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Demonstrator of a Fingerprint Recognition Algorithm Into a Low Power Soc Board using Under ATM Application

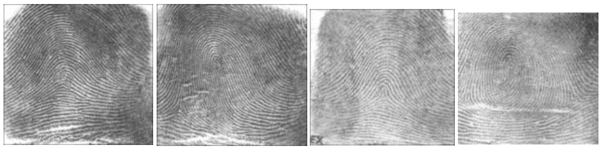
N.Kalaipriya[1], E.Padmapriya[2], DhivyaPriya E.L[3]
BE Scholar[1, 2], Assistant Professor[3]
Department of ECE
KSR Institute for Engineering and Technology, Tiruchengode, India

Abstract:
In our proposed method, of this system is to develop an system, which is used for ATM security application. In these systems, bankers will collect the customer fingerprints and mobile number while opening the accounts then customer only access ATM machine. Then the working of these ATM machine is when customer place finger on the fingerprint .it is automatically generated with every time as different 3 digit code through the GSM messages from the user. When the GSM is connected to the microcontroller. The code received by the customer should be entered by pressing the keys on the screen. After entering it checks whether it is a valid one or not and allows the customer further access.

Index Terms: Fingerprint recognition, Raspberry pi.

1. INTRODUCTION

Biometric authentication is a potential candidate to replace password based authentication system. Automated Teller Machine is a mechanical device that has its roots embedded in the accounts and records of banking institutions. Usage of biometrics offers several advantages over traditional and existing methods. The present scenario in ATM operates with digital locks and keys. This system is found to be insecure because of the identification of theft of cards and the difficulty in handling the cards. So as to overcome these difficulties, a secured system is designed with the help of RASPBERRY Pi. To initiate the process, the fingerprint of the person is entered and it is compared with database images stored. The database images are compared with the input fingerprint template. To provide an extended support to the user an access to the guardian is also been provided. When the guardian tries to access the user account, with his/her fingerprint, then an emergency alert message will be sent to the user. The further access will be proceeded only after acceptance message from the user. The acceptance message will be designed as a 4 digits security code. This support for the better secured account access. The proposed system also supports to the access of multiple banks with a single fingerprint entry. Fingerprint recognition is very popular in biometric system as fingerprint remains unchanged throughout the life of a person. Fingerprints are unique in nature and difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. Fingerprints of one person are different from another person's fingerprints. A fingerprint consists of ridges and valleys. They together provide friction for the skin. So system represents to a pixel. Fingerprint Recognition includes taking a fingerprint image of a person and records its features like arches, whorls, and loops along with the outlines of edges, minutiae and furrows. Matching of the Fingerprint can be attained in three ways, such as minutiae, correlation and ridge. Minutiae based fingerprint matching stores a plane includes a set of points and the set of points are corresponding in the template and the i/p minutiae. Correlation based fingerprint matching overlays two fingerprint images and association between equivalent pixels is calculated. Ridge feature based fingerprint matching is an innovative method that captures ridges, as minutiae based fingerprint capturing of the fingerprint images is difficult in low quality.



Arch Loop (Right Loop) Arch (Tented Arch) Whorl

Figure.1. Characteristics of Fingerprint

The three basic patterns of fingerprint ridges are the arch, loop, and whorl:
Arch: The ridges enter from one side of the finger, rise in the center forming an arc, and then exit the other side of the finger.
Loop: The ridges enter from one side of a finger, form a curve, and then exit on that same side. Whorl: Ridges form circularly around a central point on the finger.
The Main aim of the project is create a GUI (graphical user interface) using Python language that process the cash deposit and withdrawal from the bank account with the help of Biometric access.

