



Fingerprint Identification Based Attendance System with SMS Notification

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Abstract: In this project of Fingerprint identification based system with SMS notification, we are developing a system that is fully capable of automatically marking and storing the attendance of individual students in a PC or Laptop in a Period-wise fashion. This stored data can further be calculated in order to determine the percentage of the individual's attendance. Further, with the help of this project we are also able to send an SMS to the desired mobile number using a GSM module which contains information regarding the time and date of the individuals "Entry" and "Exit" into the classroom, workspace etc.

Index Terms - Fingerprint Identification, Automatic marking and storing of attendance, GSM module.

I. INTRODUCTION

Attendance plays a very vital role in any student's life. It is one of the important criteria that are strictly monitored, apart from giving detailed attention to a student's academic and co-curricular performs many institutes also give proper attention to the attendance of the individual student. Many institutes also have a set cut-off maintained for the attendance, for instance 75% or 80% that have to be met by each student mandatorily in order to be eligible for writing the exams. Though the attendance is given such importance many institutes fail to maintain a proper mechanism for taking and storing the attendance. The major reason for developing this project is to overcome the various drawbacks which are present in the current manual system of marking the attendance. These manual systems are age-old methods such as the "Roll-Call" method or "Signing the attendance sheet" method, etc. which provide the following disadvantages:-

- Difficulty in keeping the attendance list over a long period of time.
- Unnecessary time wastage during writing and signing attendance.
- Improper maintenance of the documentation.
- Students forgetting to write or sign the attendance paper.
- Lecturers forgetting the attendance list in the classroom.

Due to the above mentioned disadvantages there is a lot of time and effort which are wasted on the attendance that has to be marked by the particular organization. Further, in these manual systems there is also a compromise in the efficiency which degrades the quality of the system. Thus there exists a need for developing a better alternative such as the "Fingerprint based attendance system" which eliminates all the drawbacks of the manual system.

1.1 EXISTING MODEL

Apart from various attendance systems proposed in recent times the most commonly and efficiently used system is the RFID (Radio Frequency Based Attendance) system. This system consists of an RFID tag and reader. When the tag is brought in close proximity to the reader it is able to detect the card and mark the attendance of the concerned individual.



Fig. 1.1 Basic RFID system

1.2 PROPOSED MODEL

In the proposed model we are automatically registering the attendance of individuals using their respective biometrics i.e. using their fingerprints this system provides better efficiency and accuracy than the RFID system. The reasons for this can be understood with the help of the following:-

- The RFID System is expensive because a lot of technology goes into making it. Further, in case of large strengths of people in a given organization, purchasing tags for everyone is not just costly but is also a tedious job.
- Further there is also the risk of the student forgetting the card on a particular day or also losing it completely hence maintenance and efficiency of the RFID system is also affected.
- Replacing the microchip, radio transceiver, antenna and battery in the RFID system is tiresome and costs money
- Since it is not as secure as biometric, the system is prone to manipulation. For instance; the card of one individual can be scanned by another hence falsely marking the attendance.

In order to overcome these challenges we have used a fingerprint based attendance management system which provides better efficiency at a lower cost and hence turns out to be a better alternative. Moreover, using this system an SMS notification can also be sent to desired mobile number which serves two purposes

- It can alert the parents in case of schools and colleges, or a manager/HR in case of a corporate organization.
- It can be served as an additional backup.

II. EMBEDDED SYSTEMS

Embedded systems are systems that accomplish a pre-defined or specified task. It is made up of both hardware and software. It's just a computer hidden within a product. It's just an electronic chip with a programmable hardware design. Embedded systems are devices that control, monitor, or aid the operation of equipment, machinery, or plants, according to a broad definition. The term "embedded" refers to their status as an important element of the system. In many situations, their integration is so deep that their presence is barely noticeable to the untrained eye. A general-purpose computer, on the other hand, could be used to control the functioning of a big complicated processing plant and its presence would be visible. Computers or microprocessors are present in all embedded systems. However, when compared to a personal computer, some of these computers are quite rudimentary devices.

The most basic embedded systems are only capable of performing a single function to achieve a single goal. The functionality of embedded systems in more complicated systems is determined by an application program that allows the embedded system to be utilized for a given purpose in a specific application. Because of the capacity to have programs, the same embedded system can be utilized for a variety of tasks.



