Home Automation and Security System using Arduino

A thesis submitted by

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CERTIFICATE

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Dedicated to our beloved parents and siblings

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Acknowledgement

First of all, we give thanks to Allah. Then we would like to take this opportunity to express our appreciation and gratitude to our project supervisor Dr. Muhammad Waqar Ashraf for being dedicated in supporting, motivating, and guiding us through this project. This project cannot be done without his useful advice and helps. Also thank you very much for giving us opportunity to choose this project.

To our beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this University.

Abstract

This project presents the overall design of Home Automation System with low cost and wireless system. Prime focus of this technology is to control the household equipment's like light, fan, door etc. automatically. Also, the smart home concept in the system improves the standard living at home. Using different sensor we can also monitor room temperature, gas occurrence in kitchen, detect human in room and also provide RFID door lock system. The control circuit consists of an Arduino Uno microcontroller, which processes the user commands and controls the switching of devices. Bluetooth or wi-fi technology will be used to control the things remotely. After implementation of all functions, the system is tested in different stages and it works successfully as a prototype.

Chapter 1

Introduction

1.1 Home automation

Home automation is building automation for a home, called a smart home or smart house. A home automation system will monitor and control home attributes such as lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems .

In the present day, security systems play an important role in the protection of lives and investment. This is achieved by the incorporation of various subsystems into the security system with a single control unit such as surveillance, intruder control, access control, fire detection, etc. A smart home is one that is equipped with lighting, heating, and electronic devices that can be controlled remotely by smartphone or via the internet. An internet-based home automation system focuses on controlling home electronic devices whether you are inside or outside your home. Home automation gives an individual the ability to control things remotely or automatically around the home. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The words appliance and devices are used interchangeably. Automation is today's fact, where things are being controlled automatically, usually the basic tasks of turning ON/OFF certain devices and beyond, either remotely or in close proximity . Automation lowers the human judgment to the lowest degree possible but does not eliminate it.

Devices within the home automation system connect and communicate with each over a local wired or wireless network. The entire home automation system usually requires system management software, installation of device/appliance controllers, motion and temperature sensors and other components. [1]

1.2 Background

Before you can have smart appliances, you must invent the appliances themselves. Between 1901 and 1920 there was a rapid development in domestic apparatus, kicked off by the invention of the engine-powered vacuum cleaner.

1898: Less than a decade after the U.S. declared independence from England, Nikola Tesla invented the first remote control (to remotely control a boat)

The early 1900s: Fast-forward a few centuries, and the Industrial Revolution has paved the way for the invention of the first home appliances. Granted, they were not smart but they were absolute game-changers for early 20th century folks – at least, the wealthy ones. 1901 saw the introduction of the first vacuum cleaner, and over the next few decades, the world's minds rolled out the washing machine, clothes dryer, clothes iron, home refrigerator, electric dishwasher, garbage disposal, and many other home appliances that today we take for granted.

The 1930s: By the 1930s, inventors had already turned their imagination to home automation. Although the technology was still many decades off, the World's Fair introduced the concept of automated home and smart appliances. Spectators were, unsurprisingly, fascinated with the idea.

1950: Jack Kilby and Robert Noyce invented the computer chip – the building block for today's smart home technology.

1951: UNIVAC I, the world's first commercially available computer, is introduced to the market. Consider UNIVAC I the great- granddaddy of today's smart controls, which are all, essentially, minicomputers.

1966: Though never commercially sold, ECHO IV was the world's first home automation system. Invented by Jim Sutherland, the "Electronic Computing Home Operator" (hence, ECHO) could store recipes, relay messages, control a home's temperature, churn out a grocery list, and turn appliances on or off.

1969: DARPA introduces ARPAnet, the world's first network – the precursor to the modern Internet and with it, all our Internet of Things (IoT) smart technologies

1975: The first general purpose home automation network technology, X10, was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signaling and control, where the signals involve brief radio frequency bursts of digital data, and remains the most widely available.

1978: X10 products included a 16-channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.[2]

The 1980s: Home automation becomes commonplace, in the form of garage doors, home security systems, motion-sensing lights, fiber optics, thermostat controls, and other technology.

1981: A precursor to today's wireless (802.11) technology is invented.

1998-2000s: Smart homes became a thing. Throughout the late 1990s and early 2000s, smart technologies emerged, with gadgets and devices becoming more common and more affordable.

By 2012, in the United States, according to ABI Research, 1.5 million home automation systems were installed. Per research firm Statista more than 45 million smart home devices will be installed in U.S. homes by the end of the year 2018.[3]

1.3 Problem statement

In the present-day home automation is becoming essential for the purpose of improving our life condition. Convenience and ease of using home appliances is what home automation is offering. Home automation offers a futuristic way of life in which an individual gets to control his entire house using a smart phone, from turning on a TV to locking/unlocking doors; it also offers an efficient use of energy. But to get or acquire such system installed will cost a lot of money and that is the major reason of why home automation has not received much demand and attention, adding to that also the complexity of installing it and configuring it. Thus, it is essential to make it cost effective and easy to configure, if this is granted to people then they will be willing to acquire it in their homes, offices, and schools. In other words, a system modification for the home automation is required in order to lower the price of applying it to houses. Also, home automation offers ease of mind and body to handicapped and elders in their houses by just one click to do what they want as stated above.[4]

1.4 Objectives

The objectives of this project and thesis are

- To Manage all of your home devices by using different sensors or by using mobile phone.
- Detect LPG gas leak and makes emergency sound which can prevent massive fire accident.
- Save the waste of electricity by automatic controlling light and fan
- To Flexible for new devices and appliances
- To Maximize smart home security

- To manage insights of home .
- User also sees the room temperature through LCD.

1.5 Scopes

Our project acts as an effective solution in controlling electronics devices and home security.

i. Smart Home and security systems will increase the value of your home appliances control and system.

ii. To control the various appliances of the office-court from home

iii. There is widespread use of automation in factories, we can use this technology in different factories if we want.

iv. It is possible to ensure security even if there are no people in any place.

v. Sophisticated controlling system for the patient in the hospital.

vi. Showrooms, shopping malls where multiple electronics appliances need to be controlled.

