



## Fingerprint Sensor Based Protection System for Electric Line-Man

Mohd Inamul Haque<sup>1</sup>, Sanket Kalaskar<sup>2</sup>, Mohan Raut<sup>3</sup>, Saurav Walokar<sup>4</sup>, Ganesh Ingole<sup>5</sup>,

Prof. Nawaz Sheikh<sup>6</sup>

<sup>1,2,3,4,5</sup>Students of Electrical Department Anjuman College of Engineering and Technology Nagpur, Maharashtra, India

<sup>6</sup> Associate Professor of Electrical Department Anjuman College of Engineering and Technology Nagpur, Maharashtra, India

### ABSTRACT

In present scenario , electric line-man have to request staff personnel to switch off the line which has to be repaired or maintained. There is a major chance of miscommunication and a potential risk to human life. The proposed system focuses to eliminate this problem by providing a secured mechanism to switch on/off the supply in line. The access of this system should not be open to all hence it has an authentication process through use of fingerprint sensor. In case there is a problem in detecting fingerprint or it causes a failure we have provided a backup system which also provides user authentication. The backup system uses RFID technology to provide access to the system. Electric line-man provides a request to access system using a fingerprint sensor. If the fingerprint matches that with the one in record , access is granted and line can be switched on/off according to requirement. The LCD provides output status of the access granted or access denied. The relay is used connect or disconnect with the load and indicate the load as on or off according to status of the system. Microcontroller co-ordinates all the tasks of this system and has to be programmed for providing output when authorized users place requests. The proposed system aims to reduce chances of human errors and ensure safety for Electric line-man.

**Keywords :** Controller , Fingerprint sensor , relay , RFID , Electric lineman

### I. INTRODUCTION

Innovation is done to bring leisure to mankind. All inventions are built to decrease human exertion. In the dilemma of decrement in human exertion, the technology has long forgotten the safety of man. In this project, we are to design a system that does not only improve safety but also diagnoses the fault. As per insurance companies, even with the telephonic communication facility accidents happen that not only fry up household electronics, or burst

transformers, in some cases electrocute technicians to death, just because of the miscommunication between the maintenance staff and electric substation staff. We are to design a fingerprint and RFID-based system which will be with ease for lineman. Whilst such ease of access, in case of fingerprint failure, there shall be a RFID system with security protection to turn on or off the system. Our System is based on an Atmega 328Micro controller: Our designed system will also have the capability to provide security and allow only authorized people to access the safety.

## II. LITERATURE REVIEW

### 2.1. Existing Method

In existing system whenever any of the problems occur at distribution lines, lineman have to informs the substation operator to shut down the power of that specific line on which fault has occurred through making a phone call to substation operator or by going by himself to the substation for the maintenance of that distribution line, there is a huge chance of communication gap between the electric lineman and sub-station operator or staff. This communication gap may risk the life of an electric lineman or a transformer or other components, or household appliances.



Figure2.1: Lineman at work

Disadvantages:

- There is no safety for the lineman.
- There is a room for miscommunication.
- Time-consuming.
- Remote Control does not exist.

### 2.2. Previous Work

#### 1) Electric lineman protection using password-based circuit barker

Disadvantages:

- There is a chance of forgetting the password
- The lineman must go for the power station for setting up the password

#### 2) Electric lineman protection using user changeable password-based circuit breaker:

Disadvantages:

- The lineman must go for the power station for setting up the password.

#### 3) Electric lineman protection using circuit breaker based on an android via Bluetooth:

Disadvantages:

- The lineman must go for the power station for setting up the password.
- It works under the capacity of Bluetooth range only.

#### 4) Transmission line fault detector in remote areas using advanced wireless technology.

#### 5) Arduino based underground and overhead cable fault detection.

#### 6) Fault location for power transmission systems using magnetic field sensing coils.

#### 7) Microcontroller Based Code Locking System with Alarm.

## III. METHODOLOGY

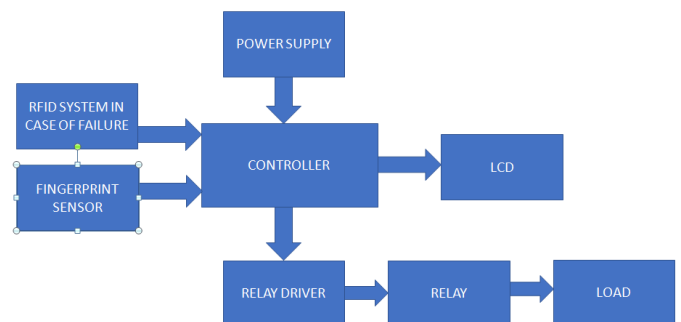


Figure 3 Block Diagram

### 3.1 Working

- A line-man puts a request of switching off power supply of the line which has to be repaired or

maintained. The request is granted only if the fingerprint matches with the ones stored in record and controller sends signal to circuit breaker for switching off supply. The line is switched off through relay mechanism

