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ELECTRICAL LINEMAN SAFETY USING IOT

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Abstract : Inadequate communication and coordination between the maintenance crew and the electric linemen, there are an increasing number of electrical mishaps involving linemen during repairs. To protect electric linemen from fatal electrical accidents, in the proposed methodology we introduce a fingerprint sensor based secured system, that offers complete control over activation and deactivation of individual power lines. By sensing his finger in the fingerprint scanner, the linemen can safely manage (turning on and tuning off) the power of specific lines. When a particular section requires maintenance, the authorized staff with the secured RFID password Tag will approach the area and sends a signal to deactivate the line, through finger print sensor based circuit, which is verified with the stored data in ATMEGA controller. The linemen are provided with RFID tags which are connected to the helmet, gloves and shoes to ensure his safety. Then a GPS module is connected to the model to ensure that the authorized lineman has only went to the specific area to complete the assigned task**.**

Keywords **– Relays, IOT Technology ,Arduino Uno,Fingerprint Scanner ,GPS Module,RFID Reader .**

I.INTRODUCTION

It is difficult to picture a world without electricity. Our daily lives today involve the use of electricity. In both households and businesses, electricity is essential. Electricity is what powers almost every piece of equipment in homes and businesses. How electricity plays a vital role in our lives. Electricity transmitted through power lines for commercial, industrial, and residential use often need for contact. The life of an electrician is likewise one that is dominant.

They perform a variety of roles in their field. An electrical switch that operates automatically, a circuit breaker guards against overload and short circuit damage to electrical circuits. This project's primary goal is to save linemen by creating a protective system that is managed by a fingerprint scanner. If there is a defect in the proposed system, the lineman uses his finger and turns off the main line. He then works on fixing the line and detects the fault again, turning on the electrical line. Due to a lack of communication between maintenance personnel and electrical linemen, there are a growing number of electrical mishaps involving linemen these days when they are fixing electrical lines. The goal of this project is to provide a solution to guarantee the safety of electric line workers. For the lineman, it is quite helpful because it is very easy to maintain. For the lineman, it is quite helpful because it is very easy to maintain. Our project's primary goal is to preserve the life of the lineman. Our project's primary element is the fingerprint scanner, which is necessary to detect the authentication of the certified linemen with the authority of maintenance.

Nevertheless, during installation, servicing and repair of power lines, contact is sometimes necessary. The lineman could be electrocuted at that point. The maintenance team cuts off the appropriate power line in the main station if the lineman wishes to fix the power system. There may be a distance between the fault-detected power lines and the main station. These may cause a communication breakdown between the lineman and the maintenance team. While operating on the power lines, any other staff members in the main station or substation could inadvertently turn on the power line without the lineman's knowledge. This could result in a deadly electrical mishap. The suggested system offers a way to guarantee lineman safety. The lineman alone will be in charge of turning the gearbox lines ON and OFF.

The suggested approach aims to provide a workable method for controlling power lines in addition to prioritizing the safety of electrical line workers. Due to a communication breakdown between the maintenance personnel and the electrical substation, lineman injuries from electrical mishaps are on the rise these days while fixing the electrical lines. In order to guarantee lineman safety, this project provides a solution to the issue. The lineman in this suggested system is in charge of turning the electrical wires on and off. In our daily lives, security is more crucial than ever. As much security as possible is needed by all. For the protection of the electric man, the based electric lineman safety system is made to operate a circuit breaker using an RFID and fingerprint sensor. The lineman can access the fingerprint sensor by utilizing the fingerprint sensor. When fixing electric lines, there are an increasing number of serious electrical mishaps. The maintenance staff's and the electric substation staff's lack of coordination and communication is what causes these mishaps. The lineman's security in this suggested method is within its own hands.In the proposed system, the lineman has full control over the electrical line's ON /OFF status as the configuration of this

system requires a fingerprint sensor to operate the circuit breaker (on/off). A microcontroller from ATMEGA328 controls the entire system.

II. HARDWARE & SOFTWARE REQUIREMENTS

Hardware:

- Arduino UNO
- Wi-Fi Module ESP 8266
- Relay
- Fingerprint Scanner
- RFID
- EM-18 Module Reader
- LCD
- LED
- Battery
- Zigbee Module
- GPS Module
- Button Switches
- Power Supply

Software:

- Arduino IDE
- Embedded C Coding

A) Arduino UNO :

Fig 1:Arduino UNO

Arduino UNO contains 6 analog input pins and 14 digital I/O pins. It features 1KB of EEPROM, 2KB of SRAM, and 32KB of flash memory at a clock speed of 16 MHz. Reset buttons allow you to restart programs, and it has the ability to run on either an external or USB power source. The Uno's simplicity and versatility make it a popular choice for DIY projects and prototyping.

B) Wi-Fi Module ESP 8266

Fig 2: Wi-Fi Module ESP 8266

A cheap Wi-Fi module that makes Internet access possible for microcontroller-based projects is the ESP8266. Like a microcontroller, it can be programmed and has a full TCP/IP stack. The module runs at 2.4 GHz and supports 802.11 b/g/n Wi-Fi standards. It can communicate with sensors, actuators, and other electronic parts via its GPIO pins. It is well-liked for DIY projects and Internet of Things applications due to its low cost, simplicity of usage, and strong community support. It can also be used as a stand-alone microcontroller or as a Wi-Fi module in conjunction with other microcontrollers, such as Arduino.

C) RELAY

Fig 3: 4 Channel Relay

An electrical signal controls an electromechanical switch called a relay. It is made up of one or more sets of contacts and a coil. A magnetic field is produced by an electrical current passing through the coil, and this field pulls the contacts together or apart to form a connection. Relays are used to regulate low-power signals, such as those produced by microcontrollers or other electronic circuits, to high-power or high-voltage devices. They are frequently utilized in applications where it is important to isolate the control and load circuits, such as automotive systems, industrial automation, home automation, and electronic circuits. There are many different kinds of relays, such as reed, solid-state, and electromagnetic relays. Each type of relay is best suited for a particular application depending on characteristics like isolation, switching speed, and power handling capacity.

- Trigger Voltage (Voltage across coil) : 5V DC
- Trigger Current (Nominal current) : 70mA
- Maximum AC load current: 10A @ 250/125V AC
- Maximum DC load current: 10A @ 30/28V DC
- Compact 5-pin configuration with plastic molding
- Operating time: 10msec Release time: 5msec
- Maximum switching: 300 operating/minute (mechanically)

D) FINGERPRINT SCANNER

Fig 4: Fingerprint Scanner R307

A portable biometric module made specifically for applications involving fingerprint identification is the Fingerprint Scanner R307. High-resolution fingerprint images can be captured via its optical sensor. It is capable of onboard fingerprint matching and template storing because to its integrated CPU and memory. The R307 is simple to integrate into a variety of projects requiring secure authentication because it interfaces with external devices via UART/TTL serial interface, such as microcontrollers or PCs. Systems that deal with time attendance, access control, and other security-related applications frequently use this module.

E) RFID TAGS

Fig 5: RFID Tags Used In Project

RFID, or radio frequency identification, is a technology that automatically recognizes and tracks tags affixed to items using electromagnetic fields. These tags hold electronically stored data that an RFID reader may read from a distance. RFID is widely employed in many different applications, including supply chain tracking, payment systems, access control, and inventory management. It transforms operations in a variety of industries, including retail and healthcare, by providing advantages including efficiency, accuracy, and automation.

F) EM-18 MODULE READER

Fig 6: EM-18 MODULE READER

With a frequency of 125 kHz, the EM-18 RFID module reader is a small device meant to read RFID tags. To find RFID tags nearby, it uses an oscillator, coil, and demodulator circuitry. Data transfer between the tag and the reader is made possible when a compatible tag enters the reader's electromagnetic field and induces a current in the coil. Because of its dependability and simplicity, the EM-18 module is frequently utilized in applications such as inventory management, attendance tracking, and access control systems.