1.6 Organizing Report

There are five chapters in this project report. The first chapter describes the concept of the project “home automation and security”, a brief description of the scope and methods. Literature review and types of home automation are in chapter two. Chapter three about component list ,components description, block diagram. Chapter four about hardware implementation and circuit diagram, hardware coding. Chapter five about conclusion of our systems and future work and finally references

Chapter 2

Literature Review

2.1 Introduction

In this section, we have talked about different parts that will be expected to make this "**Design of Home Automation and Smart Security System**".

2.2 Hardware Components

Home Automation & Security has the following main components are

1. Arduino uno
2. 16*2 LCD display
3. Servo Motor
4. RFID Card reader
5. Relay module
6. Node mcu esp32
7. Bluetooth module
8. Motion sensor
9. W1209 Temperature Control Switch
10. MQ-2 Smoke Sensor
11. Flame sensor
12. IR sensor
13. Distance sensor
14. Resistors
15. Jumper wire

2.3 Component description

In this proposed methodology, there are three modules. The first module is about all electrical appliances and devices that need to be monitored and controlled like fan, light, AC, garage door etc. The Second module consists of a Bluetooth module to receive signals, microcontroller to execute commands and sensors. The third module is our smart phone through which we will give commands and monitor our devices.

2.3.1 Arduino Uno

It is a microcontroller board, not fully computers. In this, written codes are simply executed without any obstacle. It is an 8-bit Atmel AVR Microcontroller which comprises of 32K and 512K of onboard flash memory, 2K of RAM, runs at 8-84MHz

clock speeds with voltages of 2.7V-12V.programming is done using C and carries no operating system. The code is written in the computer and then sent through USB cable for execution. Its construction simply covers digital input-output pins that are between 9-54 AND 6-12 analog input pins. Its power consumption is less than 0.5 watt.

Arduino Uno is based on the ATmega328 by Atmel. The Arduino Uno pinout consists of 14 digital pins, 6 analog inputs, a power jack, USB connection and ICSP header. The versatility of the pinout provides many different options such as driving motors, LEDs, reading sensors and more

The key features are −

- Arduino boards can read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.[5]

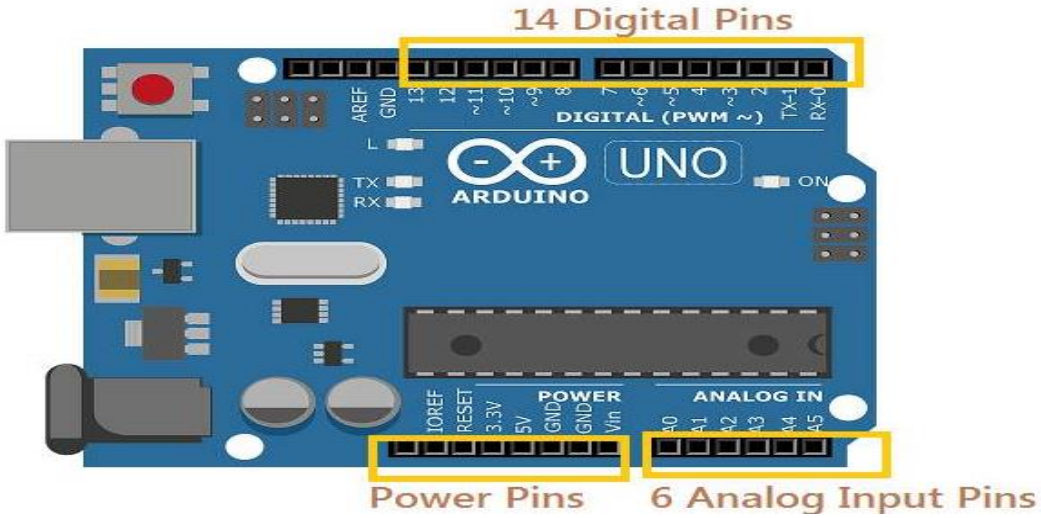

Figure 2. 1 Arduino UNO

2.3.2 16*2 LCD display

A Liquid Crystal Display commonly abbreviated as LCD is basically a display unit built using Liquid Crystal technology. When we build real life/real world electronics-based projects, we need a medium/device to display output values and messages.

A liquid crystal display is essentially a liquid crystal sandwiched between 2 pieces of glass; the liquid crystal reacts depending on current applied. Our LCD is a white on black, 16 by 2-character LCD that we will use to display symbols. Graphical LCDs also exist, but today we are just focusing on the character variety.

Each character is off by default and is a matrix of small dots of liquid crystal. These dots make up the numbers and letters that we display on screens.

Wiring

A typical LCD display consists of 16 pins that control various features of the screen. A table that shows the pins and describes each function can be seen in Table 1 below. The Arduino microcontroller can output voltages of either 5 V or 3.3 V, so the LCD can be powered by wiring VSS and VDD to the ground and 5 V pins on the microcontroller. It is possible to adjust the contrast of the screen by wiring a variable resistor to V0 located at pin 3 on the screen. The RS, R/W, and E pins are wired to pins 12, ground, and 11 respectively on the Arduino.[6]