- Relay driver: A Relay driver IC is an electro-magnetic switch that will be used whenever we want to use a low voltage circuit to switch a light bulb ON and OFF which is connected to 220V mains supply.
- The required current to run the relay coil is more than can be supplied by various integrated circuits like Op-Amp, etc. Relays have unique properties and are replaced with solid state switches that are strong than solid-state devices. High current capacities, capability to stand ESD and drive circuit isolation are the unique properties of Relays.
- The lcd is used for indication of status of circuit breaker.
- Arduino nano is programmed to provide signal to relay driver ,lcd once a fingerprint input has been recognized .
- LCD displays the status of system.
- A backup system using RFID based I-card system is employed in case if there is a delay in allotting biometric system details to new employees or any uncertain cases.
- An indicator for output is very important as it informs the user whether the line voltage is turned on or off.
- In our project this information is indicated by connecting a load at the output like a bulb.
- If an authenticated user provides his/ her details then lcd display will indicate “ACCESS GRANTED”.
- If an unauthenticated user provides his/ her details then lcd display will indicate “ACCESS DENIED”.

- This process ensures that no unauthorized access is provider and no intruder can access the system at any cost.
- This system is designed to replace the manual techniques or an lock and key mechanism that may exist and has chances of human error.
- As rfid and fingerprint sensor technology, both have advantages of user authentication it proves to be advantageous over other existing systems.
- This system ensures safety of all lineman.

### 3.2 Flowchart

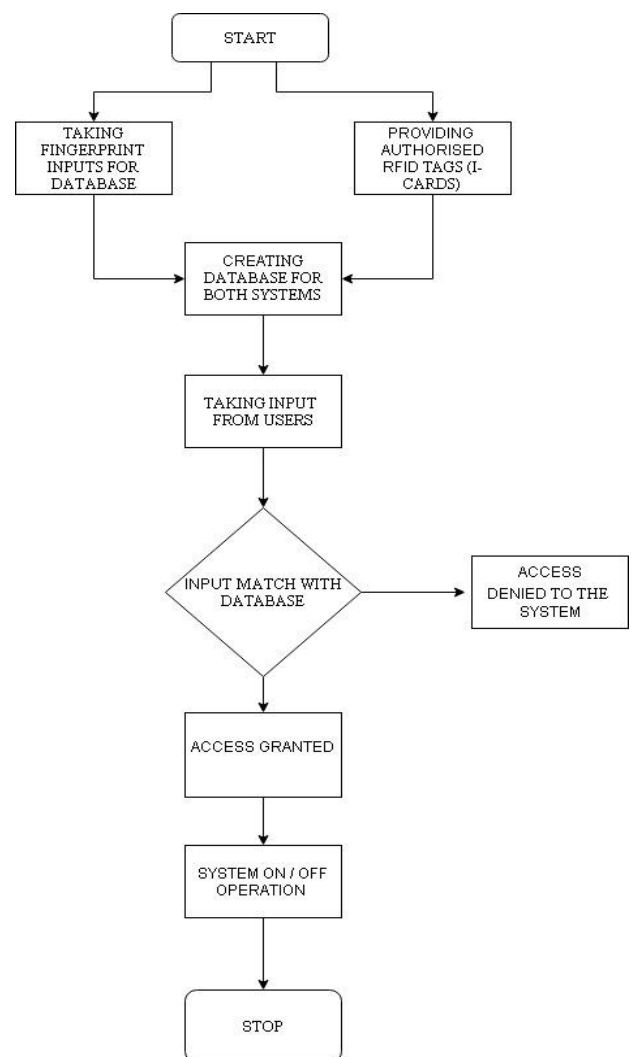


Figure 3.2 Flowchart of the Proposed System

## IV. HARDWARE DESCRIPTION

In our project, we utilized best and economical devices with exact and precise readings to make our project smart and intelligent. The Hardware components we use are:

- Arduino Nano
- Fingerprint Sensor Module
- Rfid Reader And Tags
- Connector
- Resistors
- Capacitors
- Connecting Cables
- LEDs (Light Emitting Diode)
- Optocoupler
- Connection Wires
- LCD display
- Relays

## V. SOFTWARE

Two softwares are used for this project

1. Proteus : It is used for PCB designing and circuit designing.
2. Arduino IDE: For programming of the project.

### 5.1 Proteus

Proteus ISIS is circuit designing and simulation software used for designing PCB Layouts. First you make your required circuit on Proteus, test it, and then make the desired PCB layout. It is a software suite containing schematic, simulation as well as PCB designing.

- ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.

- ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.
- The designer can also develop 2D drawings for the product.

The Proteus Design Suite combines schematic capture, SPICE circuit simulation, and PCB design to make a complete electronics design system. Add to that the ability to simulate popular micro-controllers running actual firmware, and have a package that can dramatically reduce development time when compared with a traditional embedded design process.

### 5.2 Arduino IDE

IDE stands for “Integrated Development Environment” :it is an official software introduced by Arduino.cc that is mainly used for editing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go.

## VI. DESIGN & IMPLEMENTATION

### 6.1 Steps involved in designing a system

1. Simulation of circuit
2. Programming
3. Hardware testing (breadboard testing)
4. PCB designing
5. Component mounting
6. System testing

### 6.2 Connection of components to arduino

1. Finger print sensor module to arduino

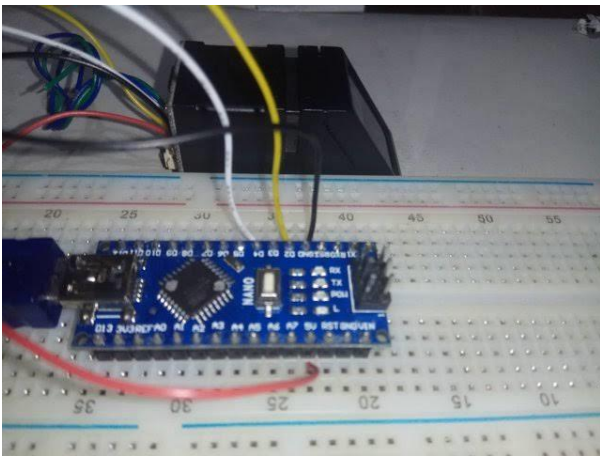


Figure 6.2 Connection of Arduino Nano to Fingerprint Sensor

## 2. Libraries

To run the program and to make sketching a code easily we need to download these library.

- Adding Adafruit-Fingerprint-Sensor-Library
- After downloading the ZIP file libraries add it to your arduino IDE libraries by locating the SKETCH include library then add ZIP library and then look for your zip file on your download folder.

## 6.3 Connection of arduino nano to RFID



Figure 6.3 Arduino Nano to RFID

1. Download the RFID library
2. Unzip the RFID library
3. Install the RFID library in your Arduino IDE
4. Restart your Arduino IDE

Place the NANO on the solderless breadboard. Connect the black jumper cable from the GND pin on the LCD. Connect the red jumper cable from the VCC

pin on the LCD to the VCC pin on the NANO. Connect the green jumper cable from the SDA pin on the LCD to the A4 pin on the NANO. Connect the yellow jumper cable from the SCL pin on the LCD to the A5 pin on the NANO.

## 6.4 Connection of arduino nano to relay module

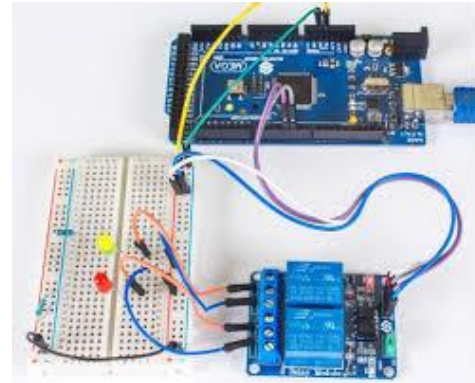


Figure 6.4 Connection of Arduino Nano to Relay Module

## 6.5 Connection of arduino nano to LCD

Place the NANO on the solderless breadboard. Connect the black jumper cable from the GND pin on the LCD to the GND pin on the NANO. Connect the red jumper cable from the VCC pin on the LCD to the VCC pin on the NANO. Connect the green jumper cable from the SDA pin on the LCD to the A4 pin on the NANO. Connect the yellow jumper cable from the SCL pin on the LCD to the A5 pin on the NANO.