G) LCD

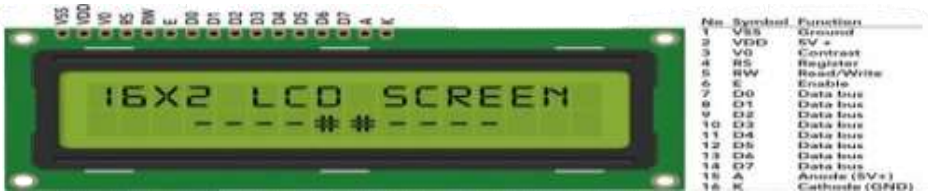


Fig 7: LCD

Using liquid crystals positioned between two transparent electrodes, liquid crystal display (LCD) is a flat panel display device that shows text or images. The liquid crystals align to regulate light passage when an electric current is supplied, forming patterns that produce the desired content. LCDs are widely utilized in gadgets like digital watches, cellphones, computer displays, and televisions because of their low power consumption, lightweight design, and excellent image and text display capabilities. There are several varieties of them, such as Vertical Alignment (VA), In-Plane Switching (IPS), and Twisted Nematic (TN), each with varying viewing angles, response times, and color reproduction capacities.

H) LED

Fig 8: LED

When an electric current flows through a Light Emitting Diode (LED), a semiconductor device, light is released. It has a clear lens encasing a semiconductor chip that is fixed on a reflecting cup. Light is produced when photons, which are emitted when electrons in a semiconductor material recombine with electron holes, release energy. The energy economy, extended lifespan, compact size, and durability of LEDs make them widely employed in a variety of applications, including lights, displays, indications, and signage. They have less of an impact on the environment and use less energy than more conventional lighting sources like incandescent and fluorescent bulbs.

I) BATTERY

Fig 9: BATTERY

A Battery is a device which stores the electrical energy. The capacity, shown as "1.3Ah" and measured in ampere-hours, indicates the maximum amount of charge that it can store and deliver over time. . The "12V" sign denotes its voltage, or the electrical potential difference between its positive and negative terminals. This battery's 12 volt voltage makes it appropriate for a variety of devices, including cars, portable electronics, and small appliances.

J) ZIGBEE MODULE

Fig 10: ZIGBEE MODULE(Transmitter & Receiver)

In a Zigbee network, a Zigbee module is a tiny, low-power wireless device that facilitates communication between devices. It uses the 2.4 GHz frequency spectrum and runs on the IEEE 802.15.4 standard. In applications including industrial monitoring, smart lighting, and home automation, Zigbee modules enable dependable and low-latency communication. They frequently have mesh networking features, which enable stable, scalable networks with long-distance data relay and communication between devices.

K) GPS MODULE

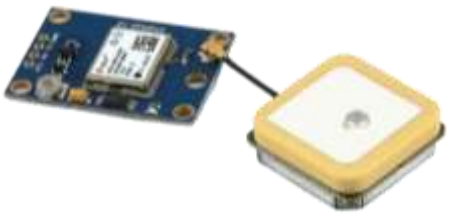


Fig 11:GPS MODULE

A GPS module is a gadget that uses signals from Earth-orbiting satellites to pinpoint its exact location, velocity, and time. It is made up of an antenna, a receiver, and frequently an integrated circuit that processes GPS data. The module uses trilateration to determine its position by communicating with several satellites at once. GPS modules are widely utilized in many different applications, such as outdoor enjoyment, vehicle tracking, navigation systems, and surveying. Their precise positioning data, usually with a few-meter error margin, allows for location-based services and activities to be carried out with accuracy.

L) BUTTON SWITCHES

Fig 12:Button Switches

Pressing a button or actuator activates button switches, commonly referred to as push-button switches. By briefly establishing or severing electrical connections, they are frequently employed to regulate circuits. Button switches are available in numerous configurations, such as normally closed (NC) or usually open (NO), and they come in two types: momentary and latching. Their tactile feedback and straightforward operation make them useful in a variety of applications, ranging from basic electronics and appliances to industrial machinery and control panels.

M) POWER SUPPLY

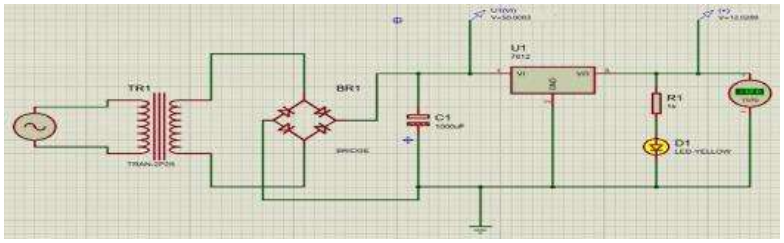


Fig 13: Power Supply

A system or equipment that supplies electrical energy to another system or device is called a power supply. It converts electrical energy into a form that may be used to power electronic equipment, usually from an accessible power source (such a wall outlet or battery).

III. WORKING PRINCIPLE OF LINE MAN SAFETY SYSTEM

i) BLOCK DIAGRAM

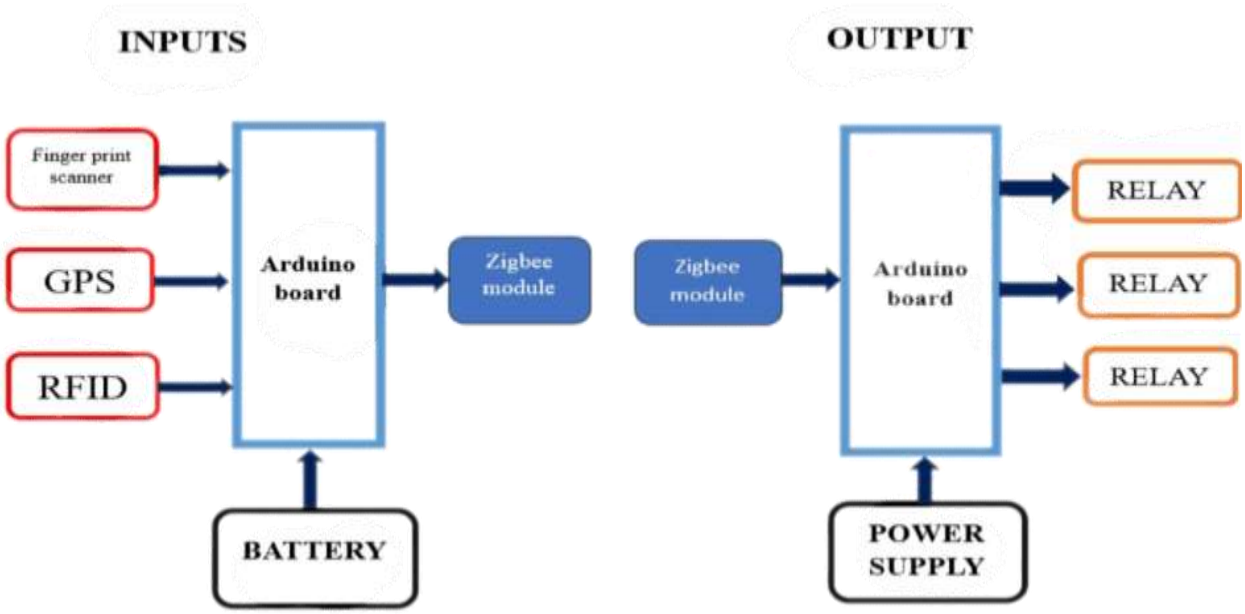


Fig 1: Block Diagram of Lineman Safety System

The above figure is an overall block diagram of MCU (Microcontroller Unit) based electronic circuit breaker which consists of finger print scanner. In the above block diagram, finger print is enrolled by a lineman. This module is connected to the MCU. Then the MCU is connected to the Zigbee Module on the input side. The input side is completely operated by the Battery. Then one more Zigbee Module is connected to the output, Both the modules are interfaced here. If the finger print stored in the scanner is matched with the authenticated finger print, MCU is turned on. This makes on or off the relay which helps to control the electric line. After the completion of the work, above process is repeated in the same manner by the lineman. In such cases, person can have the difficulty to identify themselves and gaining access. In such cases, RFID tag is used. RFID uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. These tags collect energy from a nearby RFID reader's interrogating waves. Active tags contain battery and it operate hundreds of meters from the RFID reader. The tag need not be within light of sight of the reader. RFID is used for security purpose. It consists of microchip and coil. To recognize the identity of RFID tag, RFID tag sends the signal to reader, the signal is received by coil and unique ID is identified by chip.