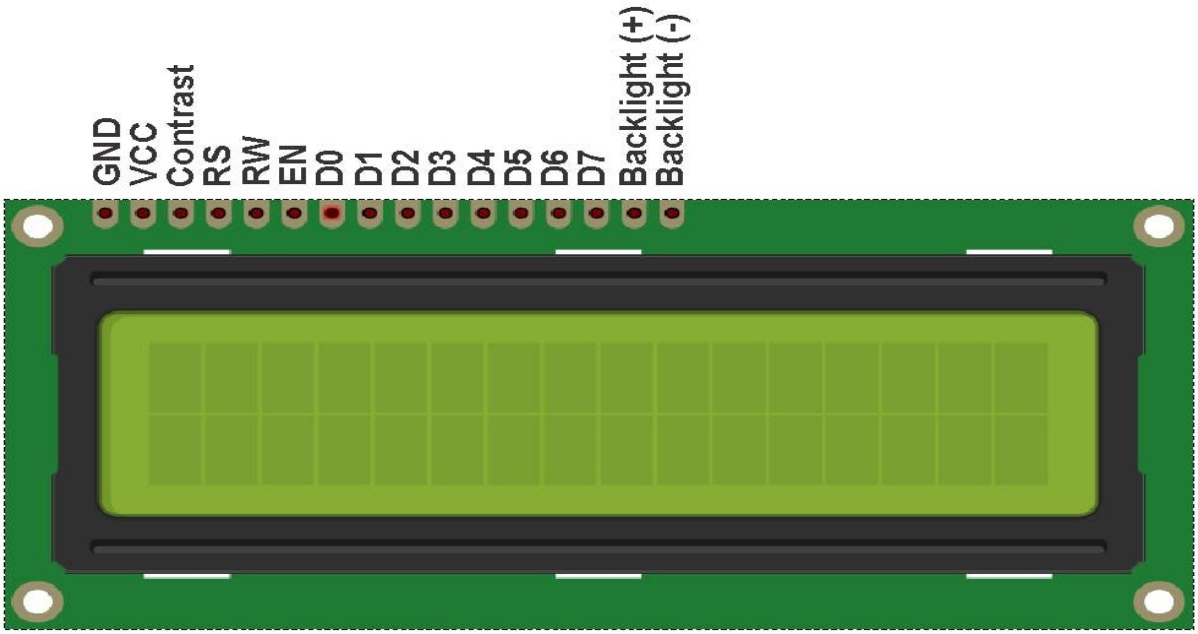

Figure 2. 2 LCD Display

2.3.3 Servo Motor

Servo motor is an electrical tool that may push or rotate an object with incredible precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is simply made up of easy motor which run via servo mechanism.

Servos are extremely useful in robotics. The motors are small, have built-in control circuitry, and are extremely powerful for their size. A standard servo such as the Futaba S-148 has 42 oz/inches of torque, which is strong for its size. It also draws power proportional to the mechanical load. A lightly loaded servo, therefore, does not consume much energy.[7]

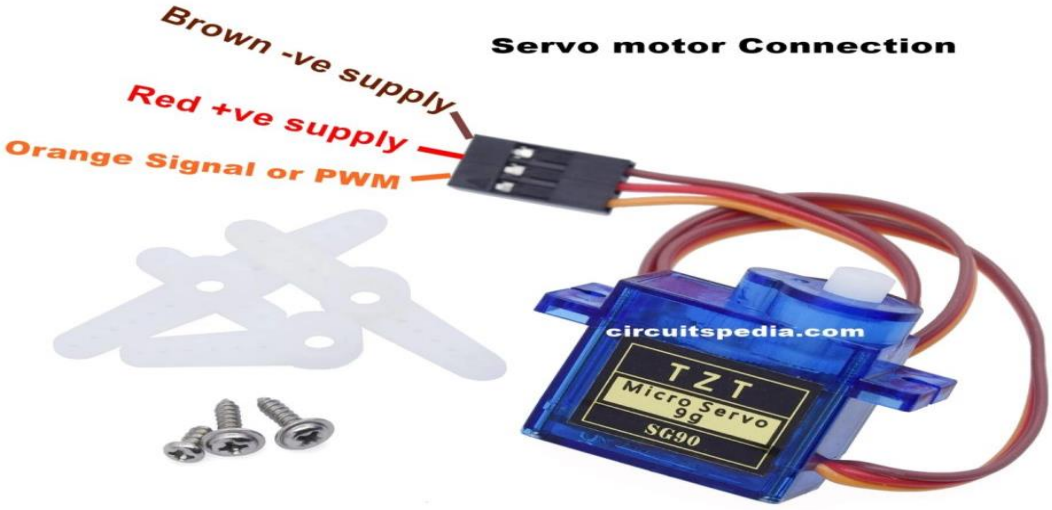

Figure 2. 3 Servo Motor

2.3.4 RFID Card reader

RFID tagging is an ID system that uses small radio frequency identification devices for identification and tracking purposes. An RFID tagging system includes the tag itself, a read/write device, and a host system application for data collection, processing, and transmission.

An RFID system uses:

- **Tags** attached to the object to be identified, in this example we have a keychain and an electromagnetic card. Each tag has his own identification (UID).
- Two-way radio transmitter-receiver, the **reader**, that sends a signal to the tag and read its response

RFID technology uses digital data in an RFID tag, which is made up of integrated circuits containing a tiny antenna for transferring information to an RFID transceiver. The majority of RFID tags contain at least an integrated circuit for modulating and demodulating radio frequency and an antenna for transmitting and receiving signals.[8]

