

ENERGY EFFICIENT LIGHTING DESIGN - A CASE STUDY OF JIGME NAMGYEL ENGINEERING COLLEGE

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Abstract— Home Automation Systems are sets of interconnected devices for controlling various functions within a house, such as lighting, heating, air conditioning etc. Mobile devices are suitable for offering a user interface in a Home Automation System because of their portability and diverse capabilities. Wireless Home Automation has been a positive inspiration for new construction as it is easier and effective to use. This Project Report presents the implementation of the wireless technology for controlling the Home Utilities, Home Security System with specific features and door lock system by using scanning technique. In this system, with the help of app, we can control Home Utilities wirelessly that intelligently communicate with one another through a wireless device. In addition, that we have installed motion and gas detector for security purpose with special features like notifying the owner with message and beeping the buzzer. Lastly, we are also installing door lock system for better security using fingerprint that will allow only authorized user to access the home.

Key words: home automation, finger print, security, wireless technology, MQ9 Sensor, PIR Sensor and Bluetooth.

1. INTRODUCTION

Home automation is a method of automating home appliances and other household function that can be operated wirelessly making it easier and more effective for lighting, heating, and controlling other home appliances. [1] have rightly stated that “Automation entails more than just transferring human tasks to machines; it also entails a thorough reorganization of the work process, through which both human and computer functions are redefined.” The idea of automating home has become one of the fastest-growing technologies.

The research team[2] have found out that more people have shown interested in the idea of remotely monitoring and controlling their household devices such as door lock system and tracking disasters such as fires and intruders by setting alarms and notifying the owner[3]. The concept of modern smart home was hypothesized early in 1950’s by science fiction authors about a future where smart devices will be available in every household, regardless of their social status or living condition [4]. Now as expected, with aid of advance technology like AI and IoT people have introduced the smart home rendering everyday activity to automatic.

Anything connected to a network, such as lights, fans, and other electronic devices, can be operated remotely using a smartphone or a biometric tool, such as speech, app[5]. Furthermore, an automated home makes life simpler and more comfortable for all, particularly the elderly and disabled[6]. There are several benefits in automating daily activities assuring comfortable, safety and secure [7]. Smart home technology makes life easier for homeowners while saving time and money on materials [8]. As a result of technological advances, new security risks arise, resulting in property damage or theft. To avoid and protect the properties, a variety of devices are designed to work together to detect threats and alert the homeowner[9] through visual or audio signals or making biometric door lock system in a doubling the security ([10]In other words, smart home protection aids in the security of our property and alerts the homeowner if any issues arise.

Related Works: According to [11]GSM Based Intelligent Home Security System for Intrusion Detection is GSM based project using PIR motion sensor and gas sensor. 2051 microcontroller was used to interface between two system and communication between them. Here the PIR motion sensor will detect the movement of intruder and send the signal to microcontroller and then sends out a warning signal to Buzzer [12]. Magnetic sensor works to detect intrusion through doors and windows and LM35(temperature sensor) use to detect the changes in temperature beyond the certain limit to ensure home safety as well as security [13].

top of that, in [14]project which is microcontroller-based project that includes doors On automation with password protected lock, temperature control fan, automated water pump, water tap and shower, light, anti-theft security and primary fire protection using various sensors like LDR, smoke, pressure, heat and object sensor. On the other hand, as per [15]Smart Security System Based on Wireless Sensor Network and Third Generation Technology is developed and implemented as an integrated wireless sensor, which is divided into three different phases. The first phase is Wireless Sensor Network WSN; it contains fire and motion sensors, water pumps and doors connected to the network using zig-Bee technology. The second phase is the central server, which let the users control and monitor buildings by Wi-Fi technology. The last phase is the tele-controlling subsystem, which allows users to monitor and control the whole system using 3G network.