ii) Flow Chart

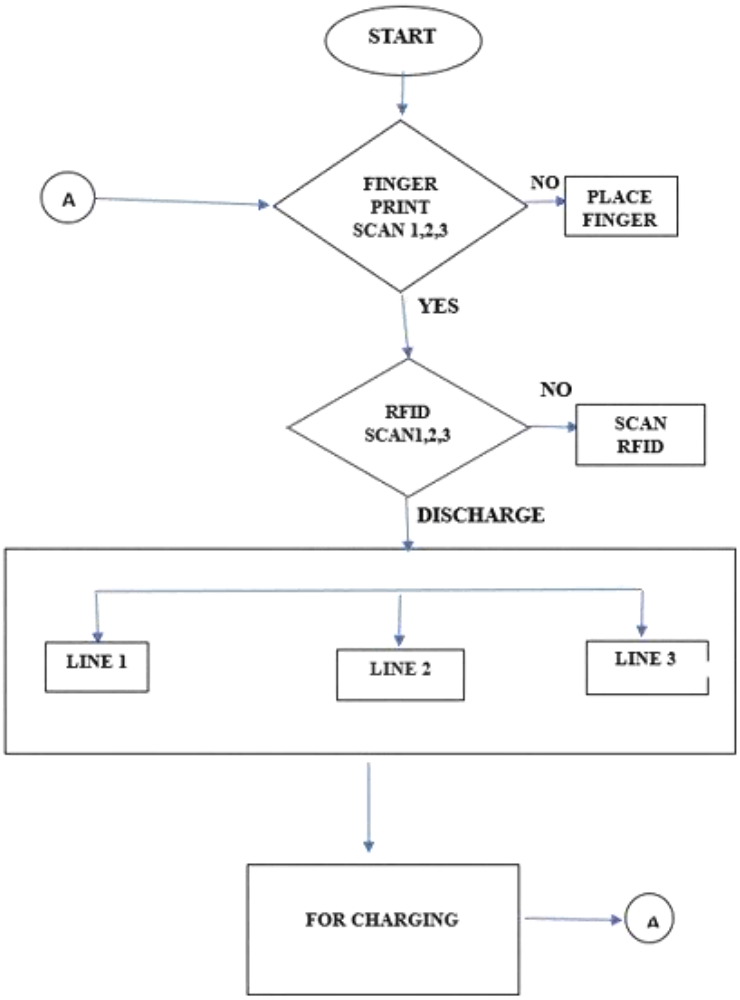


Fig 2: Flow Chart

1. Start: The process begins here.

2. Fingerprint Scan 1,2,3: The user places their finger on the scanner repeatedly (possibly at slightly different angles) to capture a complete and accurate fingerprint image.

3. Fingerprint Scanned (Yes/No): The system checks if a valid fingerprint scan has been captured.

Yes: If a valid fingerprint scan is captured, the process moves to the next step.
No: If a valid finger is not scanned it keeps on showing place finger on LCD.

4. RFID Scanned(Yes/No): The system checks if a valid RFID scan has been captured.

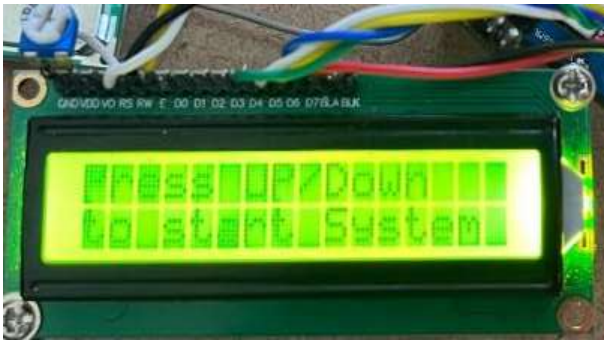
Yes: If a valid RFID is scanned, the process moves to the next step.
No: If a valid RFID is not scanned it keeps on showing scan RFID.

5. Discharge: If a valid fingerprint scan or a valid RFID scan is obtained (depending on the system's configuration), the process ends, likely granting access or performing a designated function.

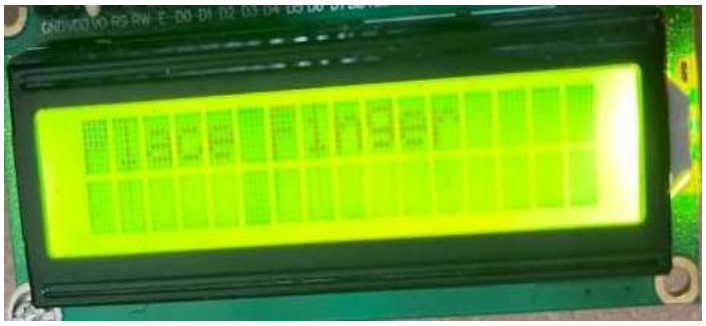
IV. RESULTS AND DISCUSSIONS

The following steps and the pictures shows the prototype working scenario and the outcomes of this System.

Steps to Discharge Line 1,



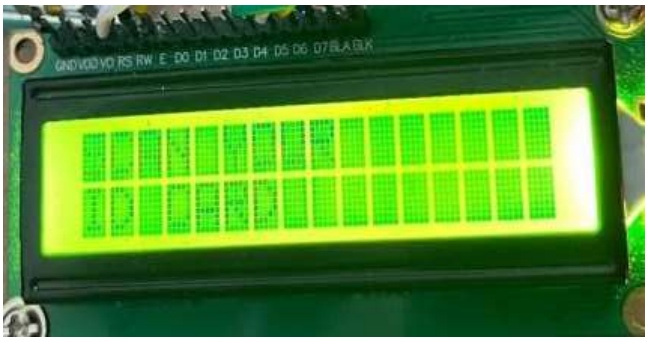
Step 1 : Display to show to start the system



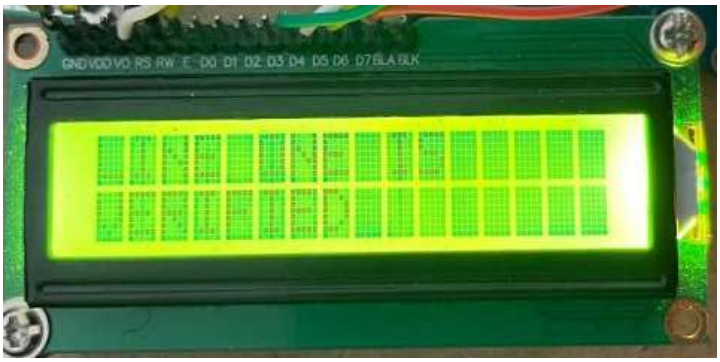
Step 2: Placing the saved finger's fingerprint on the fingerprint Scanner to discharge the line

Step 2: Placing the finger on the fingerprint Scanner To verify discharge the line