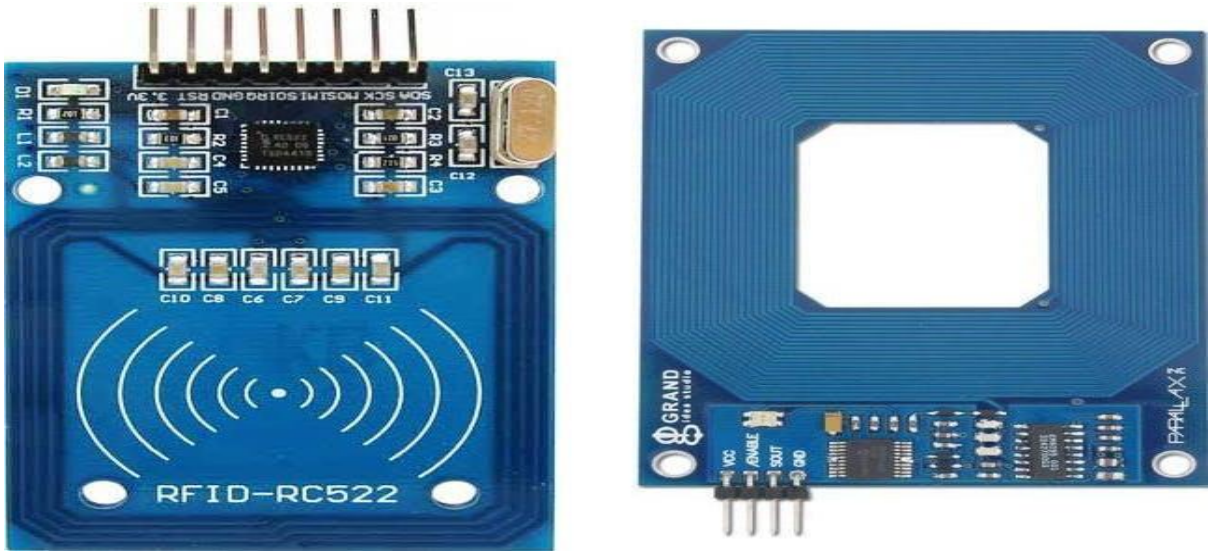

Figure 2. 4 RFID Card Reader

2.3.5 Relay module

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as controlling any other output.

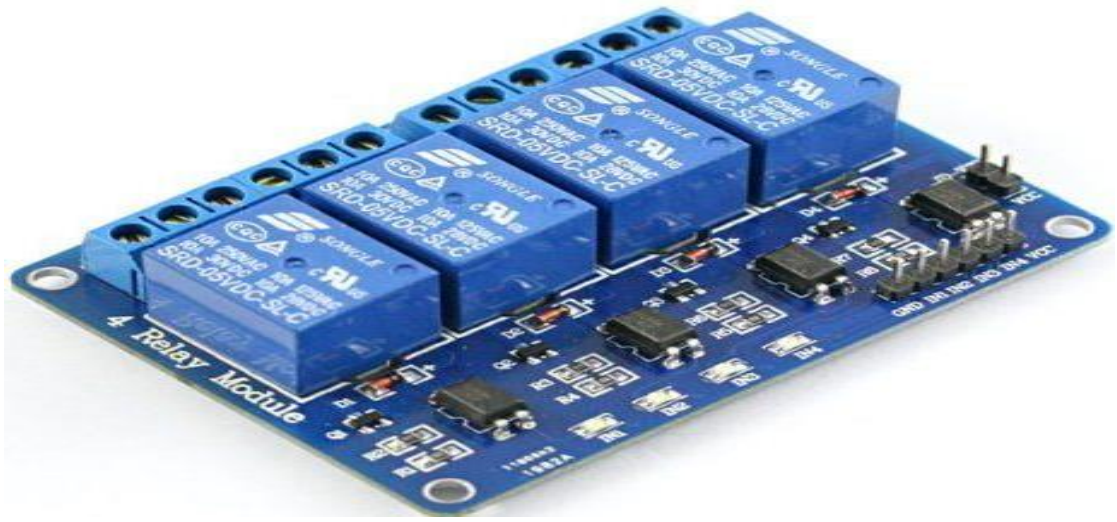

Figure 2. 5 Relay Module

This relay module has four channels (those blue cubes). There are other models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use with an Arduino.[9]

2.3.6 Esp 8266 (Node MCU) Wi-Fi Module

It is a low-cost open source IOT platform. It includes firmware which runs on ESP8266WifiSOC . The hardware is based on ESP-12 module. It has 16 digital I/O pins. And one analog pin. It is a microcontroller with Wi-Fi connectivity features and an operating voltage of 3.3v. In the proposed design it is used to switch the system on and off from anywhere in the world. The ESP8266 Wi-Fi Module is a self-contained system on a chip (SOC) with an integrated TCP/IP protocol stack that allows any microcontroller to connect to your Wi-Fi network. ESP8266 will either host an application or a separate application processor will handle all Wi-Fi networking tasks. Each ESP8266 module comes pre-programmed with AT command set firmware, so you can use an Arduino to connect it to your device, and the same Wi-Fi shield for the Wi-Fi capabilities. Will be able to help. The ESP8266 module is a low-cost board that has a large and rapidly growing user base.[10]