As a result, the highest degree of security can be maintained at home. This protection can be used not only at home, but also in places where sensitive documents are stored. The bank vault also holds records and archives. Several studies have been conducted on the topic of home automation in various areas of life. 'On and off' lamp power and variable speed fan control are only a few of the many facts of life. [16]Purpose on using hand-held interactive Voice-Controller instead of LCD and Keyboard example while purposed on

developing ZigBee-based home automation using voice control system. If user want to light the bulb, he/she can use user speech to do the work instead of physically switching the switch. The ZigBee required low data rate, longer battery life span and secure networking. The overall system is controlled from the microphone which is connected with HM 2007 speech recognition chips. The audio signal from the microphone will be input to the HM 2007 recognition chip. The HM 2007 chip will determine the command and if it is valid then it will pass the command through the control unit and ZigBee to remote station where the match command is performed [17]. [18]They have done analysis and implementation of the wireless home automation technology using the Global system for Mobile Communication (GSM Module) modem to controlled the home devices such as light and security system via Short Message Services (SMS) text messages is presented in this paper.

The PIC16F887 Microcontroller with the cooperation of GSM provides the smart automated house system with the desired baud rate of 9600 bps. This same project is done using the GSM Modem [19]. Purpose stand alone, low cost and flexible GSM-ZigBee based home automation system mainly to reduce the system's complexity and lower fiscal costs. System was built in such that it provides flexibility and scalability. ZigBee technology is designed to be used on applications that requires low data rate, low-cost, low power consumption and two-way wireless communications. GSM is a cellular network.

The combination of this technologies was used as it has a potential to provide a comprehensive home automation solution. According to [5]use the infrared technology that use a voice command base on the voice recognition system and infrared sensor that measure the infrared light emitted from remote control. The signal transmission via IR transmitter and the control unit received this signal by IR sensor to control the TV receiver then get a full remote control that work by voice command. Bluetooth-based home automation system to controlled the home devices by using an android phone apps which gives the user's ability to control their home devices.

Bluetooth-based home automation which uses an Arduino Mega 2560-R3 board and home devices are connected using the relays. The Bluetooth module is used to enable the controller to wirelessly communicate with an Android phone and home appliances are wired connected to the relay[20]. This similar project is done which is also base on Bluetooth home automation but it uses MQ-2 gas sensor to monitor CO2 content in the house[21].

[22]It is proposed to design and implementation of Wi-Fi based home automation system. This paper presents the prototype implementation of new home automation system that uses the Wi-Fi technology as a network infrastructure to connect its parts. This proposed system consists of two main components; the first part is the web server which presents 6 the system core and secondly part is hardwired interface module. The similar home automation is done using the Wi-Fi module ESP8266 [23].

Personal protection systems, such as the incorporation of video monitoring, door lock access control system based on authorization details to prevent access disputes in customized monitored areas, are emerging for the safety and security expanding to personal social security to secure every individual's personal information, valuable items, and day-to-day activities. Proposed a surprisingly secured and dependable smart bank locker safety device based totally on RFID, Biometric fingerprint, password and GSM generation. Such system can be introduced in financial institution, workplaces (treasury), schools and houses [1].

In this safety device RFID, the person will sign up his user call, password and his cellular number, then the man or woman will be placed finger on finger print module and finger print may be scanned and stored with fingerprint id [4]. On this manner consumer enrolment method could be finished. Then consumer will perform login operation and gives accurate result that if it valid or not the LCD is used to check the status of each embedded security device[14]. And also [10]designed a smart door locking system in order increase the security and constantly provide the security service using a registered password especially for big resources, wealth and highly secure documents.

The system was designed using Arduino Uno, servo motor and LCD screen where the security code or password as a key to open the door. [22]has designed Smart Door Locking System using IoT using Arduino Nano, Biometric Sensor, smartphone and savvy to prevent unauthorized access and trespassing that usually targets to place such as office, Bank, organizations and shops. In addition to door lock system, they used fingerprint is secure method to access or open the door. Tech-savvy locks are made utilizing biometric sensors were so expensive so in order to have low-cost biometric structure, smart phones with fingerprint sensor were used to make a model as smart phone with fingerprint sensor were common.

2. METHODOLOGY

By doing little research on topic 'Home Automation' we proposed our idea and its was accepted. As soon as it was accepted, we started doing literature review and come up with tuned methods with block diagram and required materials. Once we are confirmed with materials, we started with simulation on various software such as Tinker Cad, Friezing, MIT App inventor and Proteus. Then, started testing of components and prototype and installation.