Fig. 2.1 Simple Embedded system

2.1 Working Mechanism

The design is based on a modular approach. The entire architecture can be divided into 4 different sections which are as follows:-

- Input section (Fingerprint sensor).
- Control section (Arduino: ATmega328P).
- Display unit (LCD)
- Output section (GSM and PC).

Each of the above section have specified tasks which have to be performed into order to accomplish the complete working of the system. The student is expected place his/her finger on the fingerprint scanner, the scanner then records the unique biometric of the individual and compares it with the database which contains biometric of all the student's once a match is obtained it then passes this data to the Arduino (ATmega328P) and students attendance gets marked and is displayed on LCD display. Here the Arduino is the primary element which takes all the important decisions.

The Arduino is connected to two output devices one is the GSM (Global system for mobile communication) which sends a text message (i.e., SMS) to the required mobile phone. After sending the SMS the attendance of the student will also be logged into the PC along with the date and time. This switching between the GSM module and the PC is achieved with the help of a "Relay". The relay is by default connected to the GSM (i.e. when relay is LOW) and when the relay is HIGH it gets connected to the PC, with this type of mechanism maintaining a clear record for the student's attendance becomes lot easier in the long run.

The below is the basic block diagram which helps in understanding the working of the system.

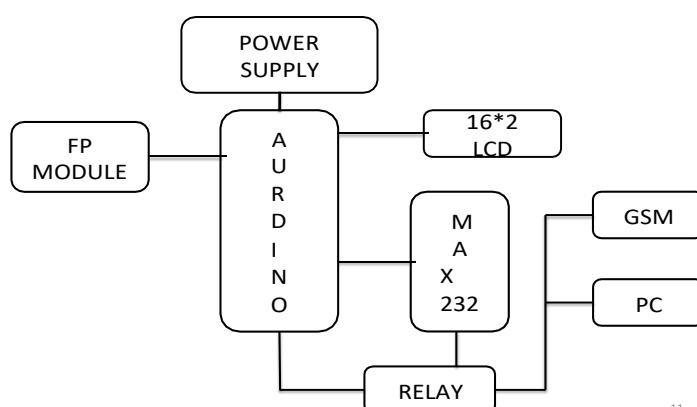


Fig. 2.2 Basic Block Diagram of Fingerprint Based Attendance System

2.2 Arduino Microcontroller (ATmega328P):

Arduino is a free and open-source electronics prototyping platform with adaptable hardware and software. Engineers, artists, designers, amateurs, and anybody interested in technology may utilize Arduino interface boards to create creative, interactive items, useful projects, and more. The Arduino ATmega328 microcontroller is an 8 bit microcontroller and contains 28 pins which are divided into 3 ports which are port B (8 pins), port C (7 pins) and port D (8 pins). It has a SRAM (static read only memory) of 2kb and an EEPROM (electronically erasable programmable read only memory) of 1kb and a flash Memory of 32kb.



Fig. 2.3 Arduunio UNO

2.3 Liquid Crystal Display (LCD):

LCD is the acronym for liquid crystal display. Because of the following reasons, LCD is increasingly being used to replace LEDs (seven segment LEDs or other multi-segment LEDs):

1. LCD prices are decreasing.
2. The ability to display data in the form of numbers, letters, and pictures. LEDs, on the other hand, are limited to numbers and a few letters.
3. Incorporation of a refresh controller within the LCD, which relieves the CPU of the work of LCD refresh. The LED, on the other hand, needs to be refreshed by the CPU in order to keep displaying the data.
4. Character and graphics programming is simple.

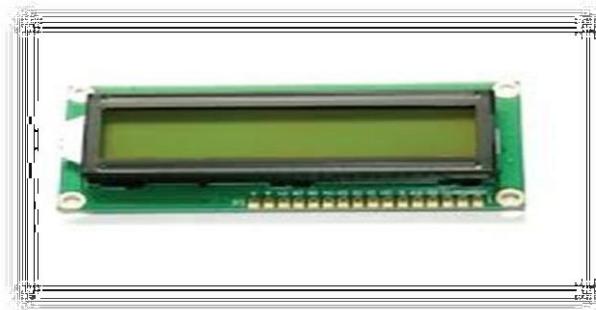


Fig. 2.4 Liquid Crystal Display

2.4 Regulated Power Supply:

Any invention especially in the field of science and technology let it be the latest technology or an age-old technology/method cannot be activated without the help of a proper source of power. So in today's "digital era" where technology has greatly influenced our world we deliberately need a good power source that will be apt for a particular requirement. A system having no proper power supply would be similar to having a car without any fuel to drive. All the electronic components starting from the

diode only work with a DC supply ranging from 5V to 12V. We are utilizing the same, cheapest, and most commonly available energy source of 230V-50Hz and stepping down, rectifying, filtering, and regulating the voltage.