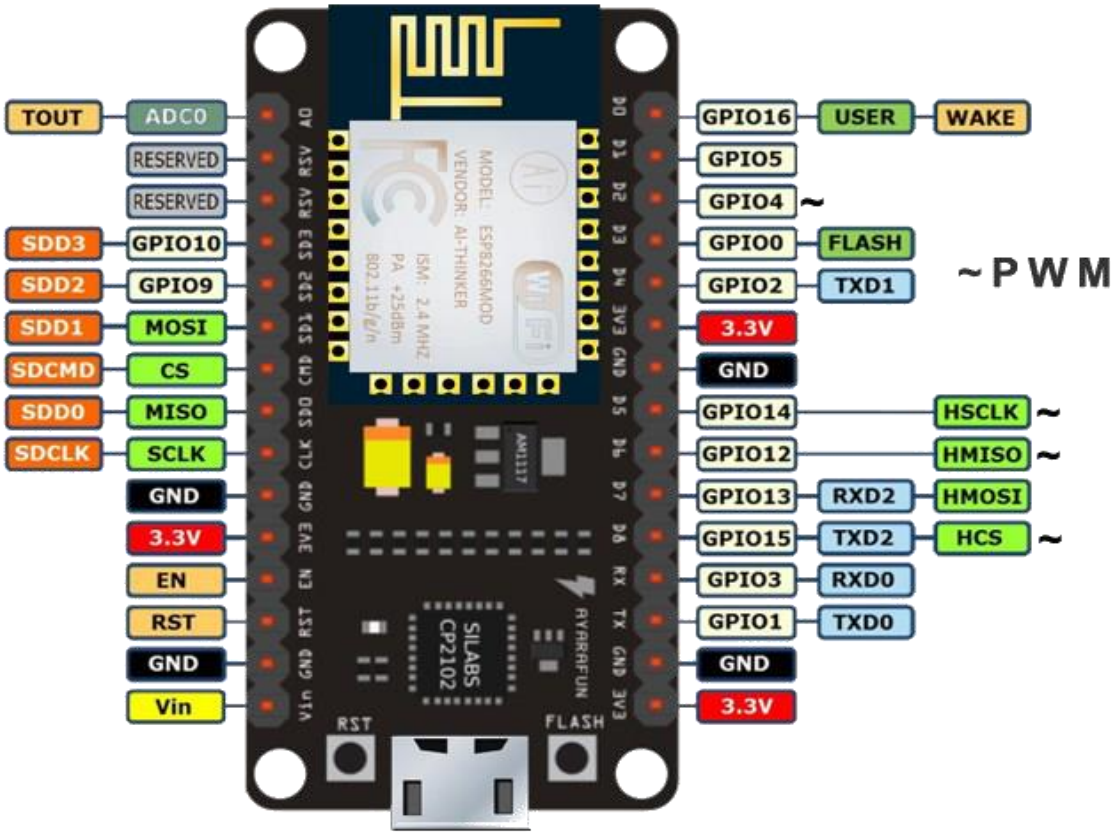

Figure 2. 6 Node MCU

2.3.7 HC 05 Bluetooth module

HC 05 Bluetooth is a wireless communication protocol; it is used in two devices as a sending and receiving the information. The Bluetooth is free to use in the wireless

communication protocol as the range of the Bluetooth is less than the other wireless communication protocols like Wi-Fi and Zigbee. The Bluetooth operates at the frequency of the 2.41 GHz and also used in many small ranges of applications. HC-06 is a slave device and it can operate at power 3.6 to 6 volts. It has 6 pins: State, RXD, TXD, GND, VCC and EN. For serial communication connect TXD pin of Blue tooth module HC-06 with RX (pin 0) of Arduino Uno and RXD pin with TX (pin 1) of Arduino Uno.[11]

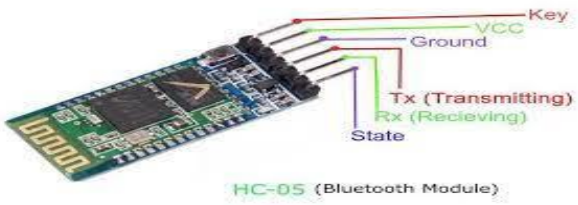

Figure 3. 7 Bluetooth Module

Applications of Bluetooth Module

- Laptops
- Mobile phones
- Wireless technology
- Bluetooth speakers

2.3.8 PIR Motion sensor

Passive Infra-Red sensors can detect movement of objects that radiate IR light (like human bodies). Therefore, using these sensors to detect human movement or occupancy in security systems is very common. Initial setup and calibration of these sensors takes about 10 to 60 seconds.

The HC-SR501's infrared imaging sensor is an efficient, inexpensive and adjustable module for detecting motion in the environment. The small size and physical design of this module allow you to easily use it in your project.

The output of PIR motion detection sensor can be connected directly to one of the Arduino (or any microcontroller) digital pins. If any motion is detected by the sensor, this pin value will be set to "1". The two potentiometers on the board allow you to adjust the sensitivity and delay time after detecting a movement.[12]

Figure 2. 8 Motion Sensor

2.3.9 W1209 Temperature Control Switch

The W1209 is an incredibly low cost yet highly functional thermostat controller. With this module you can intelligently control power to most types of electrical device based on the temperature sensed by the included high accuracy NTC temperature sensor. Although this module has an embedded microcontroller no programming knowledge is required. 3 tactile switches allow for configuring various parameters including on & off trigger temperatures. The on-board relay can switch up to a maximum of 240V AC at 5A or 14V DC at 10A. The current temperature is displayed in degrees Centigrade via its 3-digit seven segment display and the current relay state by an on-board LED.[13]

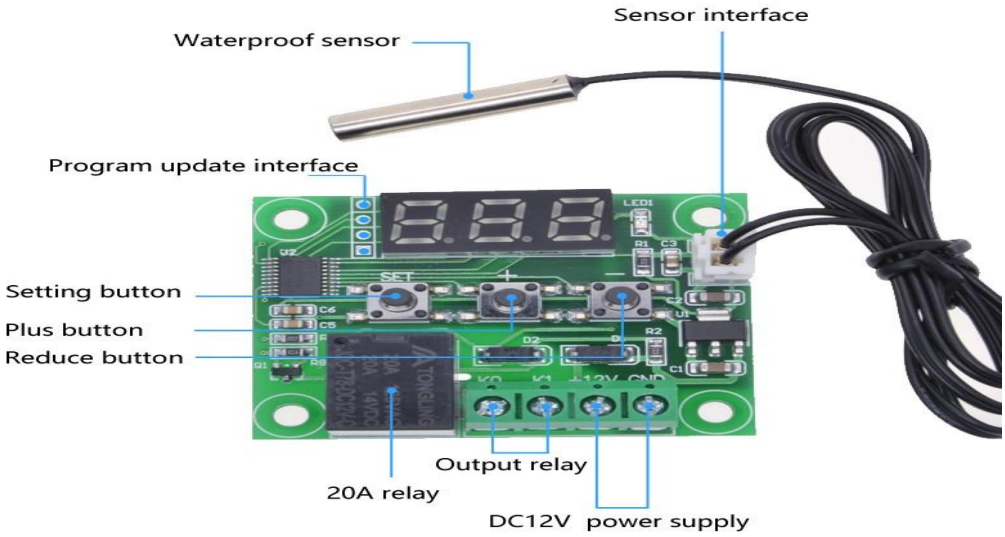

Figure 2. 9Temperature Control Switch

2.3.10 MQ-2 Smoke Sensor

The MQ-2 smoke sensor is sensitive to smoke and to the following flammable gases:

1.LPG 2.Butane 3. Propane

4.Methane 5. Alcohol 6. Hydrogen

The resistance of the sensor is different depending on the type of the gas.