2.1. Block Diagrams

In this block diagram control unit is programmed and it is interface with Bluetooth Module, which are connected through relay, when we send the commands through Bluetooth from a mobile phone. A feedback circuit is also designed and implement to check the current status of the device after it receives the command from mobile phone. Once the command has sent to turn on the device, then the feedback circuit first check the current status then send the command to turn on and the circuitry led indicates the turn on device, otherwise the device indicate the malfunctioning that the command was not executed successfully.

The above figure is the block diagram of gas and motion detector, the two sensors have been used. The PIR sensor will detect the motion of human being and the signal will be send to the Arduino Uno which will turn on the buzzer and the LED, indicating the presence of detection of human motion. While the gas sensor will detect the flammable gas leakages and the signal will be interpreted

by the microcontroller which will turn on the buzzer 2 giving an alert to the people around. The buzzer used for the motion detection has the different sound system than the buzzer that is used for the gas detection so that the people will be specified about the situation.

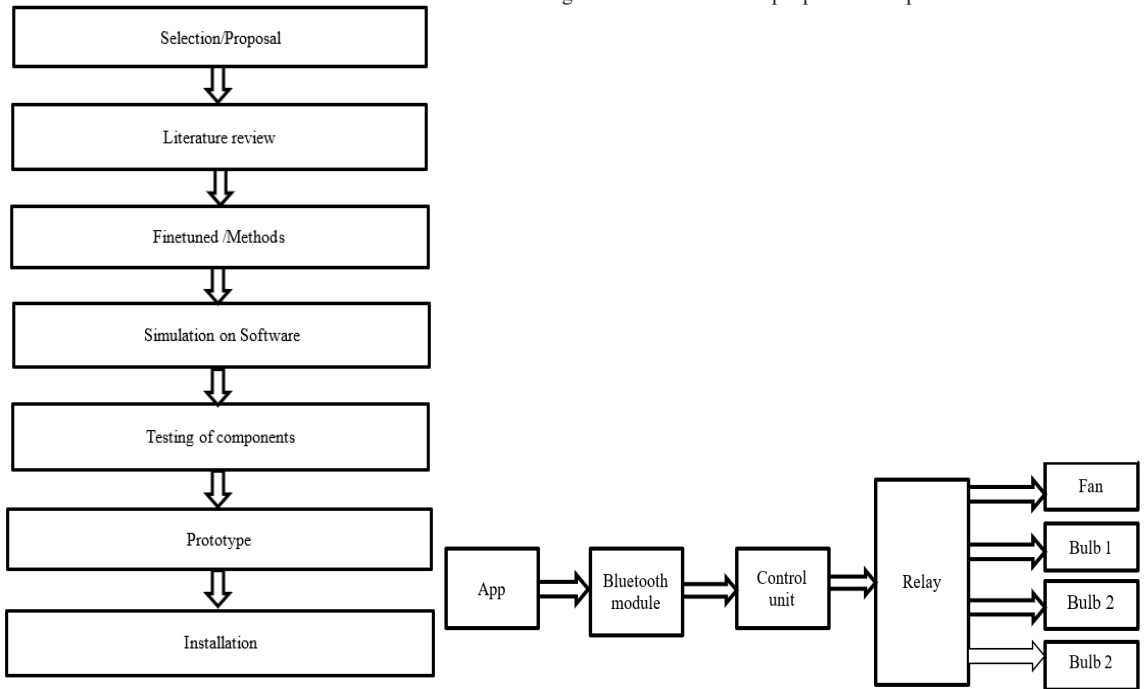


Fig. 1. Over view of project

Fig. 2. Block Diagram for Controlling Home Utilities

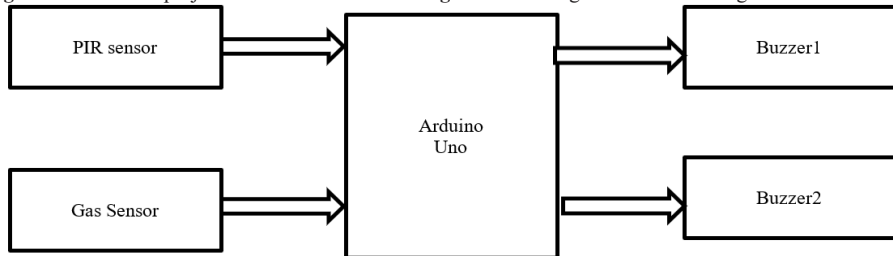


Fig. 3. Block Diagram for Gas and Motion Detection