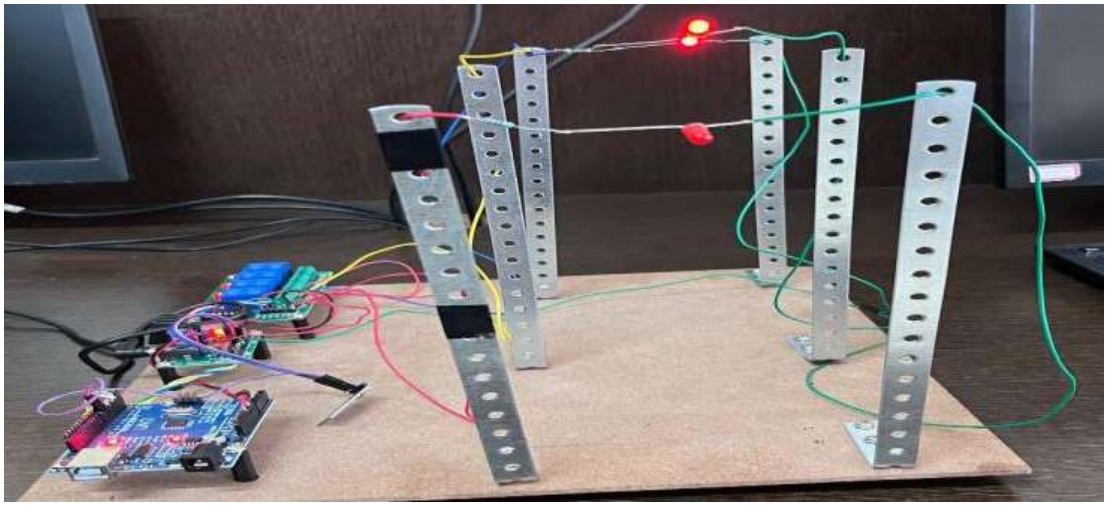
Step 3: Verification of the Fingerprint



Step 4: Scanning of RFID Cards to disconnect The Line, Two-step Authentication

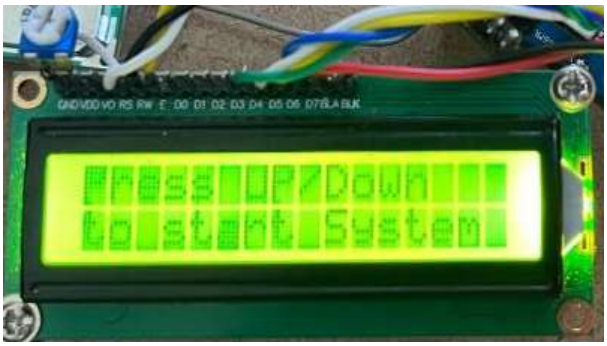


Step 5:After Verification of Card,Line One has got verified with the RFID Card and , Line one gets disconnected

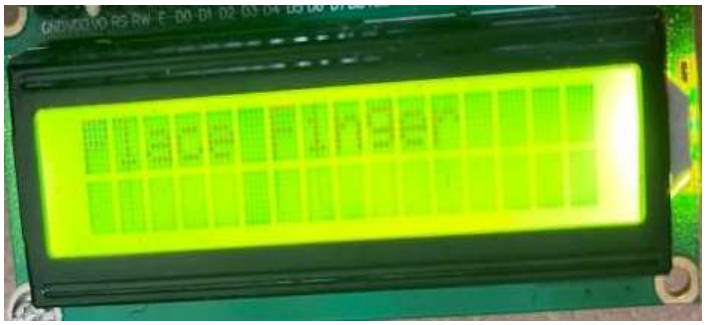


Step 6: Discharge of Line One

Steps to Discharge Line 2,

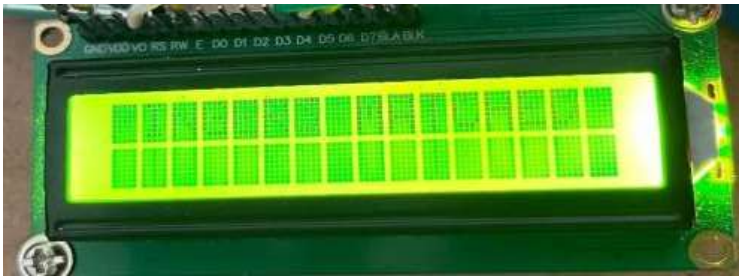


Step 1 : Display to show to start the system

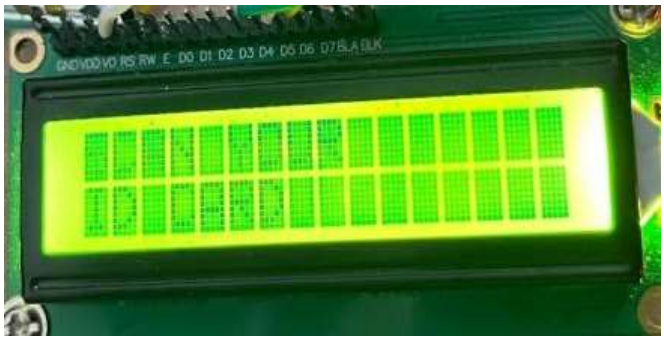


Step 2: Placing saved finger's fingerprint on the fingerprint Scanner to discharge the line

Step 2: Placing the finger on the fingerprint Scanner To verify discharge the line

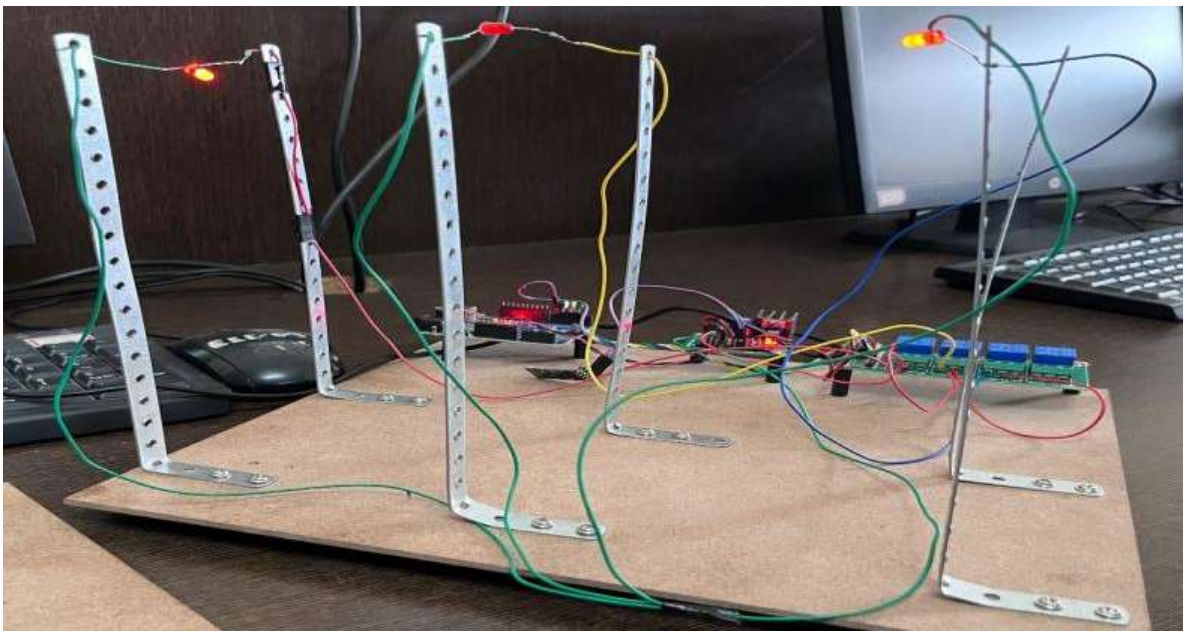


Step 3: Verification of the Fingerprint



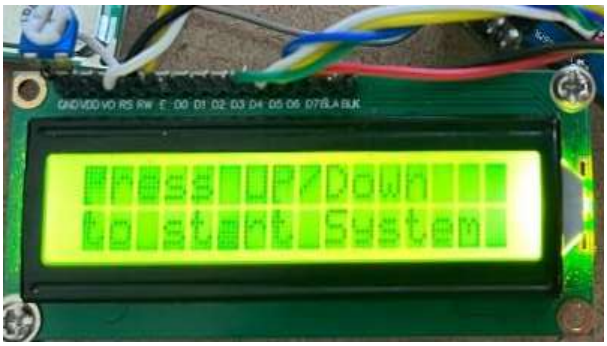
Step 4: Scanning of RFID Cards to disconnect The Line, Two-step Authentication

Step 5:After Verification of Card ,Line Two has got verified with the RFID Card and, Line Two gets disconnected