The smoke sensor has a built-in potentiometer that allows you to adjust the sensor sensitivity according to how accurate you want to detect gas.[14]

Figure 2. 10 Gas Sensor

2.3.11 Flame sensor

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So, this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital signal.[15]

Figure 2. 11 Flame Sensor

2.3.12 Infrared (IR) sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. The working principle of an infrared sensor is like the object detection sensor. This sensor includes an IR LED & an IR Photodiode, so by combining these two can be formed as a photo-coupler otherwise optocoupler.[16]

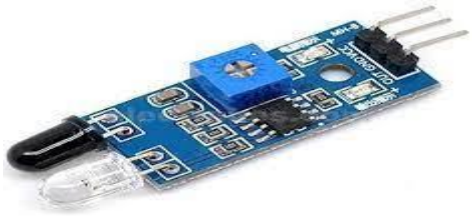

Figure 3. 12 IR Sensor

2.3.13 Distance sensor(ultrasonic sensor)

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology.[17]

Figure 2. 13 Distance Sensor

2.3.14 Resistors

The resistor is a passive electrical component to create resistance in the flow of electric current. In almost all electrical networks and electronic circuits they can be found. The resistance is measured in ohms (Ω). An ohm is the resistance that occurs when a current of one ampere (A) passes through a resistor with a one volt (V) drop across its terminals[18]

Figure 2. 14 Resistor

2.3.15 Jumper wire

The jumper wires, which are wires that have a connecting point at each end, are used to connect two densities to each other randomly. Commonly used wires are used on different boards to support the business for circuit switching.

Figure 2. 15 Jumper Wire

CHAPTER 3

Methodology

In this part, we are going to talk about the different ways that home automation used in the last few years. How they improved it and efficient they are now.

We also will compare what have they done and what is our capability in this project.

3.1 Literature Review for System Automation:

3.1.1 A web-based home automation:

IOT (Internet of Things) during the last few years was used so widely in the smart house systems. By controlling almost all appliance and security. The system consists of Arduino Uno Board, PIR sensor, temperature sensor, gas sensor, power select, and web applications.

GSM is used to communicate the microcontroller and the web page and facilitates energy management. It also monitors the type of device encountered at home and activates the operations. The sensor parameters will be stored in the cloud.

The system also can be used in mobile health care, traffic management, and so others.

In the 21st century, there was a man that had an idea which allowed him to access all the devices. Now we can even access the internet with only one click.

Home automation is a mobile application for safety and proper use of a human.

In the last 10 or more years ago, we used to switch the home appliances manually.

Based on the difficult access. At the beginning of this new automation, it was not considered an effective method yet. As the technology has improved this system to control by Bluetooth modules. The problem with using Bluetooth is that it has a limit of the wireless range, also a chance of interference with other devices using Bluetooth. In advance, they made this kind of automation to be used using Android by android mobile phones. Lately, they figured out a system that can control and monitor the home appliances using any device which has an internet connection. [19]

3.1.2 Home automation based on Bluetooth

In the last years, home automation has achieved a really great job and increased the comfortable of a lifestyle. Smartphones are used to control all their home appliances. You can communicate with all the home's controls using a smart device including new techniques. We never forget how the home automation has extremely grown, these systems have been created to improve the comfortability of a lifestyle especially for

those who are elderly and disabled these systems are designed by using a single controller that owns the ability control interconnected appliances such as lights, TVs, and so on. The most interesting thing is that you can control all these appliances easily by using smartphones. Home automation systems could be controlled throw some methodologies such as Bluetooth and Wi-Fi. Bluetooth is a technique that is secured and low cost as well. The hardware will be using an Arduino BT board and cell phone is wirelessly using Bluetooth. The smartphone uses the application that allows the user to control these appliances. The system also uses passwords to make sure it is not going to be used by some others.

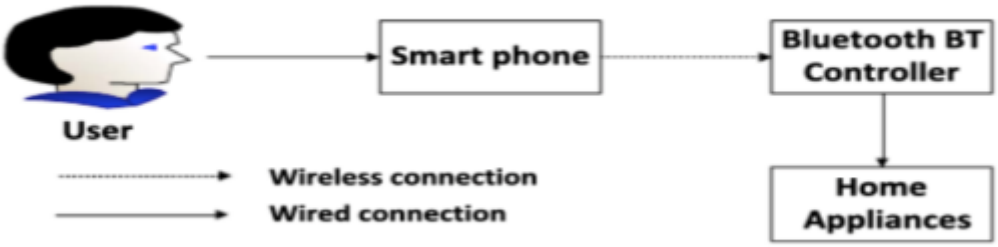

Figure 3. 1 Home automation based on Bluetooth

Issues of using Bluetooth for home automation:

- Bluetooth has a maximum communication range of 100m in ideal conditions. More may be needed in a home environment.
- Bluetooth communication has comparatively high-power consumption, so the batteries of devices need to be frequently recharged or replaced.
- Bluetooth technology has advanced and improved to Bluetooth Low Energy (BTLE), which provides the same range of communication. However, it has serious security concerns such as eavesdropping and weak encryption
- Bluetooth communication should only be used on occasions where there is a need for quick short-lived network communication with little concern for security.
- Bluetooth looks like an attractive communication technology for creating smart homes. It is cheap, easy, and quick to set up. People are already familiar with the technology. The hardware required for establishing

  Bluetooth communication is readily available. And the technology also provides the necessary bandwidth for the operation in a home. But they also have serious flaws, as discussed above.

3.1.3 Home automation based on Voice recognition

Voice recognition also implemented by a researcher. Android OS has a built-in voice recognizing feature ability to control the home appliances from user voice commands. The application converts the voice into a text after that it sends that message to Bluetooth module that is connected to the Arduino.