2. LITERATURE SURVEY

Many interesting proposals have been done in the area of fingerprint recognition for people with different module. Most of the existing systems are built in microcontroller. Algorithms used in earlier systems lack efficiency and accuracy. [1] ATM Transaction Using Biometric Fingerprint Technology: presents a prototype for extracting text for microcontroller. In these systems, Bankers will collect the customer finger prints and mobile number while opening the accounts then customer only access ATM machine. The working of these ATM machine is when customer place finger on the finger print module when it access automatically generates every time different 4-digit code as a message to the mobile of the authorized customer through GSM modem connected to the microcontroller. The code received by the customer should be entered by pressing the keys on the screen. After entering it checks whether it is a valid one or not and allows the customer further access.Using ATM terminal, the mobile number and fingerprint of the customer is required. If all the recognition is right, the system would send password to the Account holder and he will enter the same password in on the keypad for accessing the ATM Terminal. If Authentication Failure then it send the alert message to the Account holder and Bank. [2] Fingerprint Based Biometric ATM Authentication System, a microcontroller based prototype of ATM cashbox access system using fingerprint sensor module is implemented. An 8-bit PIC16F877A microcontroller developed by Microchip Technology is used in the system. The necessary software is written in Embedded ‘C’ and the system is tested. Finger-scan technology is the most commonly deployed biometric technology, used in a broad range of physical access and logical access applications. All fingerprints have unique characteristics and patterns. A normal fingerprint pattern is made up of lines and spaces. These lines are called ridges while the spaces between the ridges are called valleys. It is through the pattern of these ridges and valleys that a unique fingerprint is matched for verification and authorization. These unique fingerprint traits are termed “minutiae” and comparisons are made based on these traits. On average, a typical live scan produces 40 “minutiae”. The Federal Bureau of Investigation (FBI) has reported that no more than 8 common minutiae can be shared by two individuals. The first challenge facing a finger-scanning system is to acquire high-quality image of a fingerprint. The standard for forensic-quality fingerprinting is images of 500 dots per inch (DPI). Image acquisition can be a major challenge for finger-scan developers, since the quality of print differs from person to person and from finger to finger. [3] RBI 3X-Fingerprint Based ATM Machine, This system is to develop a system that will increase the ATM security. However, despite the numerous advantages of ATM system, ATM fraud has recently become more widespread. In this paper, we provide an overview of the possible fraudulent activities that may be perpetrated against ATMs and investigates recommended approaches to prevent these types of frauds. Biometrics technology is rapidly progressing and offers attractive opportunities. In recent years, biometric authentication has grown in popularity as a means of personal identification in ATM authentication systems. An 8-bit ATmega16 microcontroller developed by Microchip Technology is used in the system. The necessary software is written in AVR studio programmer and the system is tested. Passing of information faces massive problems due to various types of attacks to the communication link. Many security algorithms are available to protect information from being hacked. The biometric authentication process adds a new dimension of security for any person sensitive to authentication. [4] Fingerprint based ATM System, The vital objective of our system is to make ATM transaction more secure and user friendly. This system replaces traditional ATM cards with fingerprint. Therefore, there is no need to carry ATM cards to perform transactions. The money transaction can be made more secure without worrying about the card to be lost. In our system we are using embedded system with biometrics i.e. r305 sensor and UART microcontroller. The Fingerprint and the user_id of all users are stored in the database. Fingerprints are used to identify whether the Person is genuine. A Fingerprint scanner is used to acquire the fingerprint of the individual, after which the system requests for the PIN (Personal Identification Number). The user gets three chances to get him authenticated. If the fingerprints do not match further authentication will be needed. After the verification with the data stored in the system database, the user is allowed to make transactions. Fingerprint verification of ATM (Automatic Teller Machine) security system using the biometric with hybridization. The fingerprint trait is chosen, because of its characteristics like availability, reliability and high accuracy. The fingerprint based biometric system can be implemented easily to secure the ATM machine.

3.FLOW CHART

Our design with multiple banks accessing in the system. It gives the fingerprint for the additional security to the ATM machine, then the system gives the guardian access of user account with the help of ubidots message to the user.