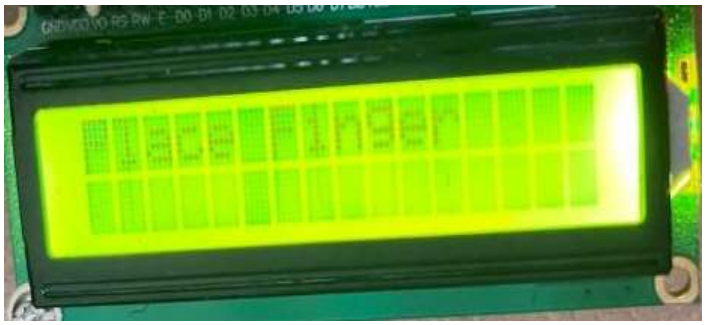


Step 6: Discharge of Line Two

Steps to Discharge Line 3,

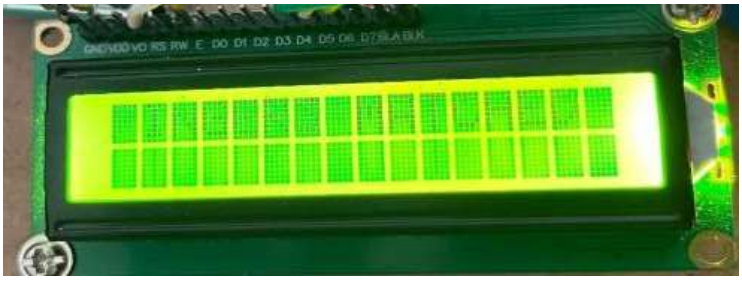


Step 1 : Display to show to start the system

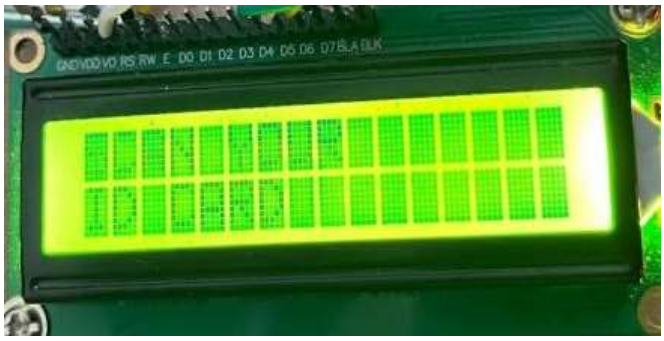


Step 2: Placing the saved finger's fingerprint on the fingerprint Scanner to discharge the line

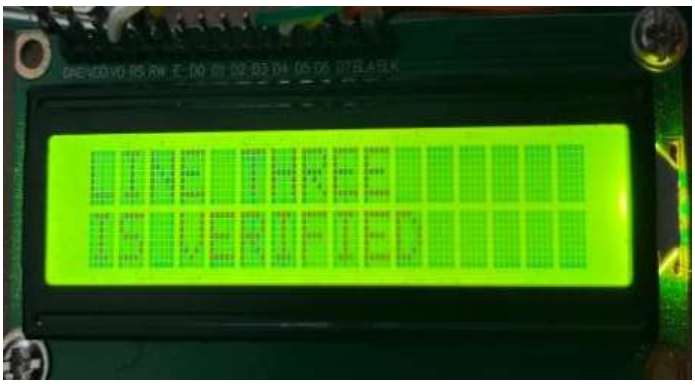
Step 2: Placing the finger on the fingerprint Scanner to verify discharge the line



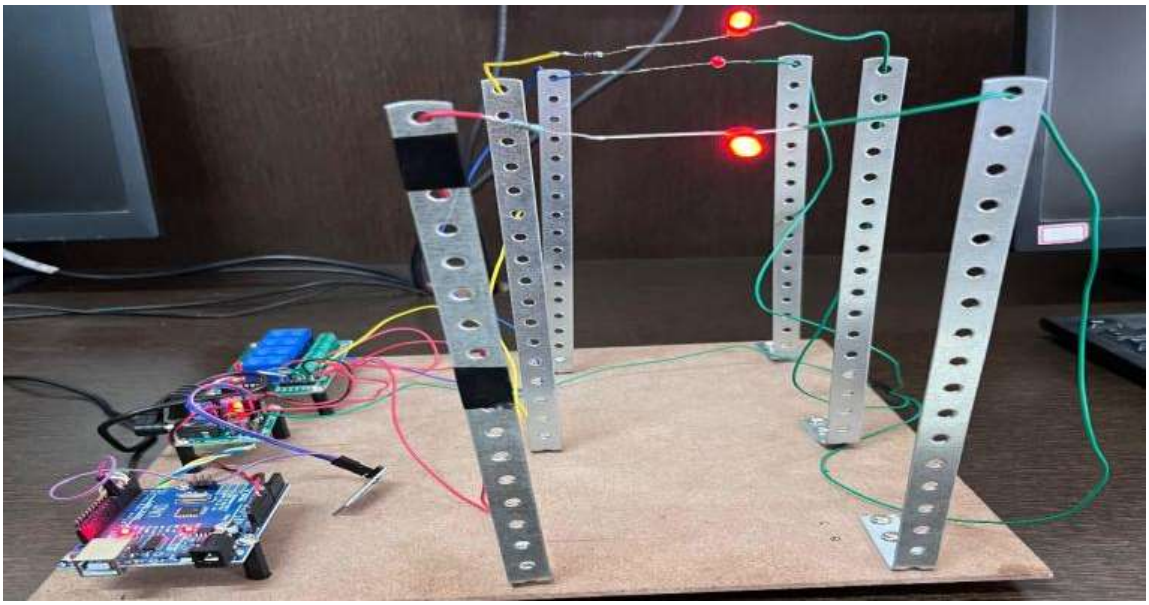
Step 3: Verification of the Fingerprint



Step 4: Scanning of RFID Cards to disconnect The Line, Two-step Authentication



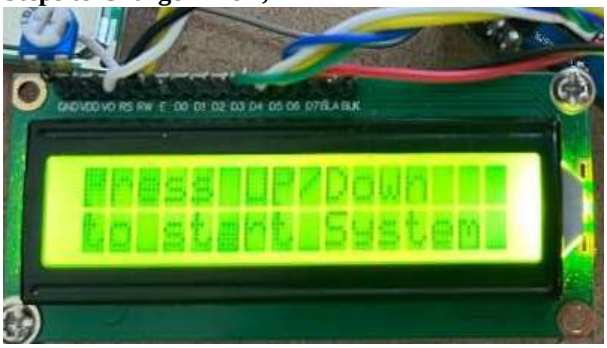
Step 5: After Verification of Card ,Line Three has got verified with the RFID Card and, Line Three gets disconnected



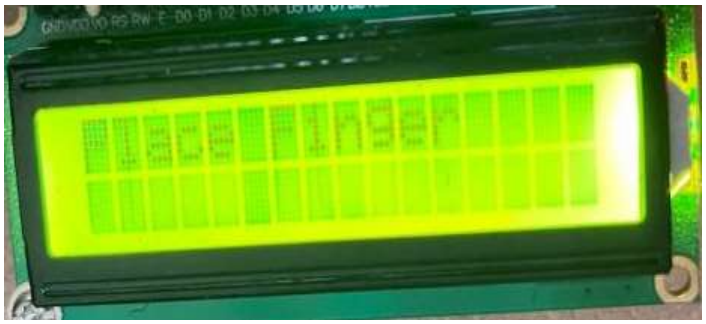
Step 6: Discharge of Line Three

After the completion of work the lineman has to Charge the Lines, So the Charging of the line is shown in the following Steps.