Fig. 2.5 Regulated Power Supply

2.5 Fingerprint Module (R305):

The Fingerprint module used is a TTL UART interface fingerprint sensor module for direct connections to a microcontroller UART or a PC via a MAX232 / USB-Serial adapter. The user can save the finger print data in the module and use it to identify the person in 1:1 or 1:N mode. The FP module can connect to a 3v or 5v microcontroller directly. Interfacing with a PC serial port necessitates the use of a level converter (such as MAX232). Access control, attendance, safety deposit boxes, and car door locks are just some of the applications for this optical biometric fingerprint reader with a lot of capabilities.



Fig. 2.6 Fingerprint Module

2.6 Light emitting diode (LED):

A light-emitting diode (LED) is an electronic light source (LED). LEDs are increasingly being used in a range of applications for lighting and as indicator lamps. When LEDs were initially developed as a functional electrical component in 1962, they produced low-intensity red light, but today's LEDs are available in visible, ultraviolet, and infrared wavelengths, with exceptionally high brightness. The internal structure and parts of a LED are as shown in the below Figure.

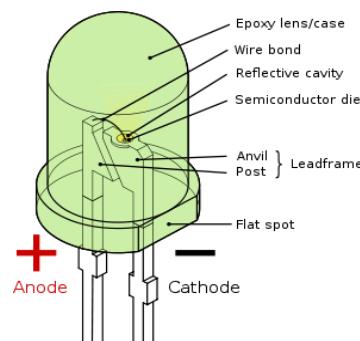


Fig. 2.7 Internal components of an LED

2.7 MAX232:

The MAX232 is an integrated circuit used as a communication interface device by Maxim Integrated Product. In practice the output obtained by the fingerprint module as well as the Arduino are in RS232 (Recommended standard number) which is not compatible with the GSM and PC. The GSM and PC work with TTL (transistor-transistor logic). Hence in order to convert the RS232 into TTL we use the MAX232. It contains a Charge Pump, which uses a single 5V supply to generate +10V and -10V. In addition, this I.C. has two receivers and two transmitters in one chip. When you simply need to use the Transmit and Receive data lines, this is quite useful. It is not necessary to use two chips, one for the receive line and the other for transmission. All of this convenience comes at a cost, but it's a bargain when compared to the cost of constructing a new power supply.

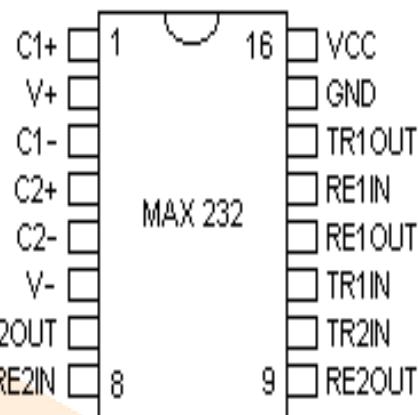


Fig. 2.8 Pin Diagram of MAX232

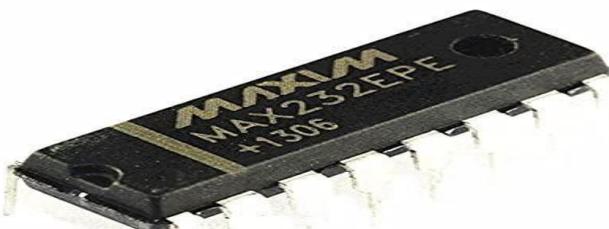


Fig. 2.9 MAX232

2.8 Relay:

A relay driver IC is nothing more than an electro-magnetic switch (i.e., it functions similarly to a normal switch, except that the opening and closing operations in a relay are performed automatically rather than manually, as in the case of a general switch). The current required to run the relay coil is greater than what can be provided by other integrated circuits such as Op-Amps. Relays have special qualities and are being phased out in favor of solid-state switches, which are more durable than solid-state devices. Relays have unique qualities such as high current capacity, ESD resistance, and drive circuit separation.