The Power is supplied to Microcontroller (Arduino Mega) on which the algorithms for the function of automatic door scanning. The fingerprint sensor is placed outside of the door and is electrically connected to the microcontroller. On the other hand, the servo motor is placed inside the door which will give responses according to scanning and microcontroller. For the operation part, the particular visitor has to scan his fingerprint for registering personal finger ID in the database. So, if the visitor is eligible after registration, then he/she can get access to entrance after scanning the finger. However, the particular visitor will be notified by Liquid Crystal Display with a line of instructions.

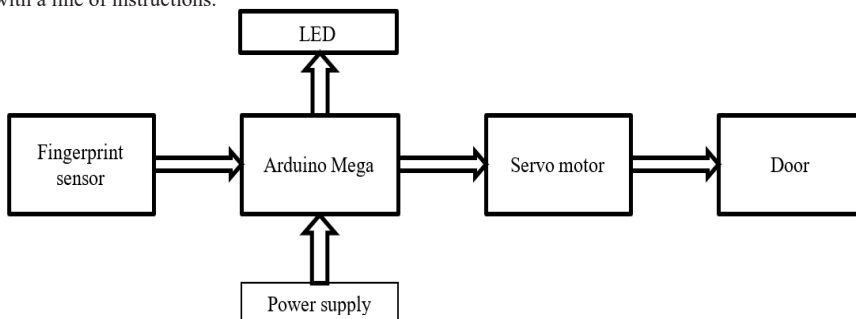


Fig. 4. Block diagram for Door Locking System

2.2. Flow charts

The system will start and collect the information from two sensors. The PIR sensor will collect the data related to motion while the gas sensor will sense the level of gas. If the motion is detected then the buzzer will turn on if not it will go to first and start collecting the information once again. Similarly, the gas sensor will detect the level of gas and buzzer will turn on if it is above threshold level, if not

it will once again go to first and start collecting data. This system will help to reduce the risk to both the human being and our property.

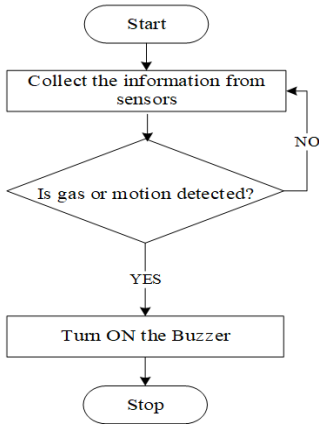


Fig. 5. Flow chart for gas and motion sensor

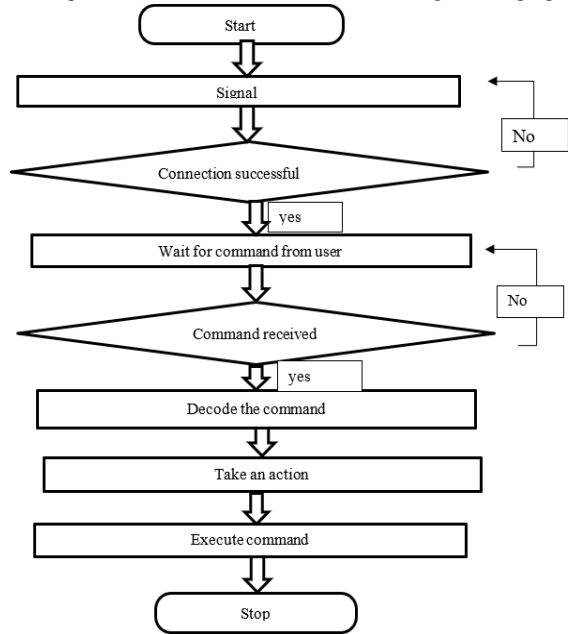


Fig. 6. Flow chart for Controlling Home Utilities

The above flowchart shows that moment when wireless signal is found it will check whether the connection is successful or not. If it is successful than it will wait the command from the user such as turn ON or OFF the devices. When the command received it will decode the command and it automatically take an action which means that Fan or Bulb will turn ON or OFF as per the command received and execute the command.