Steps to Charge Line 1,



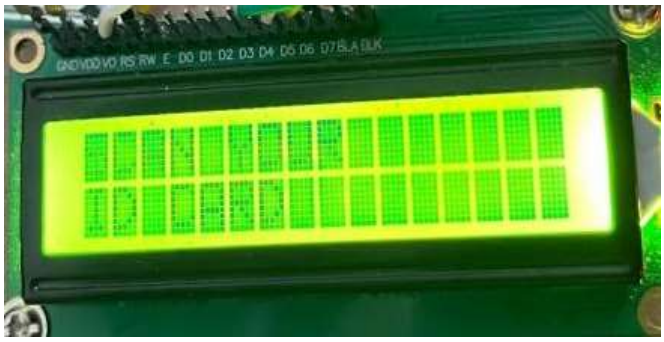
Step 1 : Display to show to start the system



Step 2: Placing the saved finger's fingerprint on the fingerprint Scanner to discharge the line

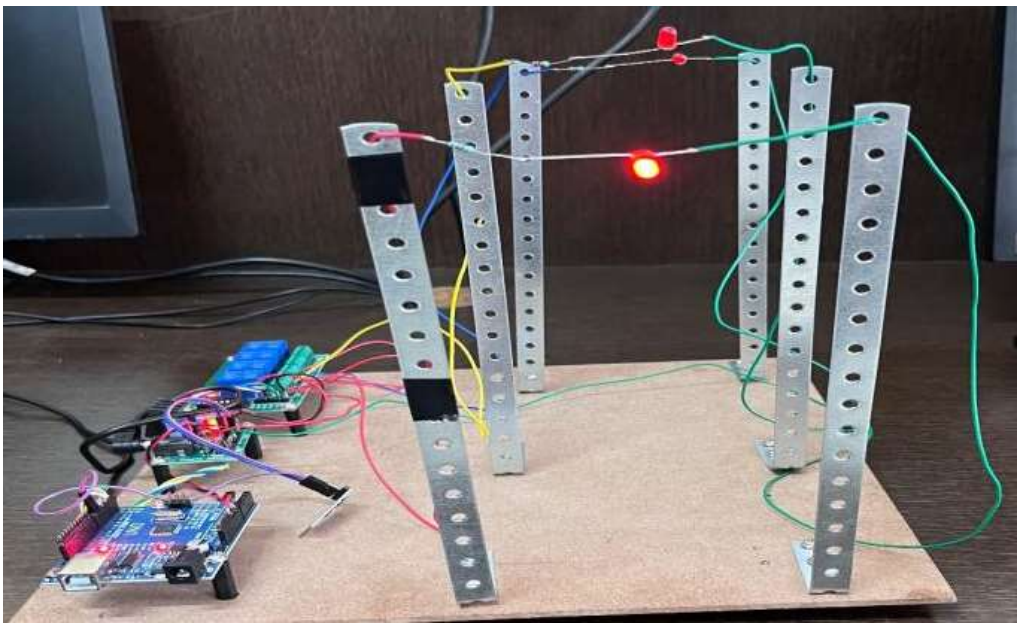
Step 2: Placing the finger on the fingerprint Scanner to verify to charge the line

Step 3: Verification of the Fingerprint



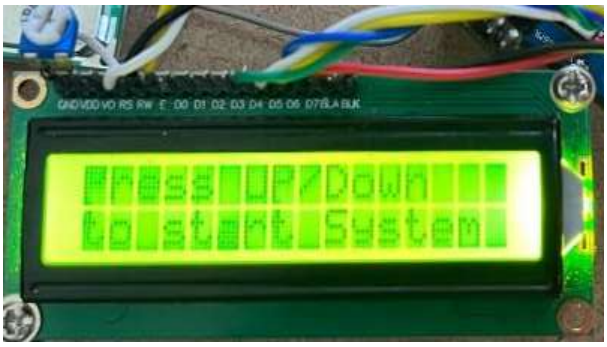
Step 4: Scanning of RFID Cards to connect The Line, Two-step Authentication

Step 5: After Verification of Card ,Line One is Charged

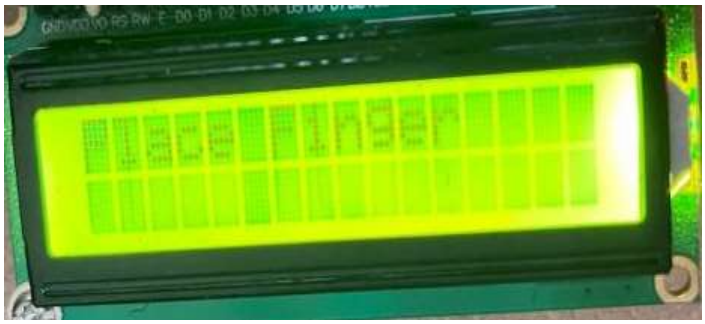


Step 6: Charging of Line 1

Steps to Charge Line 2,

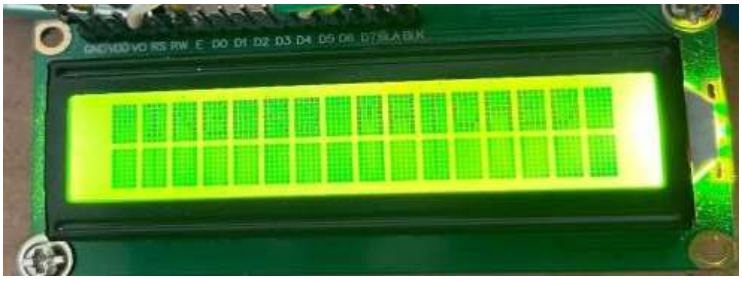


Step 1 : Display to show to start the system

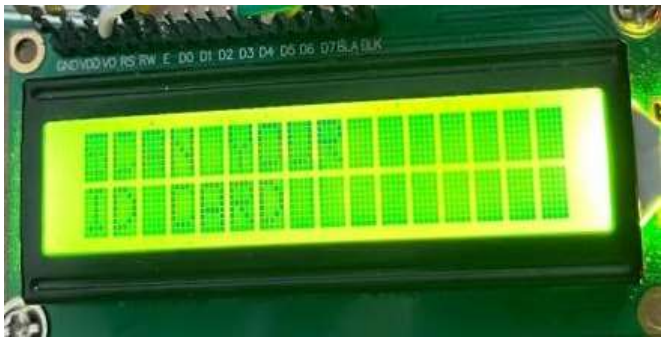


Step 2: Placing the saved finger's fingerprint on the fingerprint Scanner to discharge the line

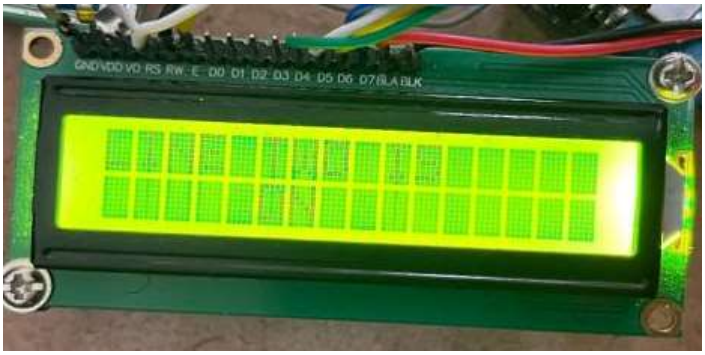
Step 2: Placing the finger on the fingerprint Scanner to verify to charge the line



