

A COMPREHENSIVE STUDY ON THE DEVELOPMENT OF AN AUTOMATED RFID-BASED SECURITY SYSTEM FOR RESIDENTIAL AND INDUSTRIAL APPLICATIONS

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ABSTRACT

The project's objective is to develop a fully automated security access system for both household and industrial use. Security is a key concern for both individuals and firms. In response to the demand for security, we have created an automated security access system that is easy for users to navigate. Automation is the most commonly written word in the domain of electronics. The need for automation has sparked numerous technological breakthroughs. RF communications is one of the technologies that has experienced significant advancements. The outcome of this process is the production of RFID cards that transmit a distinct identifying number. The RFID number can be detected using an RF reader. The level of access to the house or industry might be granted in its entirety or restricted based on the RFID cards. The determination of granting either full access or limited access is made by an onboard computer that is connected to the RF reader. The doors of the house/industry serve as the output module and are connected to the onboard computer via a motor. This onboard computer has a variety of input and output ports. The word typically used to refer to the onboard computer is microcontroller. The controller's input and output ports are connected to various input and output modules based on specific needs. Put simply, the microcontroller serves as a means of communication amongst all the modules in the project. The device is equipped with an LCD screen that provides information regarding the status of the doors, whether they are open or closed.

Keywords: Home security, Arduino, Internet of Things, RFID module, DC motor, Buzzer.

1. INTRODUCTION

Ensuring security is of paramount importance in the contemporary society. The Internet of Things (IoT) has been demonstrated to be a cutting-edge technology that is effectively addressing numerous security-related challenges. The Internet of Things (IoT) refers to a network of interconnected physical things that may be accessed over the internet. The entrance plays a crucial part in ensuring room safety. Providing a secure door system for residential and commercial buildings has become a crucial area of study. The objective is to implement a security system by integrating mobile phones and IoT through the use of RFID technology. Presented is an Internet of Things (IoT) based solution for room security, utilizing Radio Frequency Identification (RFID) technology. We will construct an Access Control System that utilizes RFID technology, specifically using Node MCU. The system can also be referred to as the Smart Lock System, which utilizes RFID technology. If you have visited large hospitals or corporations, you may have observed the utilization of RFID-based locks to limit entry to specific regions. The objective is to implement an intelligent locking system that can only be accessed by people with approved cards, while also keeping a record of users' entries and exits from the area using an online interface. Due of its internet connectivity, the device can be remotely managed from any location with internet access.

Therefore, it is possible to remotely monitor any room or property from any location. Ensuring the protection of homes has become a significant priority. Currently, residences are more vulnerable to a wide range of hazards, with burglary being a prominent concern. Therefore, home security is necessary. Home security necessitates a secure system for the entryway. The objective of this study is to address a specific security issue that currently exists in the world. Ensuring effective security solutions has proven to be challenging for individuals, despite the advancements in technology.

The Internet of Things (IoT) is gaining popularity in numerous major cities and is generating a multitude of groundbreaking impacts. The concept of a Smart door lock system has been suggested. Simply present the card to the RFID Reader box, and the lock will be automatically unlocked accompanied by an audible beep and a visual LED indicator. This DIY RFID Door Lock may be effortlessly constructed within the comfort of your own home and thereafter installed on any door of your choosing. This door lock is an electrically operated lock that opens when a voltage (usually 12v) is applied to it. Through this method, only individuals who are authorized are able to obtain the necessary clearance to gain access to the doors. The utilization of RFID

technology enables the system to distinguish between authorized and unauthorized users. Furthermore. The system's door status is continuously updated, allowing for remote monitoring from any location worldwide. This method allows only authorized individuals to receive permission to enter the doors.