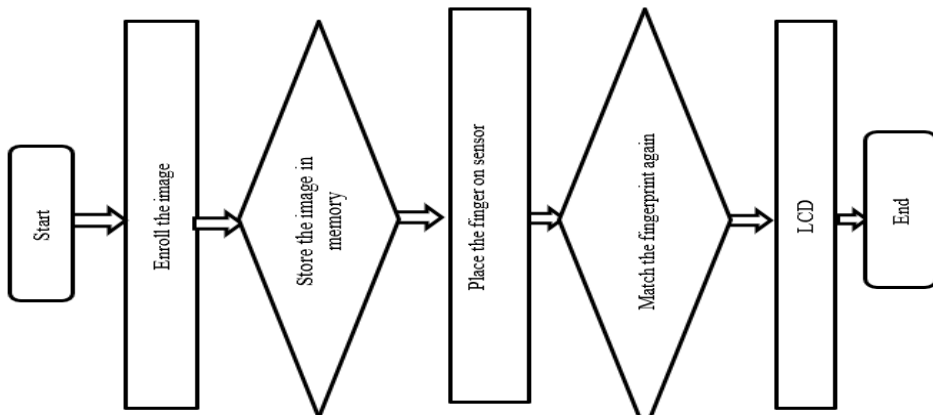


Fig. 7. Flow Chart for Finger Print Door System

When the user starts the system, the first operation will be the enrollment of fingerprint image of all the authorized users. For accessing, the users then have to place the finger on the sensor to match with the stored image in the sensor’s memory. If the user has his/her fingerprint already stored then the permission will be granted and a message will be displayed on LED. If the user is unauthorized, where the fingerprint does not match then the user will be once again asked to place the finger on the sensor