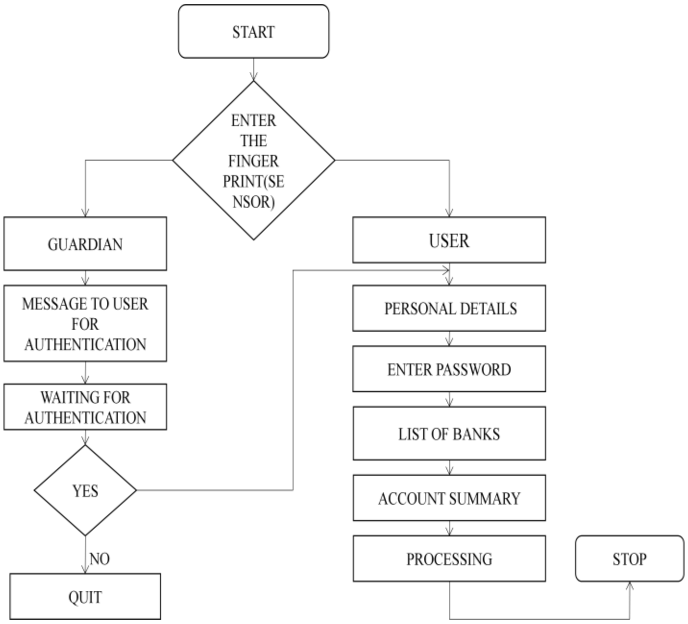


Figure.2. Flowchart

If user accept the message or if the user allows the guardian can access the bank process of that withdrawn or deposit or any other process in the users account. Multiple of bank can be access in single ATM machine and also both deposit and withdraw machine in the ATM.

4.PROPOSED SYSTEM

In our proposed system, we can access to multiple banks. Since, fingerprint is used, the missing of cards and hacking and misusing of money is prevented. In addition is this we can also give authentication of our guardian in order access the money using their fingerprint and password then it gives intimation to the user. Through GSM message with that link of Ubidots login of user. If user give yes, the guardian can debited amount from the user's account.

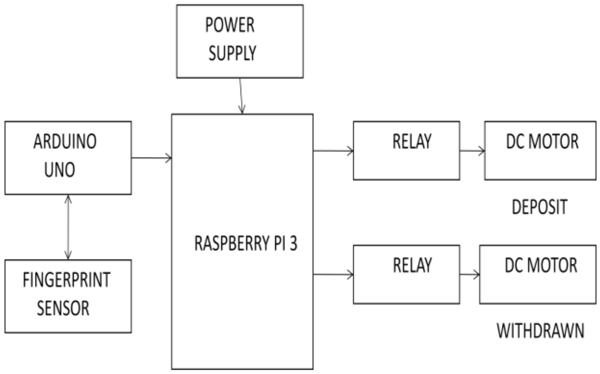


Figure.3. Block Diagram of proposed system

Working of proposed Design:

Step 1: Raspberry pi processor is used for this proposed method. 5v power supply is given to the raspberry pi.

Step 2: Fingerprint sensor is interfaced with Arduino Uno

Step 3: DC Motor is used as deposit and withdrawn machine in the project, the relay is connected between the raspberry pi and dc motors.

Step 4: Fingerprint sensor receiver should not connect directly with the transmitter of raspberry pi, so we used voltage divider to receiver the data from raspberry pi.

Step 5: If the Fingerprint is matched with the database, it gives the bank details of the customer of multiple banks.

Step 6: If the customer can't able to access the bank due to illness guardian can access the account with the help of customer, by using GSM message and fingerprint of guardian.

A. Hardware implementation:

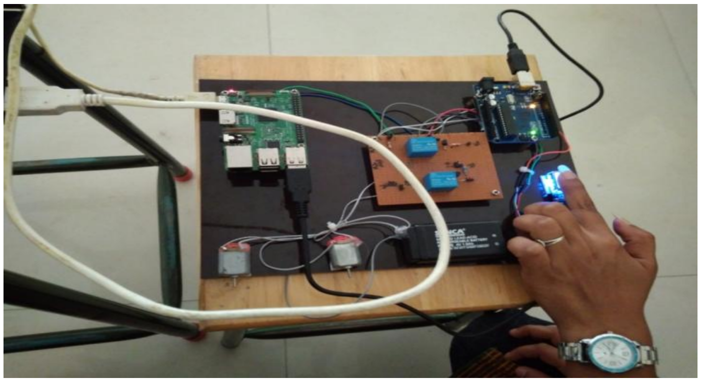


Figure.4. Fingerprint sensor interfaced with Raspberry pi processor.

