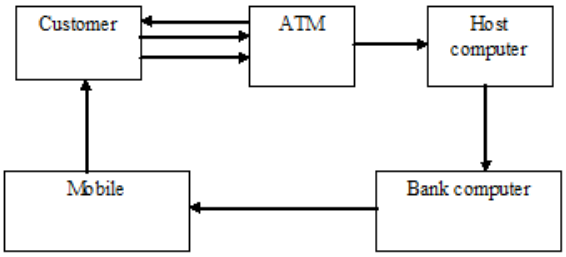


Fig. 13 OTP technology

D. Biometrics technology in ATM

Navneet Sharma et al said that to protect the customer ATM card, there is a single PIN(password) but now a day it is no safe. There are more fraud and techniques by which hackers hack the card and PIN number. So protect that transaction using biometric user authentications. [35] Biometric is security for both customers and bankers. Customers insert the card and PIN, then access is grant to another security is biometric process. Using valid PIN and biometric process customers can access the ATM transaction process such as deposits, transfer, balance enquiries, cash withdrawl by using biometric technique. Customer can save the money, if card is taken by the third party they can't make the transaction without biometric process. [40]

Some of the biometric techniques are :

- Finger print scanning
- Iris scanning
- Face recognition

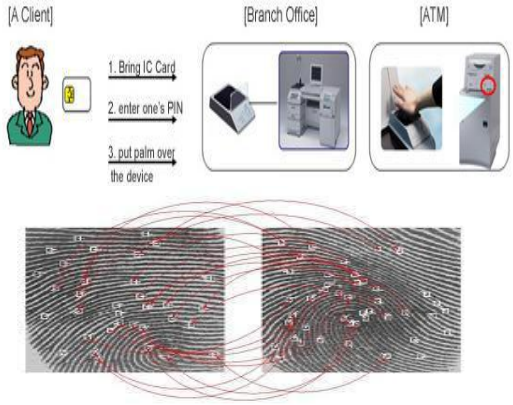


Fig 14: fingerprint scanning[36]

Customer fingerprint stored in bank database at encrypted format. Scanner is available in ATM centre, it scans the users fingerprint. [37] Customer first insert the card and PIN, if it is correct, next scanner scan the fingerprint pattern its compare to stored pattern in the database. Next scans the iris and face[38], it also compared to stored pattern in the database. If it is matched customer can access the transaction, otherwise no access will be provided. So unauthorized persons are not able to hack the account. In this biometric system technology is wireless scanner used for scanning iris[39], face and fingerprint.

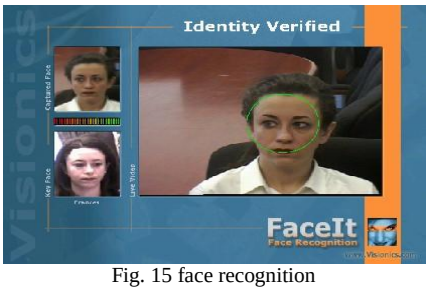


Fig. 15 face recognition

Disadvantages

No biometric has yet been developed that is perfectly reliable or secure. For example, finger prints and palm prints are usually frayed; voice, signatures, hand shapes and iris images are easily forged; face recognition can be made difficult by occlusions. Biometrics, such as fingerprints and iris and face recognition can be are susceptible to spoofing attacks, that is, the biometric identifiers can be copied and used to create Artifacts that can deceive many currently available biometric devices .

E. Finger-vein Technology

The finger-vein is a promising biometric pattern for personal identification in terms of it security and convenience . Compared with other biometric traits, the finger-vein has the following advantages: (1) the vein is hidden inside the body and is mostly invisible to human eyes, so it is difficult to forge or steal. (2) The non-invasive and contactless capture of finger-veins ensures both convenience and hygiene for the user, and is thus more acceptable. The finger-vein pattern can only be taken from a live body. [41]

Finger-vein recognition algorithm contains two stages: the enrollment stage and the verification stage. Both stages start with finger-vein image pre-processing, which includes detection of the Region of Interest (ROI), image segmentation, alignment, and enhancement refer to P. Harsha et al.

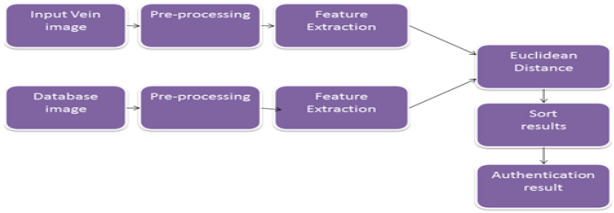


Fig. 16 The flow-chart of the finger vein recognition algorithm

IV. CONCLUSION

In this paper, we discussed about more wireless devices used in ATMs. Nowadays ATMs are used in user friendly manner and more technologies involved in ATM. Using wireless communication in ATM, it provide some advantages such as less cost, simple installation, reliability and fast transaction. But disadvantage is less security. So we have to involve in providing more technologies to improve the security system of ATM for our customers to have safe and secure ATM using in future.

REFERENCES

[1] Donald Clark, "Communication and Leadership" ,4 DECEMBER2013.

[2] Legal information institute, 14 JUNE 2014.

[3] Rose Mary, "Wireless communication and Types".

[4] David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication" ,13 AUG 2004.

[5] Andrea Goldsmith, "Wireless Communication" ,2005.

[6] Momah Ego Nkiruka, "History of Wireless Technology".

[7] Cambridge Dictionary Automatic Teller Machine.