The great thing of this voice application transmit is that the user only needs to pronounce the application name throws the microphone and say the commands that he wanted to do such as turn the light ON or OFF. By using this kind of home control, the user doesn't have to do anything except saying the words that the application will recognize to achieve these commands.[20]

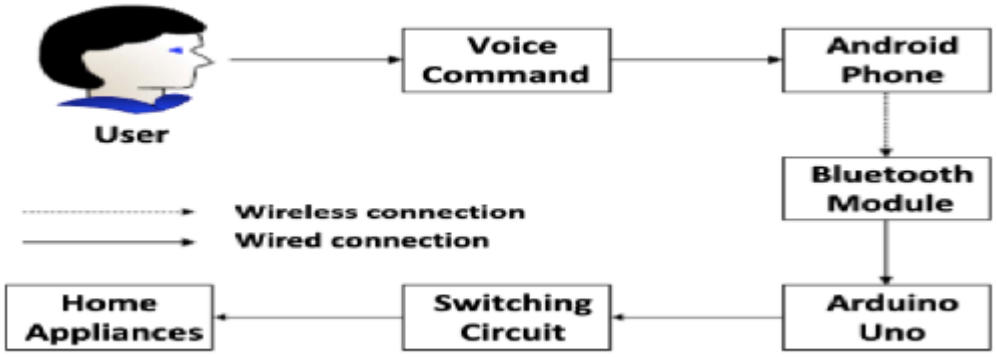

Figure 2.2 Home automation based on Voice recognition

3.1.4 Home automation system for Android

To communicate and facilitate connection between the android application and the appliance, a module of Wi-Fi is used. A home automation system in which an android mobile application with integrated Wi-Fi can be used. In working, this system of home automation uses an application installed in a smart phone to transfer the data using a long-range Wi-Fi technology. A preconfigured Wi- Fi device can be used to update status collected from sensors continuously on the firebase database. Using Wi-Fi technology SSCS switches and devices can be remotely controlled using and android application. There is a development in the smart home system field that it can offer a longer range and can control multiple devices at the same time from anywhere in the world. ESP 8266.

The most useful feature of this is that a USB can be used to power this device rather than using batteries. It is very useful for beginners due to its durable nature and easier operation. In smart homes, low cost, multi-purpose and flexible remotely monitoring and controlling of devices through a Wi-Fi medium which is a sophisticated wireless device

system using mobile application which can be easily operated by the people from their mobile phones is done. Delivery of control instructions can be done through Wi-Fi medium by utilizing text messaging technology.

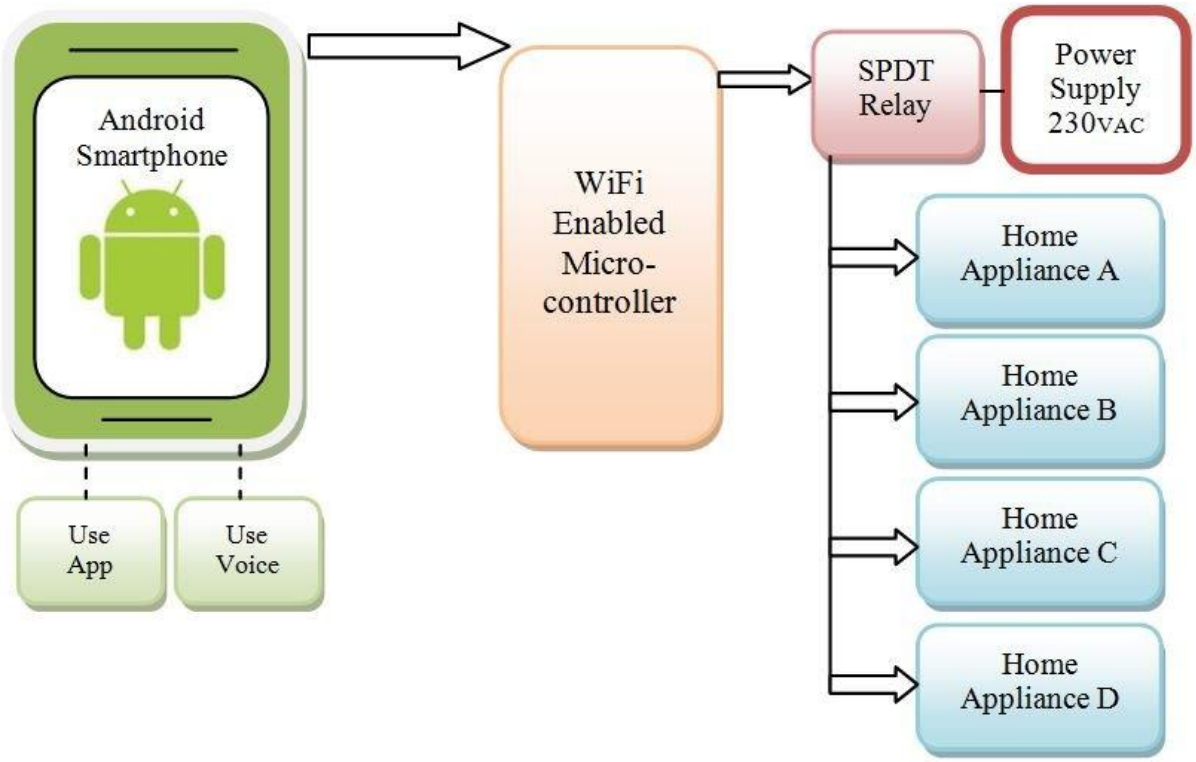

Figure3. 3 Home Automation System for Android

3.1.5 Difference between home automation based on Bluetooth and home automation based on voice recognition:

Many home automation systems have pros and cons. Bluetooth home automation systems are easy and low cost as well, but the system can only work in a short range. Voice recognition home automation systems are suitable and the best choice for the elders and handicapped people, they can control the home appliances by only saying the words that the user wanted to happen, just like commands.[21]

3.2 Assumption and Limitation

Through we try hard to do best but this project has some limitation. I try to list some laminations

- If sensors are damage or not working properly there will be occurred serious site effect
- This virtual system is limited to one time server, which means that only one person can run the system at a time. If there is a fault due to the disconnection of the cable, the entire system will be destroyed.