Therefore, individuals have the ability to remotely monitor their residence from any location. A digital door locking system is built and controlled by an RFID reader, which verifies and validates the user's identity, allowing the door to open automatically. Additionally, it maintains a log of the user's check-in and check-out activities. Authenticating the user is crucial prior to accessing a secure area, and RFID technology offers a solution for this purpose. The system allows users to perform check-in and check-out procedures quickly, securely, and conveniently. The system comprises a door locking mechanism that is activated when the user's tag is brought into contact with the reader and the user's information corresponds to the data already entered in the database. The RFID system regulates the door's access by managing its opening and closing. This study employs RFID technology to offer a safe access solution for a given area, while simultaneously maintaining a record of the user. Thanks to recent advancements in registration and communication techniques, many applications that previously relied on isolated systems can now be interconnected in an Internet of Things (IoT) environment. This integration provides users with a more comprehensive view of the entire system and new ways to interact with their surroundings. The Internet of Things (IoT) has facilitated a shift from intelligent devices to smart homes, and now towards intelligent organizations and smart cities.

However, this progress also brings new challenges and risks that need to be addressed and handled. Individuals should actively participate in the advancement towards a society that combines human and machine elements. Consequently, it is necessary to design new human-machine interfaces (HMIs) and communication tactics. In the field of security, we utilize the Internet of Things (IoT) which offers valuable benefits to customers. customers have the flexibility to utilize IoT devices according to their own requirements.

Implemented to facilitate a seamless and rational link. The entrance control serves as a conventional interface connecting a security system with humans. The purpose of this system is to identify and recognize the presence of an individual, specifically by using one or more authentication methods, record the event in a database, and authorize access. The placement stage is employed when the sensors are capable of detecting the physical proximity of humans at the entrance control point. It pertains to the presence of several types of proximity sensors or cameras. During the verification process, the identification and differentiation of individual dependents rely on pre-existing data such as passwords, RFID, mobile applications, or responses to security questions. The approval stage can be fully automated, where access is granted or denied based on an algorithm without human intervention. Alternatively, this stage can be human-assisted, where the validation result and relevant information are sent to the system administrator. Ultimately, the administrator may or may not approve the access, with or without additional requirements from the applicant. Our primary focus is on enhancing security for unlock systems. Therefore, we are developing an Automatic door unlock system that incorporates advanced security features, all at an affordable price.

2. LITERATURE SURVEY

In [1], SMART DOOR LOCK SYSTEM By, Nayana R and Shashidhar R. This paper gives an overall idea about how we use fingerprints of an authorized person to enter in the room. The fingerprints of the authorized person are stored previously in the microcontroller, and a matching algorithm is used to check whether the person is authorized or not. If the person is authorized, OTP (One Time Password) has been sent to that person's mobile number using GSM. If an unauthorized person tries to enter the room, the buzzer will turn on indicating that someone is trying to access door. This system can be implemented to places where security place major role that is in banks, offices, etc. The main aim of this research is to provide high security with low cost, because security plays major role in our society in almost every sector. In [2], SMART DOOR LOCK AND LIGHTING SYSTEM By, Rahul Satoskar and Akarsh Mishra. In the proposed approach, a smart door lock and lighting system using IoT for smart home is presented. A smart door lock system is a system which uses digital password for opening and closing the door. The door lock is the foremost and endmost thing people come across in entering and leaving the home respectively, the home automation function in digital door lock system allows users to comfortably control and monitor home environment and situation all at once. It also allows users to remotely overlook the situation inside the house through World wide web or any other public network. A smart lighting is proposed which can be remotely controlled using Internet. In [3], ANDROID BASED SMART DOOR LOCKING SYSTEM By, Manish Kumar, M Hanumanthappa, T V Suresh Kumar and Amit Kumar Ojha. This paper gives detailed information about system in which we can unlock the door by using pre-decided password. It increases the security level to prevent an unauthorized unlocking done by attacker. In case the user forgets the both passwords, this system gives the flexibility to the user to change or reset the password. This automatic password based lock system will give user more secure way of locking-unlocking system. First the user combination will be compared with pre-recorded password which are stored in the system memory. User

can go for certain number of wrong combinations before the system will be temporarily disabled. The door will be unlocked if user combination matches with the password. The same password can be used to lock the door as well. This system will give the user an opportunity to reset his own password if he wants. In [4], PASSWORD BASED SECURITY LOCK SYSTEM By, Arpita Mishra, Siddharth Sharma, Sachin Dubey and S. K. Dubey. This work has considered about a secure access for a door which needs a password to open the door. Using keypad, it enters a password to the system and if it is entered correctly door is open by motor which is used to rotate the handle of the door lock. It will give three attempts to enter the password when it is entered incorrectly a t the first time. Some features like adding new users and changing old password are configure by the keypad. LCD module is used to display messages to the user. Now a day's most of the systems are automated in order to face new challenges and present day requirements to achieve good results. Automated systems have fewer manual operations, so that the flexibility, reliabilities are high and accurate. Hence every field prefers automated control systems, especially in the field of electronics.