2.3. Simulation on Software

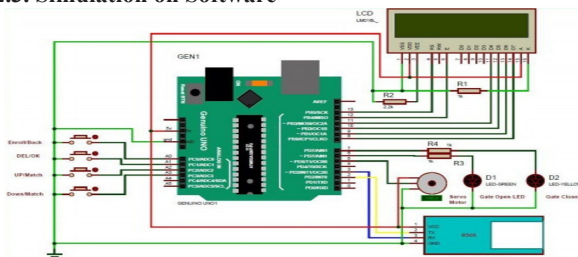


Fig. 8. Door Locking System Simulation

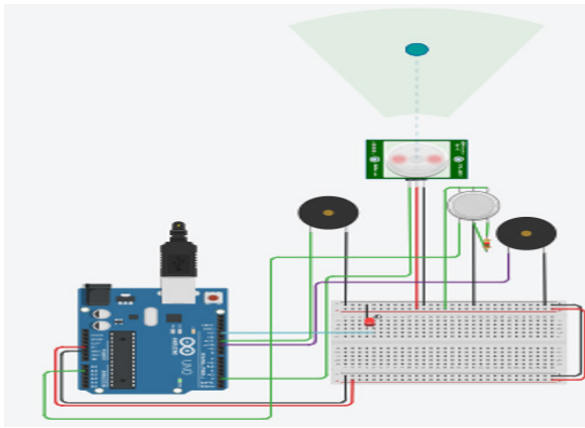


Fig. 9. Simulation After Motion Detected

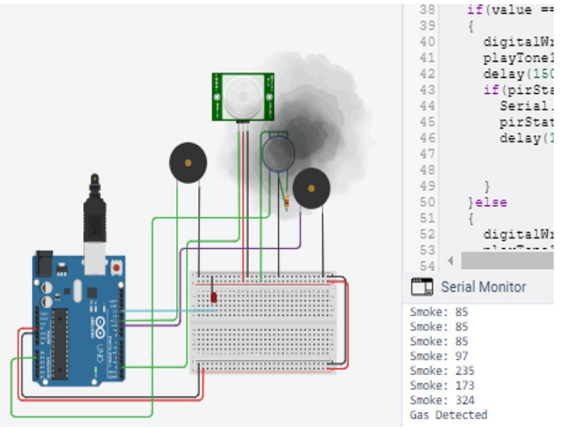


Fig. 10. Simulation After Gas Detected

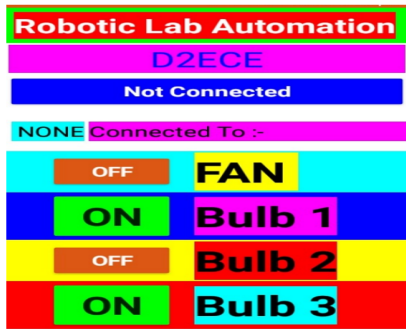


Fig. 11. App

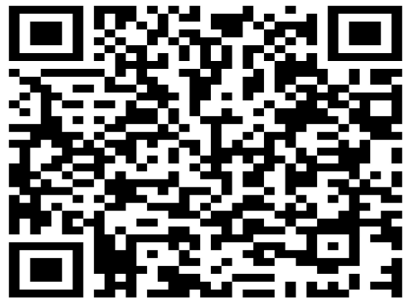


Fig. 12. QR Code

2.4. Hardware set ups



Fig. 13. Set Ups for Controlling Home Utilities

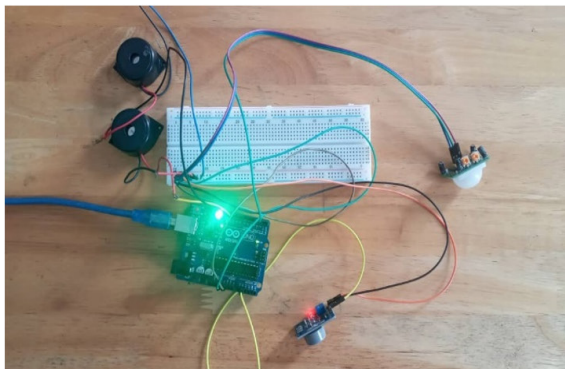


Fig. 14. Set Ups for Home Security System

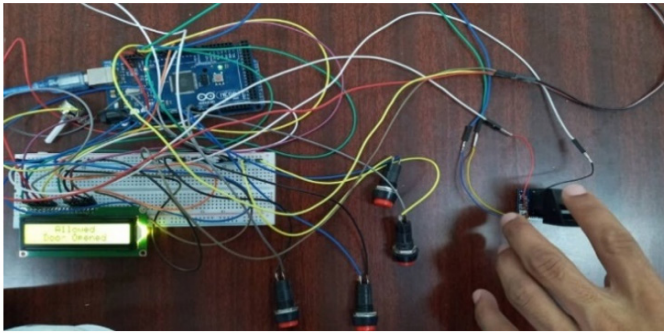
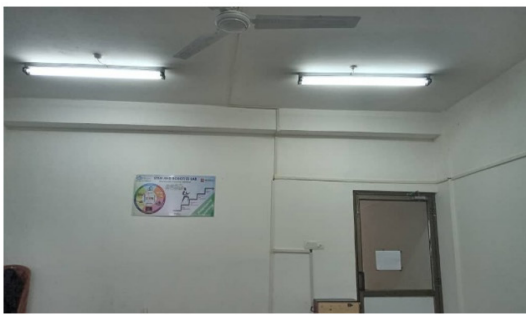


Fig. 15. Set Ups for Door Lock System

3. RESULT

3.1. Result of Controlling of Home Utilities

The robotics lab automation using the apps which was develop using the MIT Apps Inventor for controlling all the fan and bulb that are present in the lab. Apps is created in such a way that it can properly controlled all the devices through the wireless network. The QR code is also made so we can scan and download it. The connection of the circuit is simulated as per the available controlling devices in which many connections have to be deal with the direct Ac voltage and it was successfully completed. The following are the devices that we are controlling using HC-05 sensor up to 10-meter range:



Wirelessly controlled light



Circuit connection

Fig. 16. Controlling of Home Utilities

Table 1.