I. Raspberry pi 3:

The raspberry pi is a series of small single-board computers developed in the United Kingdom by the raspberry pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics.

II. Arduino Uno:

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. To interface fingerprint sensor and raspberry pi.

III. Fingerprint sensor:

A fingerprint sensor (GT511C3) is an electronic device used to capture a digital image of the fingerprint pattern. The captured image is called a live scan. This live scan is digitally processed to create a biometric. Fingerprint processing includes two parts: fingerprint enrollment and fingerprint matching (the matching can be 1:1or 1:N). When enrolling, user needs to enter the finger two times. The system will process the two time finger images, generate a template of the finger based on processing results and store the template. When matching, user enters the finger through optical sensor and system will generate a template of the finger and compare it with templates of the finger library. For 1:1 matching, system will compare the live finger with specific template designated in the module; for 1:N matching, or searching, system will search the whole finger library for the matching finger. In both circumstances, system will return the matching result, success or failure.

IV. Fingerprint Library :

System sets as idea certain space within flash for fingerprint template storage, that's the fingerprint library. The contents of the library remain at power off. The capacity of the library changes with the capacity of flash, system will recognize the latter automatically. Fingerprint template's storage in flash is in sequential order. Assume the fingerprint capacity N, then the serial number of template in library is 0,1,2,3…N. The user can only access library by template number.

V.DC Motor Driver :

The L293D is a quadruple high-current half-H driver. It is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. It is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

Fig 4: Block diagram of fingerprint recognition

Fingerprint: A fingerprint is the feature pattern of a finger Binarization: A Process to convert gray scale image into binary image by fixing the threshold value.

Fingerprint: A fingerprint is the feature pattern of a finger Binarization: A Process to convert gray scale image into binary image by fixing the threshold value.

Block Filter: A process to reduce the thickness of all ridge lines to a single pixel width to extract minutiae points effectively.

Minutiae Extractruction: The minutiae location derived after minutiae extraction. Minutiae Matching: To compare the input fingerprint data with the template data Minutiae matching is used. Matching Score: it is used to calculate the matching score between the input and template data.

VI. Ubuntu:

Ubuntu is an open source operating system for computers. It is a Linux distribution based on the Debian architecture. It is usually run on personal computers, and is also popular on network servers, usually running the Ubuntu Server variant, with enterprise-class features. Ubuntu runs on the most popular architectures, including Intel, AMD, and ARM-based machines. Ubuntu is also available for tablets and Smartphone's, with the Ubuntu touch edition. Ubuntu is the most popular operating system running in hosted environments, so-called "clouds", as it is the most popular server distribution. Linux is a family of free and open-source software operating systems built around the Linux kernel. Typically, Linux is packaged in a form known as a Linux distribution for both desktop and server use. The Linux kernel is a widely ported operating system kernel, available for devices ranging from mobile phones to supercomputers; it runs on a highly diverse range of computer architectures, including the hand-held ARM-based iPAQ and the IBM mainframes System z9 or System z10. Most distributions also include support for python language. Linux distributions select components from a pool of free and open-source software with which they construct a GUI implementing some more or less strict design guide. Python provides various options for developing graphical user interfaces (GUIs).

VII. Tkinter

Tkinter is the Python interface to the Tk GUI toolkit shipped with Python. Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit. Creating a GUI application using Tkinter is an easy task. All you need to do is perform the following steps −

- Import the *Tkinter* module.
- Create the GUI application main window.
- Add one or more of the above-mentioned widgets to the GUI application.
- Enter the main event loop to take action against each event triggered by the user.

VIII. Software design

This system of software is implemented by the steps as follows: first of all, the Linux kernel and the File system are loaded into the main chip. The next, the system is initialized to implement specific task, such as checking ATM system, Fingerprint, GSM communication and so on, and then each module reset for ready to run commands. Before using ATM terminal, the mobile number, fingerprint of the customer, bank account details and guardian fingerprint and there details is required.