3. EXISTING SYSTEM

In existing system of Security system r Design Smart Lock System using Bluetooth Technology [2] and their mainly focused on Bluetooth technology which is present almost all the gadgets. The system uses Bluetooth technology with low power, the design of system is over and special features to improve the security and the comfort of the users. To secure the patience health the proposed model implemented with IOT setup automatically sends alerts to doctor and relative in case of emergency.

4. PROPOSED SYSTEM

The basic idea behind building this work is building a system which includes a RFID reader in order to open the door. Once the door is opened by a Valid user, the data is entered on the web using ThingSpeak. The basic principle of RFID technology: the RF signal to be transmitted by the reader&writer is coded and loaded onto the high frequency carrier signal, and then sent out through the antenna. The electronic label entering the working area of reader&writer receives the signal. The relevant circuits of the chip in the card perform voltage doubling rectifying, modulating, decoding, deciphering, and then judging the command request, password, authority, etc. Finally, signal processed by tag according to the command. The data is stored on the ThingSpeak website and displays the user who have last entered the room.

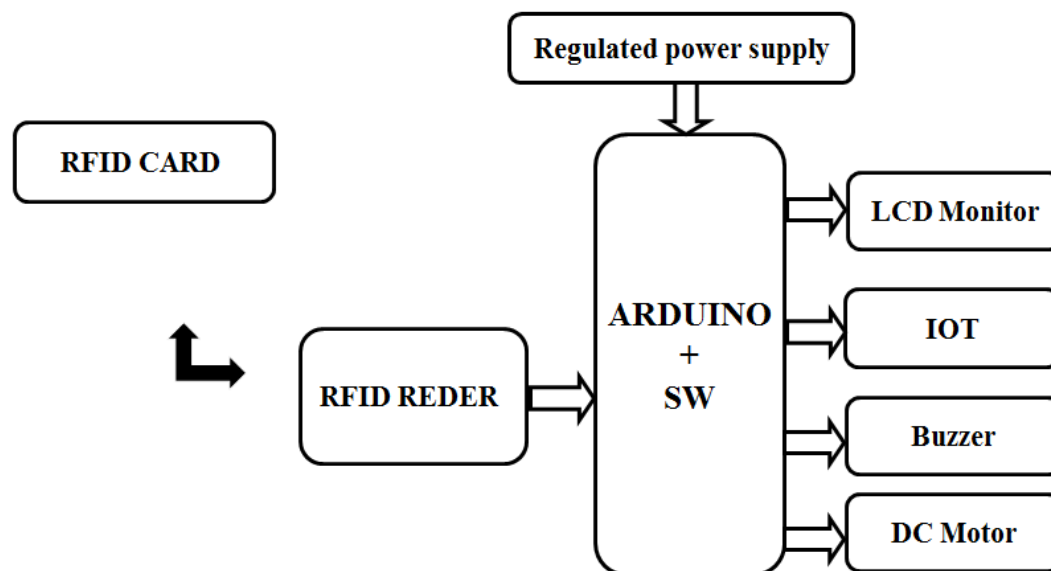


Fig.1. Block diagram

The objective of this work is to provide remote access to door lock system. The obvious motivation for providing such a kind of remote access to door lock is to make properties much more secure and enable it to automatically distinguish between a valid user and an intruder. This work also ensures that the owner need not worry about whether the door is left unlocked or not and hence ensures peace of mind for the owner. The proposed system aims to achieve Access control mechanism in a smart way. By using RFID the system will distinguish a valid user with an invalid one. Also, the system can be monitored from anywhere in the world due to the constant updating of the status of the door on web (ThingSpeak).

ARDUINO

The Arduino Uno R3 is a open source microcontroller board based on the ATmega328 chip. This Board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started. The recommended range is 5v to 12v for Arduino Uno.