Fig 2.11 Relay

2.7 Global System for Mobile Communications (GSM):

The GSM (Global System for Mobile Communications) is the most widely used digital mobile phone system today. This second-generation (2G) system uses digital modulation to increase audio quality and delivers voice and limited data services. The following are the various GSM variants that are available:-

- GSM band 900 (850-915MHz up-link frequency and 935-960MHz downlink frequency)
- Digital cellular system (DCS) 1800 band or GSM 1800 band (1710-1785MHz up-link frequency and 1805-1880MHz downlink frequency)
- PCS 1900 band (Personal Communication Service) (1850-1910MHz uplink frequency and 1930-1990MHz downlink frequency)

Electronic devices that collect data and transfer it to a central location using SMS or GSM data calls can make clever use of the GSM mobile communication system. The GSM module makes use of the AT (attention) commands in order to send the SMS or make a GSM data call. Unlike the general mobile phones, where we have to manually send the messages and calls, the GSM module enables us to do this automatically.

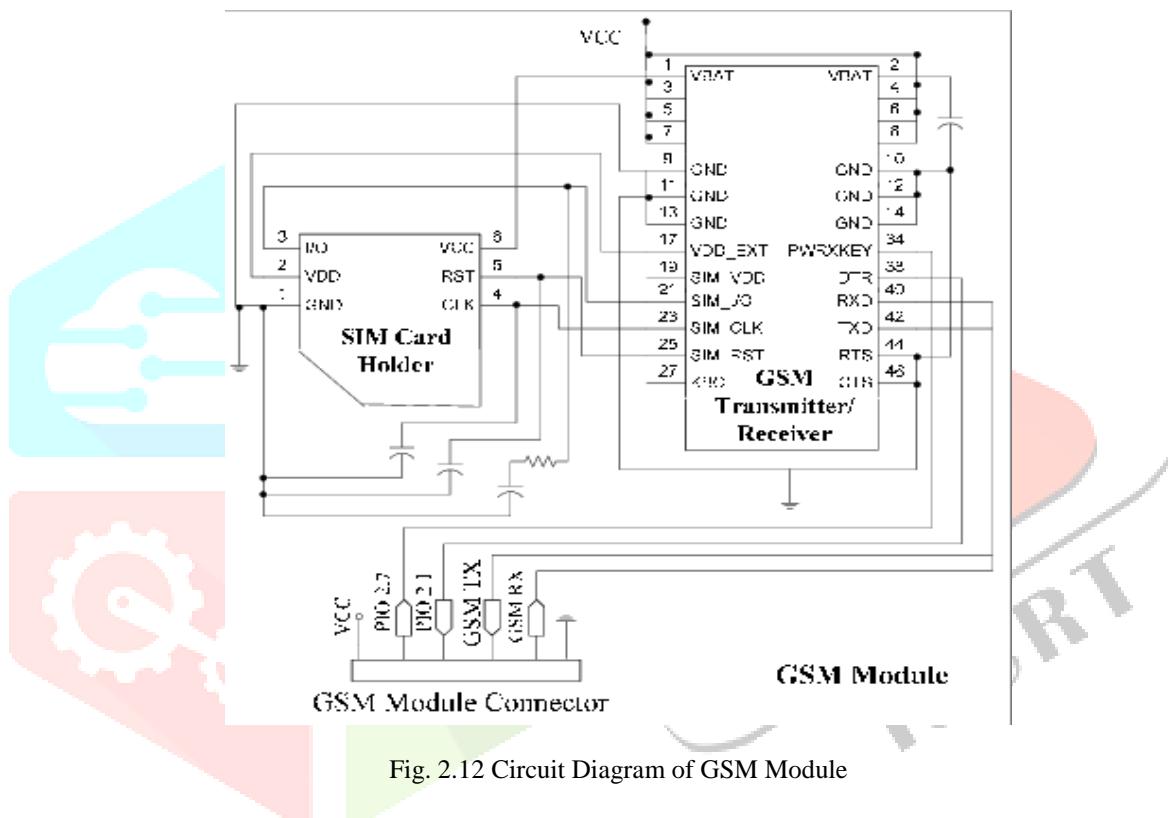


Fig 2.13 GSM Module

III. FLOWCHARTS

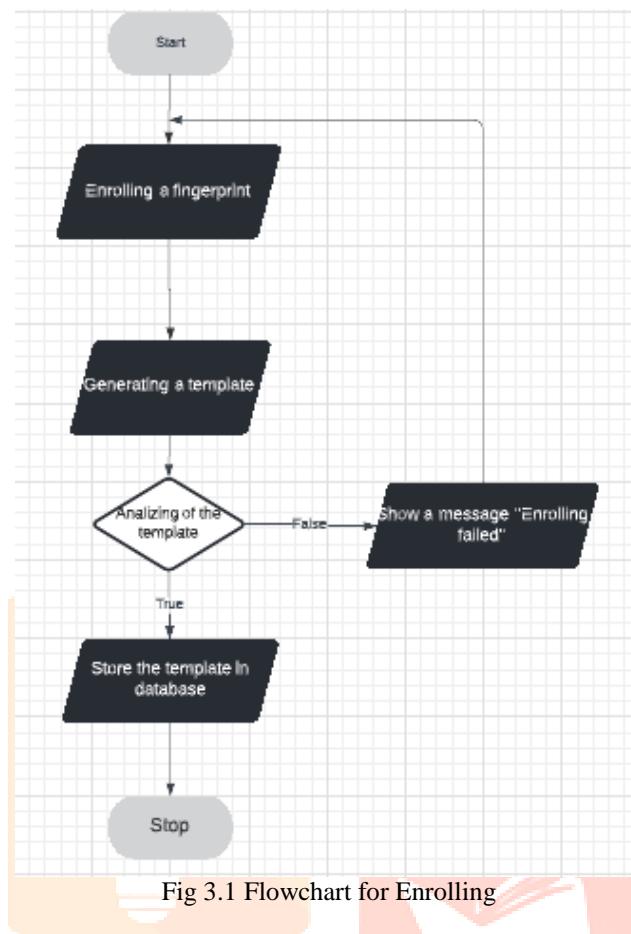


Fig 3.1 Flowchart for Enrolling

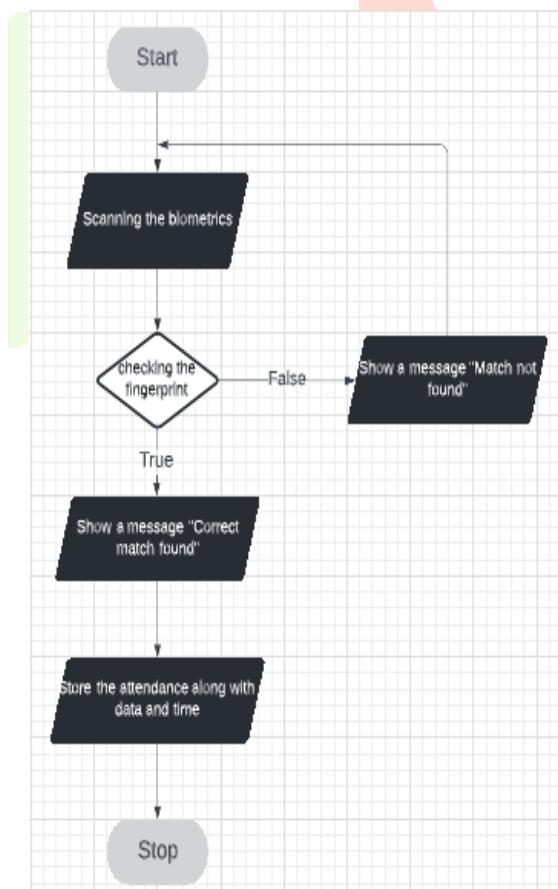


Fig 3.2 Flowchart for Identification

IV. ADVANTAGES

This attendance management system eliminates all the drawbacks of the manual attendance process which are follows:-

- Improved accuracy compared to the manual system because of the use of biometrics.
- It immediately notifies the concerned authority about the attendance of the individual.
- No compromise on efficiency, because attendance calculations are quickly automated by this system.

V. OUTPUT

The final output after carefully assembly all the hardware components and making the necessary connection between individual elements is as shown below.