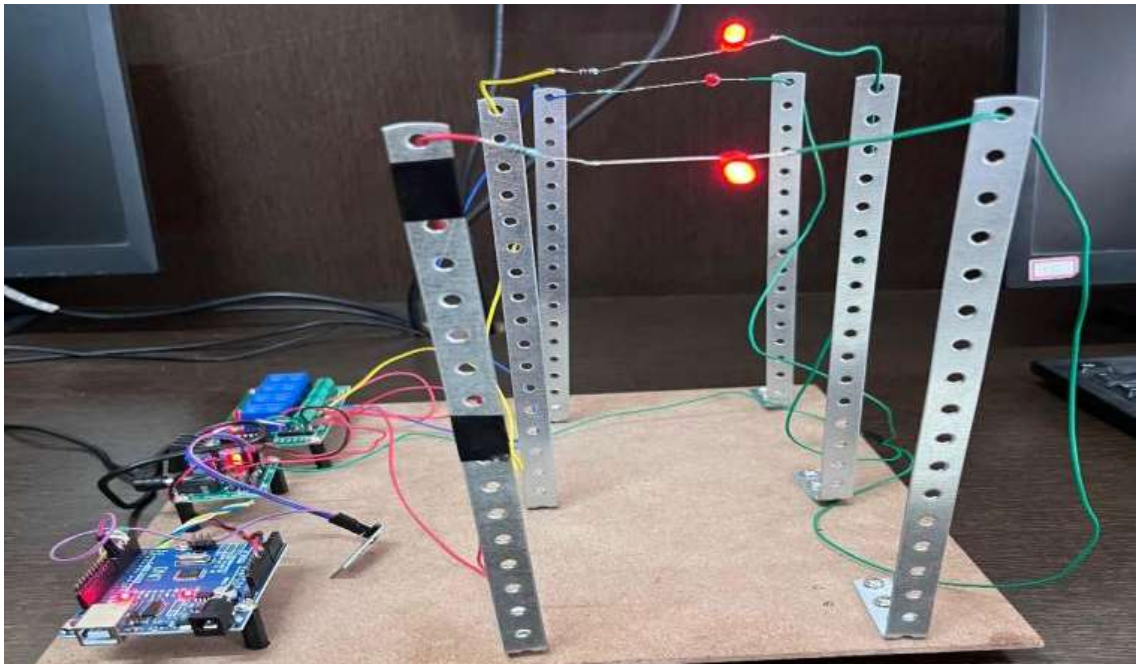
Step 3: Verification of the Fingerprint



Step 4: Scanning of RFID Cards to connect The Line, Two-step Authentication

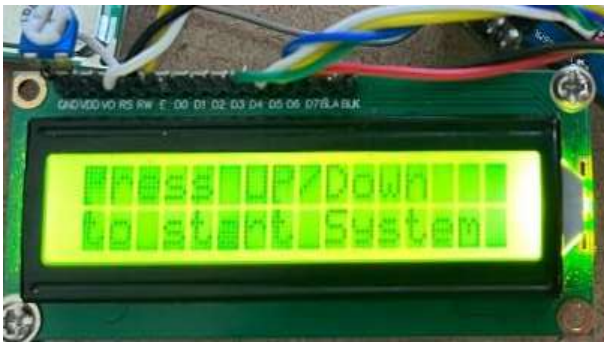


Step 5: After Verification of Card ,Line Two is Charged

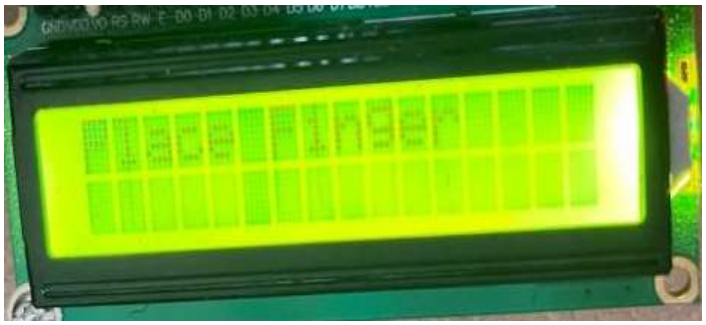


Step 6: Charging of Line 2

Steps to Charge Line 3,

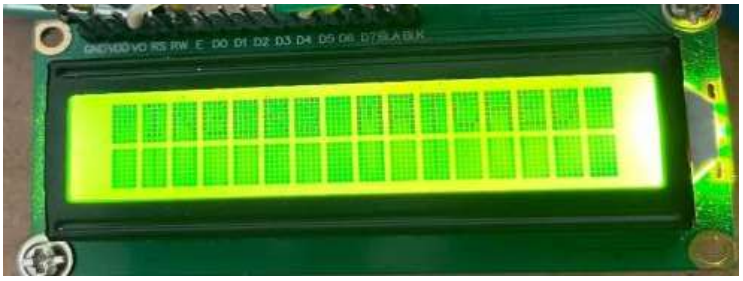


Step 1 : Display to show to start the system

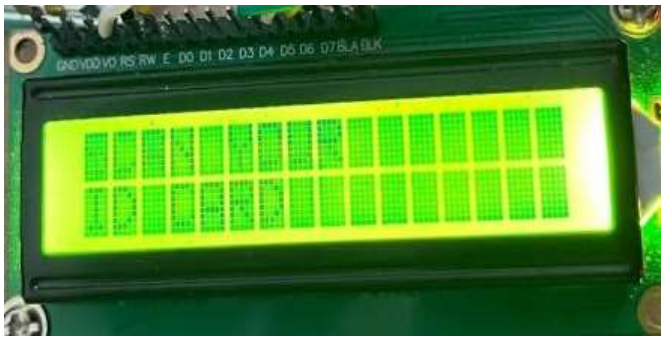


Step 2: Placing the saved finger's fingerprint on the fingerprint Scanner to discharge the line

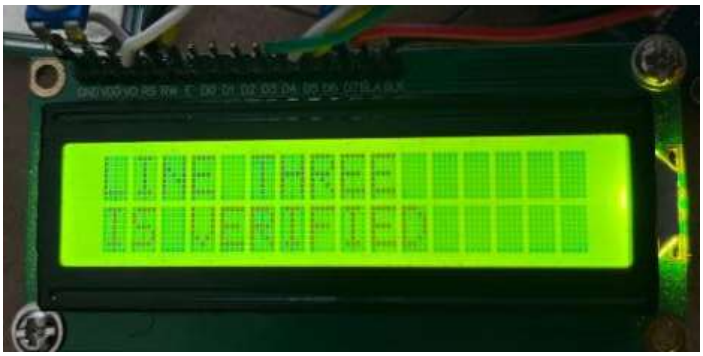
Step 2: Placing the finger on the fingerprint Scanner to verify to charge the line



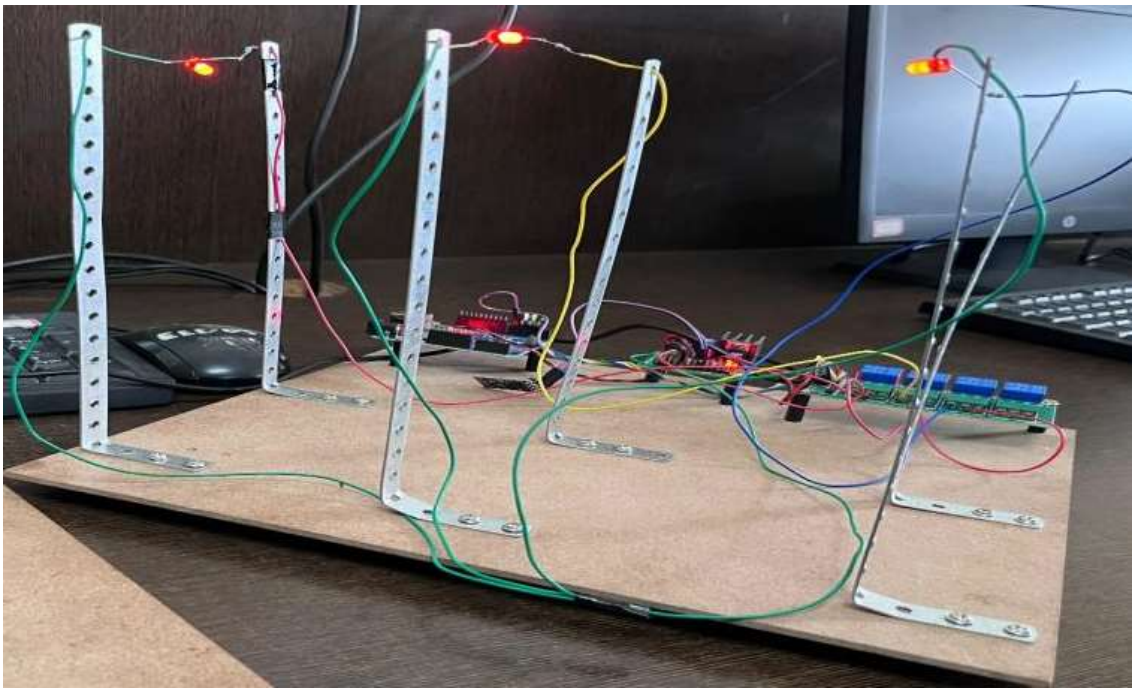
Step 3: Verification of the Fingerprint



Step 4: Scanning of RFID Cards to connect The Line, Two-step Authentication



Step 5: After Verification of Card ,Line Three is Charged



Step 6: Charging of Line 3

The following figures shows the Overview of the proposed system.