FEATURES:

Microcontroller: ATmega328P, Operating Voltage: 5V, Input Voltage: 7-12V, Digital I/O Pins: 14 (of which 6 provide PWM output), Analog Input Pins: 6, DC Current: 40mA, Flash Memory: 32 KB, SRAM: 2 KB, EEPROM: 1 KB, Clock Speed: 16 MHz.

LCD MONITOR

Liquid Crystal Display used to display the parameters for status of the proposed system. This can display 32 characters having 2 columns. When each sensor is activated corresponding message will be displayed in 16*2 LCD modules. In this we use four data pins using this pins we transfer the data from micro preprocessor to LCD.

IOT- MODULE

Internet of things used for controlling any device or monitoring the device status through internet. This proposed system we use this IOT module for taking the all parameters data and post into the cloud called server. ESP8266 modules as IOT module it can operate through Wi-Fi frequency concept.

BUZZER

Buzzer is the output module for alerting of any parameter changes. if any sensor increases the threshold value or if increases then microprocessor alert us by using this system.

SOFTWARE

Software is the important parameter to make the device automation. In proposed implementation we used embedded c programming language and compiler arduino IDE we used. Here we used arduino IDE software for programming write up and execution of entire system.

RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays found extensive use in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device triggered by light to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".

DC MOTOR

A dc motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy, is accomplished by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input of a DC motor is current/voltage and its output is torque (speed).

The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Figure shows a picture of a typical DC motor, Figure shows a picture of a DC armature, and Fig shows a picture of a typical stator. From the picture you can see the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. You should also notice that the ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commutator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

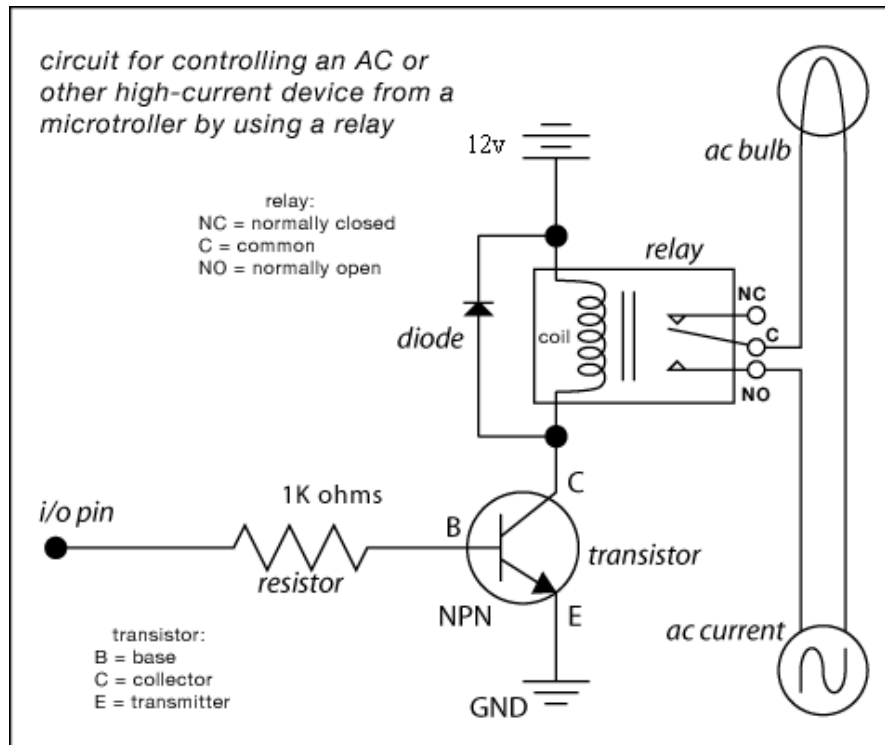


Fig. 2: Relay circuit diagram.

5. EXPERIMENTAL RESULTS

The actual working of the system starts when a user holds an RFID tag card over the EM-18 reader. The reader tries to scan the card. There is a possibility that the card held by the user is not an RFID tag but something else like id card, college card, atm card, etc. In that case the RFID reader is not able to recognize the card. If the card is to be an RFID tag, the scanner receives the 12 digit number from the tag and then passes on to the microcontroller i.e. Node MCU. Then the microcontroller runs the script to send the data on web.