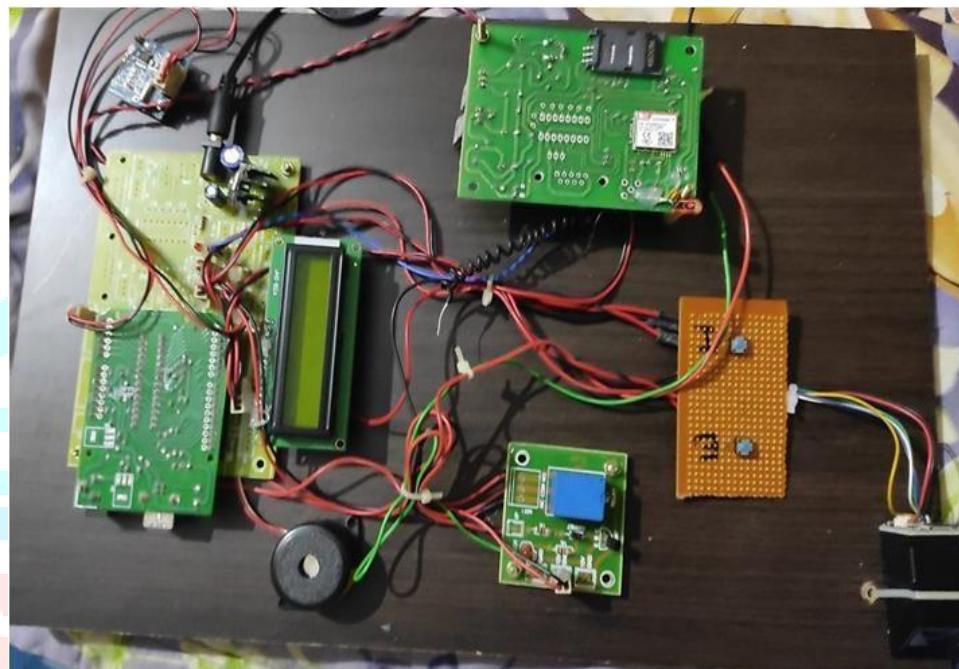


Fig 5.1 Final Output



Fig. 5.2 SMS notification received on given mobile number

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FP_NOT_FOUND
Y:2022 M:4 D:19 H:16 m:58 s:6
Person-1_IN
Y:2022 M:4 D:19 H:16 m:58 s:38
Person-1_OUT
Y:2022 M:4 D:19 H:16 m:59 s:8
Person-1_IN
Y:2022 M:4 D:19 H:17 m:4 s:6
Person-1_OUT
Y:2022 M:4 D:19 H:17 m:4 s:38

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Connected 0:10:04 Auto detect 9600 8-N-1 SCROLL CAPS NUM Capture Print
Words: 11,309 English (United States)

Fig. 5.3 Output obtained in the PC

VI. CONCLUSION

The project consists of various hardware components. Each of which have specific functionality, these functionalities are thoroughly studied, understood and finally connected together. Further, the required working of the project is achieved using the software mechanism of the Arduino microcontroller, GSM module and the LCD.

VII. REFERENCES

1. Radio Frequency Identification (RFID) Based Attendance System with Short Message Service (SMS) Backup Ukoima Kelvin Nkalo, Ekwe Ogbonnaya Agwu, Ezeonye Chinonso Stanley.
2. Fingerprint Attendance System for Educational Institutes Mohammed Alhothaily, Mohammed Alradaey, Mohammed Oqbah, Amin El-Kustaban.
3. Smart and Secure Fingerprint Attendance System using Arduino UNO with GSM Alert Ritam Dutta, Tenzing Tamang, Pranoy Paul Nitesh Kumar, Chandan Chetri, Pradip Kumar Dutta.
4. Fingerprint attendance system for classroom needs. Mohamed, K.P Basheer, Raghu IEEE Annual, IEEE India Conference (INDICON) - Kochi, India (2012).
5. Automated Wireless Biometric Fingerprint Based Student Attendance System. 2021 1st Odisha International Conference on Electrical Power Engineering, Communication and Computing Technology (ODICON). Biswaranjan Swain, Jayshree Halder, Siddharth Sahany, Praveen Priyaranjan Nayak, Satyanarayan Bhuyan.