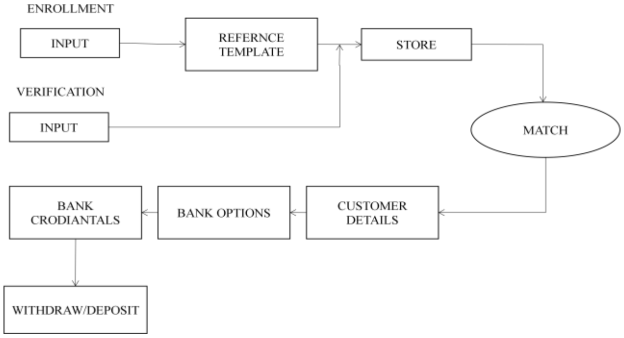


Figure.5. Software design flow block diagram

Algorithm for fingerprint recognition:

Input: Fingerprint image.

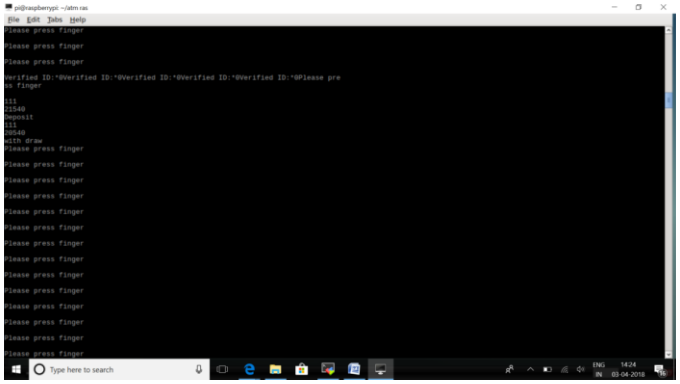
Output: Verified fingerprint image with matching score.

1. Fingerprint is binarized
2. Thinning on binarized image
3. Minutiae points are extracted. Data matrix is generated to get the position, orientation and type of minutiae.
4. Matching of test fingerprint with template
5. Matching score of two images is computed, if matching score is 1 images are matched and if it is 0 then they are mismatched.

4. IMPLEMENTATION:

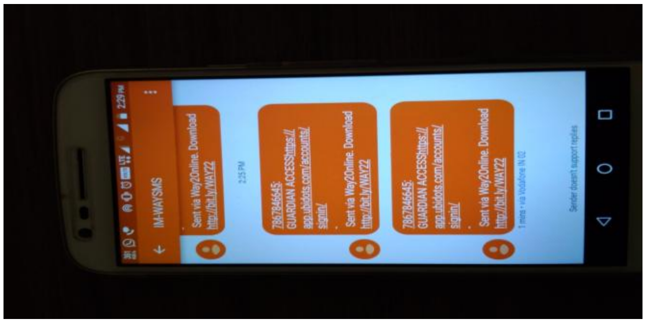
The following hardware components are needed to implement the system.

1.Raspberry pi 3,
2. Fingerprint Module (GT511C3),
3. GSM Message using Ubidots,
4. Arduino Uno,
5. Voltage divider,
6. DC Motor,
7. Relay,
8.Power Supply.



```
Please press finger

Please press finger

Please press finger

Verified ID:*0Verified ID:*0Verified ID:*0Verified ID:*0Verified ID:*0Please pre
ss finger

111
21540
Deposit
111
20540
with draw
Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger

Please press finger
```

Figure.6. Guardian access of user account



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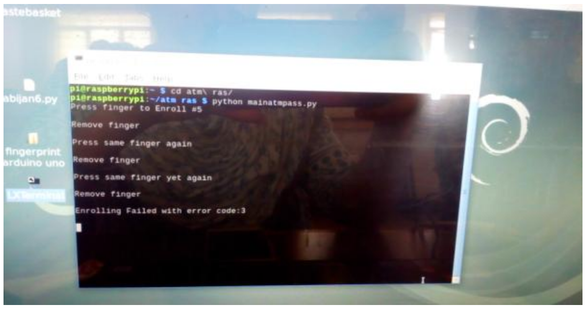
7867846645 GUARDIAN ACCESShttps:// app.ubidots.com/accounts/ signin/ Sent via Way2Online. Download http://bit.ly/WAY22