Sl.no	Controlling Devices	ON state	OFF state
1	Fan	ON	OFF
2	Bulb 1	ON	OFF
3	Bulb 2	ON	OFF
4	Bulb 3	ON	OFF

3.2. Result of Home Security for Gas and Motion Detection

Home security play a crucial role in present scenario in line with the wide range of the pros and for health safety. Under this we have made a security system using the gas sensor MQ-9 and PIR sensor. The gas sensor MQ-9 is mainly for detection of the flammable gas. If the level of Gas crosses the threshold value, then the buzzer will beep and if not, it will not. Similar to that, if the PIR Sensor detect any motion, then the Buzzer and LED are turning ON.

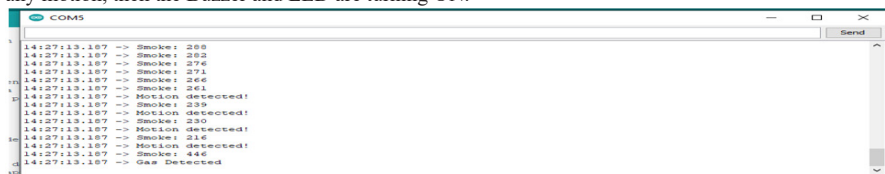


Fig. 17. Detection of Gas and Motion and LED glowing

3. 3. Result for Finger Print Door Lock System

Door lock based on Finger Print System is mainly implemented for security. Door will be only access to those who are already enrolled in fingerprint sensor if not door will be closed. In order to alert we have used 16*2 lcd which will be place in front of door with 4 buttons for enrolling, delete, up, down.

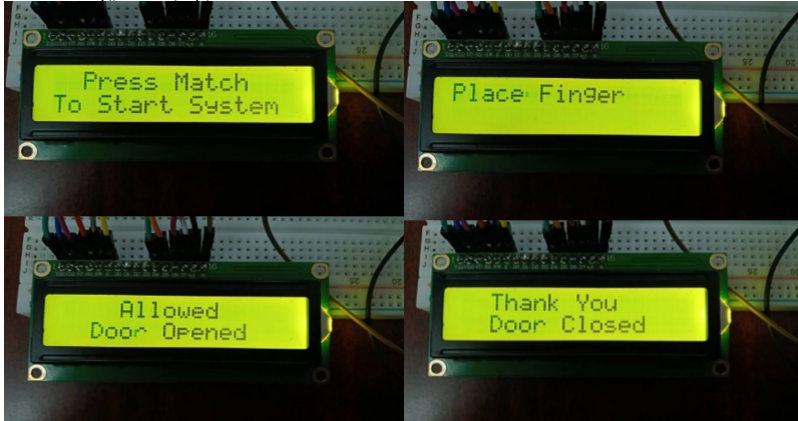


Fig. 18. Result for Finger Print Door Lock System

4. CONCLUSION

We have successfully completed a project on 'Home Automation' which is broadly categorized in two that is Controlling of Home Utilities and Home Security System. Further, Home Security System is categorized and divided as Detection of Gas and Motion and Finger Print Door Lock System.

Likewise, we have introduced design and implementation of a low cost, flexible and wireless solution to home automation. The system is secure and it helps keep any place or house from intruder. To use the system developed and control the home appliances it is necessary to pair the Bluetooth devices, match the password and download cell phone app. Thus, aiding to keep safe and protection from unauthorized user. This system can be used as a test bed for any appliances that requires ON and OFF the devices without any internet connection.

On the other hand, in home security system, both the motion and gas sensor work to detect human movement as well as detects flammable gases and alerting the people around with the alarm system if danger situation exists. Thus, avoiding any hazards that we may face and before anything happen to both human being or property, which gives us sufficient time to prevent the risk by gathering the required equipment and man power to prevent the cause.

At the same time, Fingerprint door locks are great investment for home. It provides greater security by providing restrictions to unwanted and unauthorized access. This device increases level of security by adding unique biological features of authorized person.

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