Next step load the Arduino IDE and upload the sketch

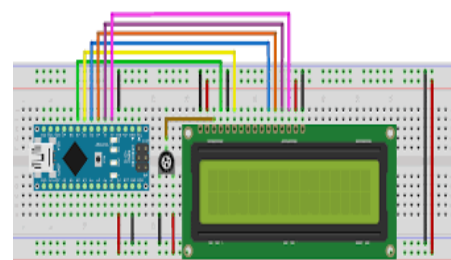


Figure 6.5 Connection of Arduino Nano to LCD Display.

## 6.6 Schematic circuit diagram of project

6.7

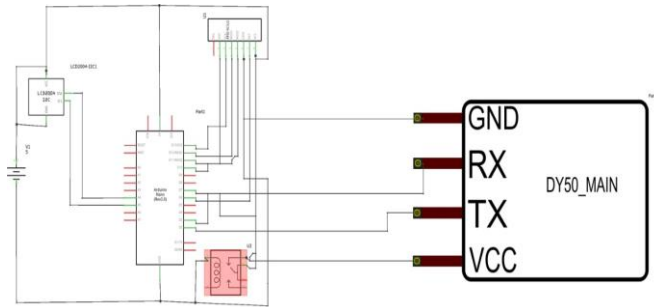


Figure 6.6 Circuit Diagram of Project

## 6.7 PCB Etching

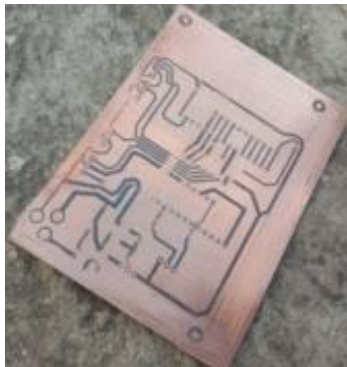


Figure 6.7.3 PCB before etching process



Figure 6.7.2 PCB during etching process



Figure 6.7.3 PCB after etching process

## VII. RESULT

This system provides a solution, which can improve the safety of the project. It is designed to control a circuit breaker with the help of a fingerprint access mechanism. The maintenance staff e.g. Line man's for control to turn ON/OFF. The line works with the line man only this system is arrangement such that a password is required to operate the circuit breaker (ON/OFF) but it has many disadvantages hence moving to another approach. Line man can turn off the supply and comfortably repair it, and return to the substation, then turn on the line by accessing the system. The system fully controlled by a ATmega 328 IC. If the user is not authenticated then he cannot access it and if it is authorized access is correct, then the line can be turned (ON/OFF). Security is a prime concern in our day-to-day life. Everyone wants to be more secure as much as possible. This system provides a new approach to a lineman's security for their life. The circuit can be used without any fail of a lineman. The circuit can be used without any load can also be controlled when required.

## VIII. ADVANTAGES OF MODEL

### 8.1 ADVANTAGES

There are many advantages related to this model which are listed below, which indicate the effectiveness and reliability of this system.

- Quick response time
- No need of remembering passwords
- Team based system to facilitate smooth working.
- Fingerprint sensors are accurate
- Backup system available
- RFID system assures authentication of user
- Cost effectiveness
- Avoids electrical accidents to line man



- It improve the line man safety
- Project is implementable a large scale
- Uses commonly available components
- Most useful to operate in the public areas

## 8.2 Applications

- It is used in electrical substations to ensure line man safety.
- RFID based circuit breaker is used in buildings and houses.
- Used for saving power in hotels and shopping malls.

## IX. FUTURE SCOPE

The system designed ensures a cost effective and novel approach of designing of a safety mechanism for lineman but this does not restrict the design from modifications or adding up of extra features which shall increase the safety further. There is a scope of improvement of this project in terms of technology used like we can also use internet as platform to provide the status of usage of this mechanism. The system can be tested for different complex working conditions and also can be used to identify further needs. Mentioned below are points that can be considered for future scope of this project.

- Provision of system front end
- Keeping track record of lineman workers

Using the concept of internet as a service.

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