1 mins • via Vodafone IN 02

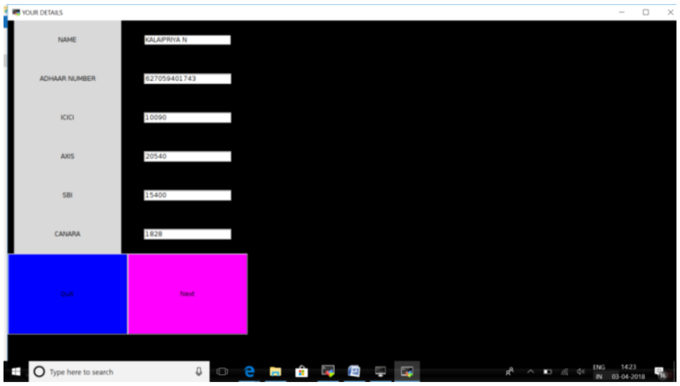
Sender doesn't support replies

Figure.7. Message intimation to the user



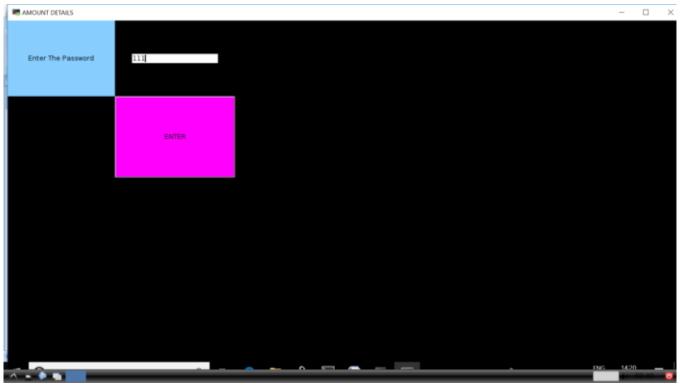
```
pi@raspberrypi:~ $ cd atm\ ras/
pi@raspberrypi:~/atm ras $ python mainatmpass.py
Press finger to Enroll #5

Remove finger

Press same finger again

Remove finger

Press same finger yet again

Remove finger

Enrolling Failed with error code:3
```

Figure.8. Enrolling of fingerprint



NAME: KALAIPRIYA N
ADHAAR NUMBER: 627059401743
ICICI: 10090
AXIS: 20540
SBI: 15400
CANARA: 1828

Figure.9. User's personal details with multiple accounts



Enter The Password: 111

Figure.10. Password of 3 digits

5. CONCLUSION & FUTURE SCOPE

Automatic teller machines have became a major technology which provides financial services to an increasing segments of the population in many countries. biometrics, and in particular fingerprint scanning, continuous to gain acceptances as a realiable form of securing access through identification and verification processes. this paper identifies a high level model for the modification of existing ATM systems using both security protocols as pin and biometric fingerprint strategy. The system was programmed using python language. Fingerprint detection followed by recognition using Ubuntu Linux OS with Tkinter feature extraction method that improves accuracy of our proposal method. After successful Tkinter creating and output of ATM with multiple creation of bank of user. Using this system, guardian access of user account with guardian fingerprint and also with the help of user GSM message code intimation. Further we implemented Fingerprint recognition in this proposed method.

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AUTHORS

N.Kalaipriya, She is doing her bachelor degree in electronics and communication engineering at KSR Institute for Engineering and Technology, Tiruchengode, Namakkal(Dt). She has presented one national conference at Knowledge institute of technology. Her area of interest are embedded systems, networking and her year of passing is 2018.

E.Padmapriya, She is doing her bachelor degree in electronics and communication engineering at KSR Institute for Engineering and Technology, Tiruchengode, Namakkal(Dt). She has presented one national conference at Knowledge institute of technology. Her area of interest is embedded systems and her year of passing is 2018.

E.L.Dhivyapriya, She completed her bachelor degree in Electronics and Communication Engineering at K.S.Rangasamy college of technology, Tiruchengode in the year of 2015 and master degree in the specialization of Communication Systems at Kongu Engineering college, Perundurai, Erode in the year of 2017. She published her research paper in IEEE explore and two papers in international journals. She also presented her PG research work in the international conference conducted by Madras Institute of Technology, Chennai. Her areas of interest are optical communication and networking.