[8] Yingxu Wang, Yanan Zhang, Philip C-Y.Sheu, Xuhui Li, Hong Guo, "Design Model of an Automatic Teller Machine" ,2010.

[9] "Diebold ATM Fraud" Retrieved 11 NOV 2011.

[10] B. Jeffrey, Carruthers, "Wireless Infrared Communications" ,2002.

[11] David Barras, Frank Ellinger and Heinz Jackel, "A Comparison Between Ultra Wideband and Narrowband Transceivers".

[12] R. Shorey, B.A. Miller, "The Bluetooth Technology:Merits and Limitations" ,IEEE Conference, 17 DEC 2000.

[13] Ji-Shyan Lee, Yu-Wei Su and Chung-Chou Shen, "A Comparative Study of Wireless Protocols Bluetooth, UWB, Zigbee and WiFi" ,2007.

[14] Matthew B. Shoemake, "WiFi(IEEE 802.11b) and Bluetooth" ,FEB 2001.

[15] Chatschik Bisdikian, "An Overview of the Bluetooth Wireless Technology" ,IEEE Magazine, DEC 2001.

[16] Daniel Cams-Mus, Andres Garcia-Saavedra and Pablo Seuano, "Device to Device Communications with WiFi Direct: Overview and Experimentation" ,2012.

[17] Jha Rakesh, A. Wankhede Vishal Upena Dalal, " A Survey of Mobile WIMAX IEEE 802.16 Standard" ,International Journal, Vol-8, No-1, APRIL 2010.

[18] Shantanu Pathak and Shagun Batra, "Next Generation 4G WIMAX Networks IEEE 802.16 Standard" ,2012.

[19] S.S Riaz Ahamed, "The Role of Zigbee Technology in Future Data Communication System" ,2009

[20] Nisha Ashok Somani and Yask Patel, "Zigbee: A Low Power Wireless Technology for Industrial Applications" ,International Journal, Vol-2, No-3, MAY 2012.

[21] Soyoung Hwang and Donghuiyu, "Remote Monitoring and Controlling System Based on Zigbee Networks" ,International Journal, Vol-6, No-3, JULY 2012.

[22] Moe Rahnema, "Overview of the GSM System and Protocol Architecture" ,IEEE Magazine, APRIL 1993.

[23] Jian Cai, J. David, "General Packet Radio Service in GSM" ,IEEE Magazine, 1997.

[24] M. Kretschmar and S. Welsby, "Capacitive and Inductive sensor's in Technology Handbook" ,2005.

[25] M. Aijaykumar, N. Bharathkumar, "Anti-Theft ATM Machine using Vibration Detection Sensors" ,International Journal, Vol-3, Issue-12, DEC 2013.

[26] V. Padmapriya, S. Prakasam, "Enhancing ATM Security using Fingerprint and GSM Technology" ,Vol-80, No-16, OCT 2013.

[27] Hans-Rolf Trankler, Olfa Kanoun, "Recent Advances in Sensor Technology" ,IEEE Conference, 21 MAY 2001.

[28] Abhijeet S. Kale, Sunpreet Kaur Nanda, "A Review Paper on Design of Highly Secured Automatic Teller Machine System by using Aadhaar Card & Fingerprint" ,Vol-2, Issue-1, JAN 2014.

[29] Chang Soon Kim, Mun-Kyu Lee, "Secure and User Friendly PIN Entry Method" ,IEEE Conference, pp.203-204, 2010.

[30] H. Lertold, V. Payer, R. Posch, "A Hardware Independent Encryption Model for ATM Devices" ,IEEE Conference, pp.205-211, 1998.

[31] Shun Wong, "The Encryption Technology of ATM Networks" ,2 APRIL 2005.

[32] Mary Agoyi, Devrim Seral, "The Use of SMS Encrypted Message to Secure Automatic Teller Machine" ,2010.

[33] U. Onwudebelu, O. Longe, S. Fasola, N.C. Obi, O.B. Alaba, "Real time SMS based hashing scheme for securing financial transactions on ATM systems " ,IEEE Conference, pp.1-6, 2010.

[34] Yang Xiao, Chung-ChinLi, Ming Lei, S.V. Urbsky, "Differential Virtual Passwords, Secret Little Functions, and Codebooks for Protecting Users from Password Theft" ,IEEE Journals, Vol-8, Issue-2, pp.406-416, 2014.

[35] Navneet Sharma, Vijay Singhrathore, "Role of Biometric Technology Over Advanced Security and Protection in Auto Teller Machine Transaction" ,Vol-1,Issue-6,AUGUST 2012.

[36] H. Lasisi, A.A. Ajisafe, "Development of Stripe Biometric Based Fingerprint Authentications Systems in Automated Teller Machine", IEEE Conference, pp.72-175, 2012.

[37] Vaibhav R. Pandit, Kirti A. Joshi, Narendra G. Bawane, "ATM Terminal Security using Fingerprint Recognition" ,2013.

[38] H. Sako, T. Miyatake, "Image Recognition Technologies towards Advanced Automated Teller Machine" , IEEE Conference, Vol-3, pp.282-285, 2004.

[39] N.G. Richard Yew Fatt, Tay, Yong Haur, Kai Ming Mok, "A Review of Iris Recognition Algorithms" ,IEEE Symposium, Vol-2, pp.1-7, 2008.

[40] L. A. Mohammed, "Use of biometrics to tackle ATM fraud," vol. 1, pp. 331–335, 2011.

[41] P. Harsha, R. Kanimozhi, C. Subashini, "A Real Time Embedded System of Vein Used for Authentication in Teller Machine" , Vol- 3, Issue 1, JAN 2013.