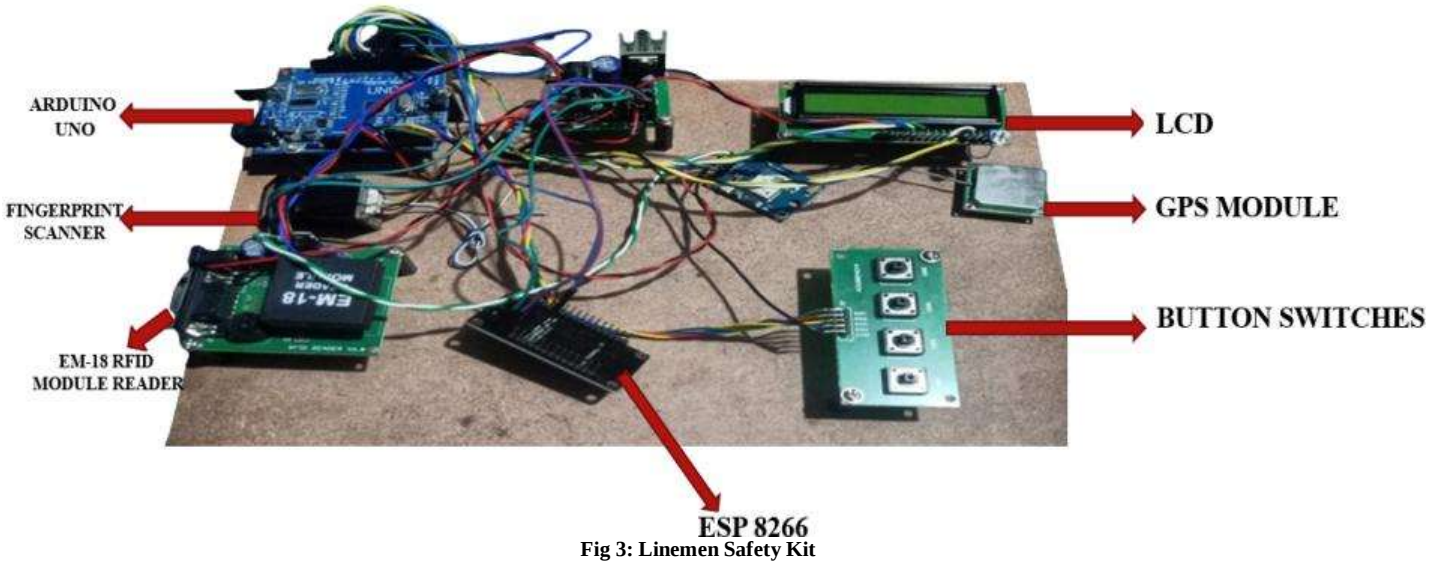


Fig 3: Linemen Safety Kit

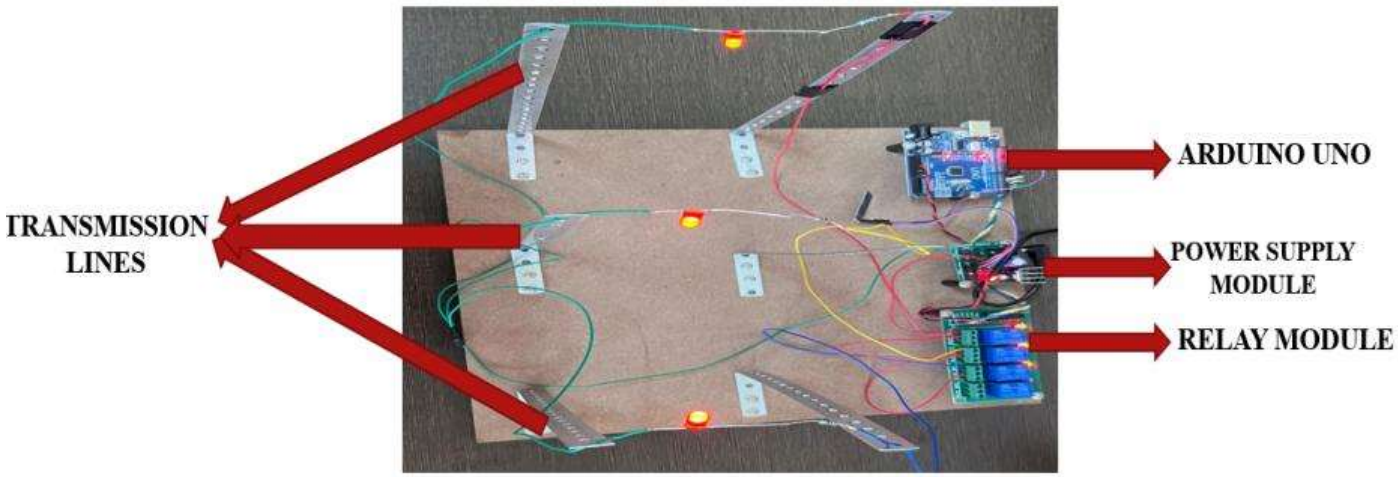


Fig 4: Linemen Safety Poles/ Lines

V. CONCLUSION

The creation and effective implementation of the suggested safety system constitute a critical turning point in guaranteeing the safety and health of linemen assigned to repair electrical lines. This device, which incorporates cutting-edge characteristics into its design, is a paradigm shift in lineman safety practices, especially with regard to preventing electric shock-related deadly electrical mishaps .By incorporating state-of-the-art hardware components and paying close attention to detail, the safety system not only solves current safety issues but also establishes a new benchmark for the industry. Its all-inclusive design guarantees that all aspects of lineman security are taken into consideration, so completely reducing the hazards related to electric line repair.

In addition, the effective execution of this safety system signals the beginning of a new phase of assurance and confidence for linemen as well as their supervisory teams. By preventing deadly electrical mishaps, the technology not only protects workers' lives but also makes the electrical infrastructure more durable and dependable. The significance of this safety mechanism cannot be emphasized as we look to the future. Its success is evidence of the ability of creativity and teamwork to tackle important issues in the utility industry.

VI. FUTURE SCOPE

The usage of IOT-based fingerprint-based circuit breakers can improve lineman safety in electrical power networks. Remote Control technology can be used to increase lineman safety in several ways. Linemen can operate electrical equipment remotely with fingerprint-based circuit breakers, which lowers the possibility of electrocution or electrical shock. By Monitoring real-time data on electricity consumption can be obtained using IoT-enabled circuit breakers, which can help detect any safety risks and facilitate preventative maintenance and repairs. By getting Alerts and NotificationsIf there are any electrical equipment-related problems, dangers, or alarms, lineman can receive alerts and notifications from fingerprint-based circuit breakers.

REFERENCES

[1] Ashish Prasad, Milind Kumar Sahu, Sindhu Suresh Kumar, Srijan Mishra, Tikeshwar Prasad " Password Based Circuit Breaker For Line-man Safety" published on 2023.

[2] Dr.Irala Suneetha, K.Amani, T.MuraliKrishna Reddy, U.Nithishna, D.Charan **"**Electrical Line Man Safety using Finger Print Sensor" published on 2019.

[3] Pramod M. Murari, Mahabal V. Kinnerkar, Prashant S. Koppa, Vishal S. Kamble, Rashmitha R. Mendan "Electric Line Man Safety with Password Based Circuit Breaker and Intimation of HT Wire Sag using GSM" published on 2017.