Once the scanning is done a buzzing sound is made to notify the user that the card has been scanned. Based on the code installed, the microcontroller either recognizes the tag number or it doesn't. If the tag number is not in the code it sends a signal to the LCD to display that the user is invalid. Also the system alarms thru the buzzer, notifying that the card is invalid. If the tag number is present in the code, LCD displays the User details and the card number on the screen. The servo motor is then signaled and it is rotated in order to open the door. After few seconds the motor is rotated back to close the door again.

While the data is being uploaded, the LCD displays "Uploading on Web". Using the API key of the ThingSpeak account, the microcontroller sends the data to the server. The received data is used to get a visualization. The visualization depicts when and which user had accessed the door. After successful uploading the data on web (after 18 seconds) the system is ready for scanning next tag.

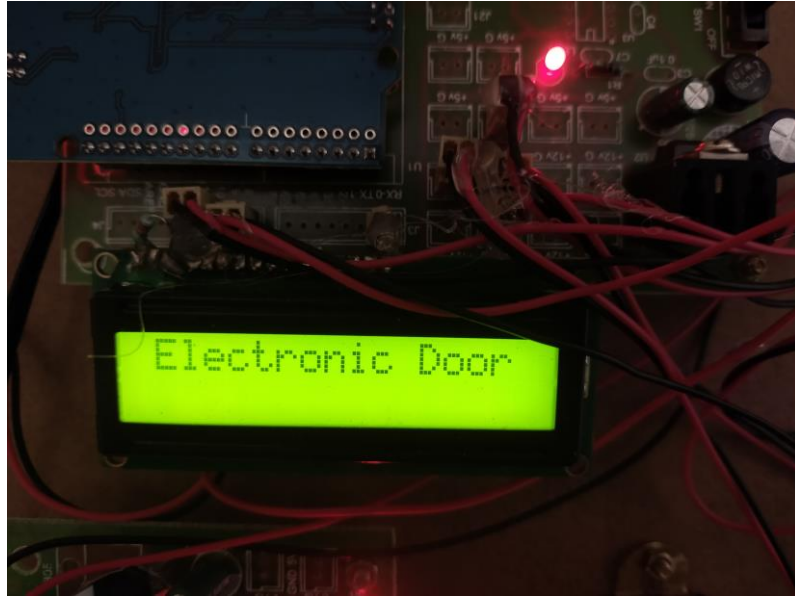


Fig. 3: Hardware setup

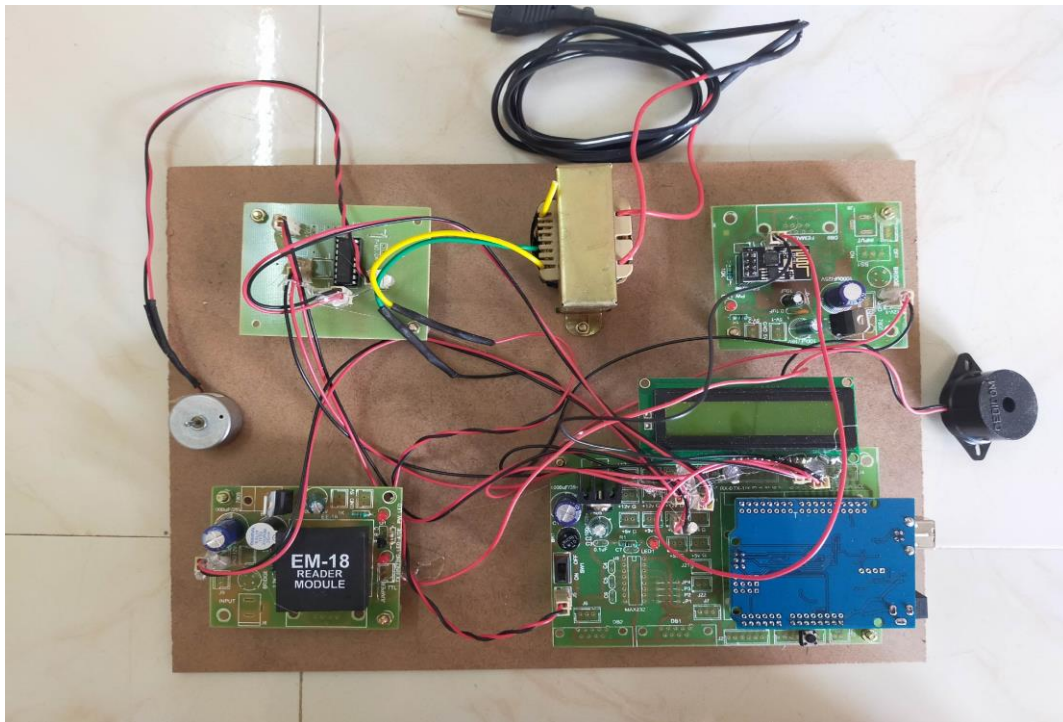


Fig. 4: Overall hardware setup.

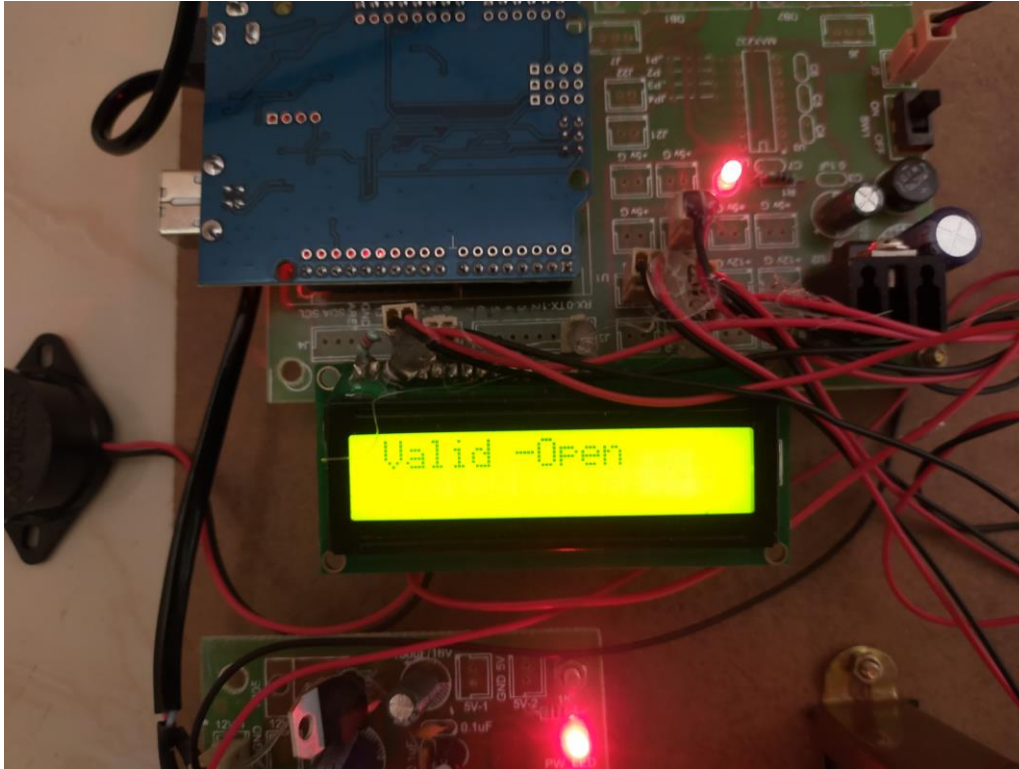


Fig. 5: Displaying output on LCD.

6. CONCLUSION

A smart secure electronic door opener system is presented which is a novel access control system using IOT which includes the online monitoring. The smart lock system provides a convenient way to automate the access control feature thereby enhancing security and enabling the owner of the property carefree. It is a low cost, flexible, and a very easy to install system with no overhead like planning, cabling, and construction works. IOT Technology gives more security and user benefits Compare to Bluetooth Technology. In our project we provided the security to the user by Password, RFID and IOT. If the door is unlocked, then the notification window will come to the user.

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