CHAPTER 4

Discussion of Experimental Results

4.1 Hardware Implementation

In this topic, we will discuss the hardware implementation process for the Design of a Home Automation and Smart Security

4.1.1 Door Security System Using RFID RC522 and Arduino

Connections for Door Security System Using RFID RC522 and Arduino

RFID RC522 module to Arduino connections

- SDA to D10
- SCK to D13
- MOSI to D11
- MISO to D12
- IRQ is not use
- GND to GND
- RST to D9
- 3.3V to 3.3V

Servo to Arduino Connection

- Starting from left
- Pin 1 to ground.
- Pin 2 to 5V.
- Pin 3 to D6.

Working of Door Security System Using RFID RC522

When the user brings the token near the module it detects the token and read its value. If the value is same as defined in the code, then Access Granted message is shown on LCD and it opens the door for the user. After some delay which is also defined in the code the door automatically closes. This process occurs every time the user wants to access. There can be multiple users but each user has it unique token.

Circuit Diagram:

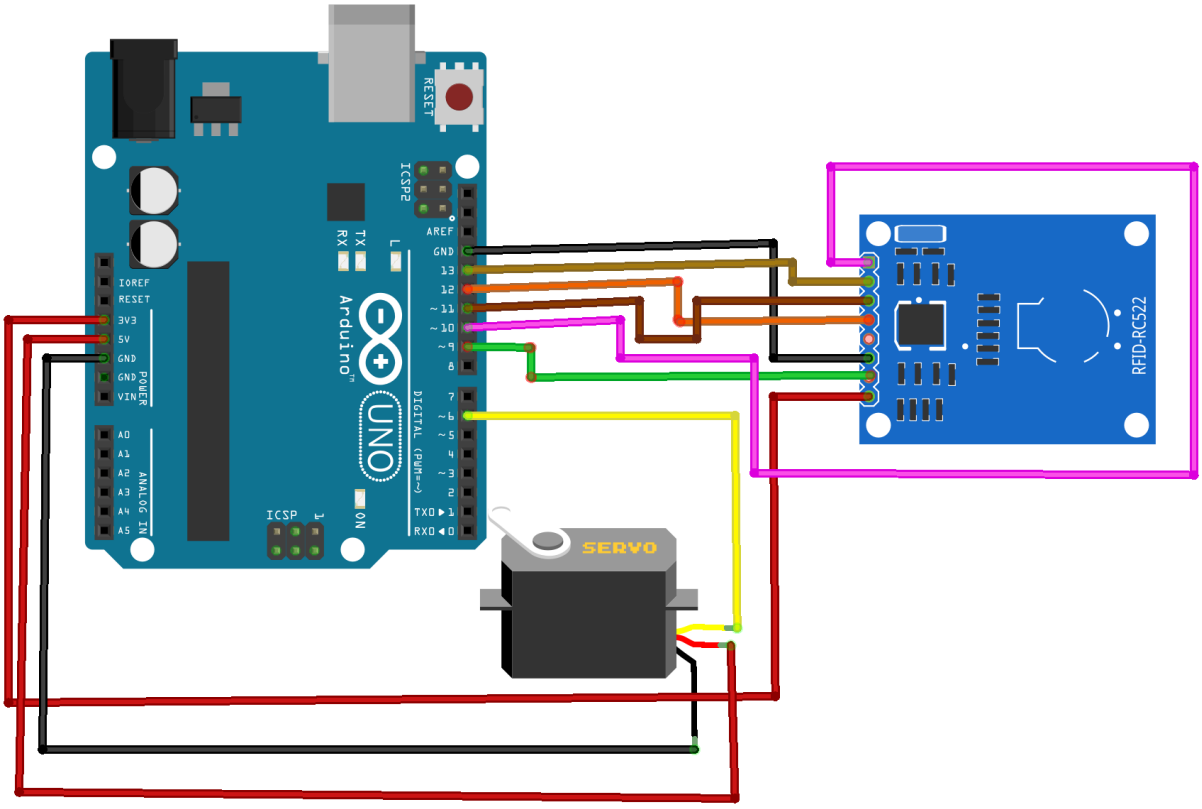

Figure 4. 1 Circuit Diagram of Door Security System Using RFID RC522 and Arduino

Code 1 :

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>
#define SS_PIN 10
#define RST_PIN 9
#define SERVO_PIN 3
Servo myservo;
#define ACCESS_DELAY 2000
#define DENIED_DELAY 1000
MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.
void setup()
{
  Serial.begin(9600);   // Initiate a serial communication
  SPI.begin();          // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522
  myservo.attach(SERVO_PIN);
  myservo.write( 70 );
```

```
  delay(7500);
  myservo.write( 0 );
  Serial.println("Put your card to the reader...");
  Serial.println();
}
void loop()
{
  // Look for new cards
  if ( ! mfrc522.PICC_IsNewCardPresent())
  {
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
  //Show UID on serial monitor
  Serial.print("UID tag :");
  String content= "";
  byte letter;
  for (byte i = 0; i < mfrc522.uid.size; i++)
  {
     Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
     Serial.print(mfrc522.uid.uidByte[i], HEX);
     content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
     content.concat(String(mfrc522.uid.uidByte[i], HEX));
  }
  Serial.println();
  Serial.print("Message : ");
  content.toUpperCase();
  if (content.substring(1) == "15 2D B0 28") //change here the UID of the card
  {
    Serial.println("Authorized access");
    Serial.println();
```

```
   myservo.write( 70 );
   delay(7500);
  myservo.write( 0 );
 }
 else   {
    Serial.println(" Access denied");
    delay(DENIED_DELAY);
  }
}
```

4.1.2 Gas Leak Alert Security Alarm using Arduino

This gas sensor uses a MQ-2 gas sensor to indicate if there is gas in the area. so the sensor has a threshold value (the threshold value is around the amount of smoke in there is a fire) in that if it goes above it starts alerting people in the vicinity. The alert just shows a red led and starts beeping

MQ-2 sensor Pin Wiring to Arduino Uno

A0 to A5

D0 none

GND to GND

VCC to 5V

other components

D13 to +ve of buzzer

GND to -ve of buzzer

D12 to anode of red light

D11 to anode of green light

GND to cathode of red light

GND to cathode of red light

Circuit Diagram

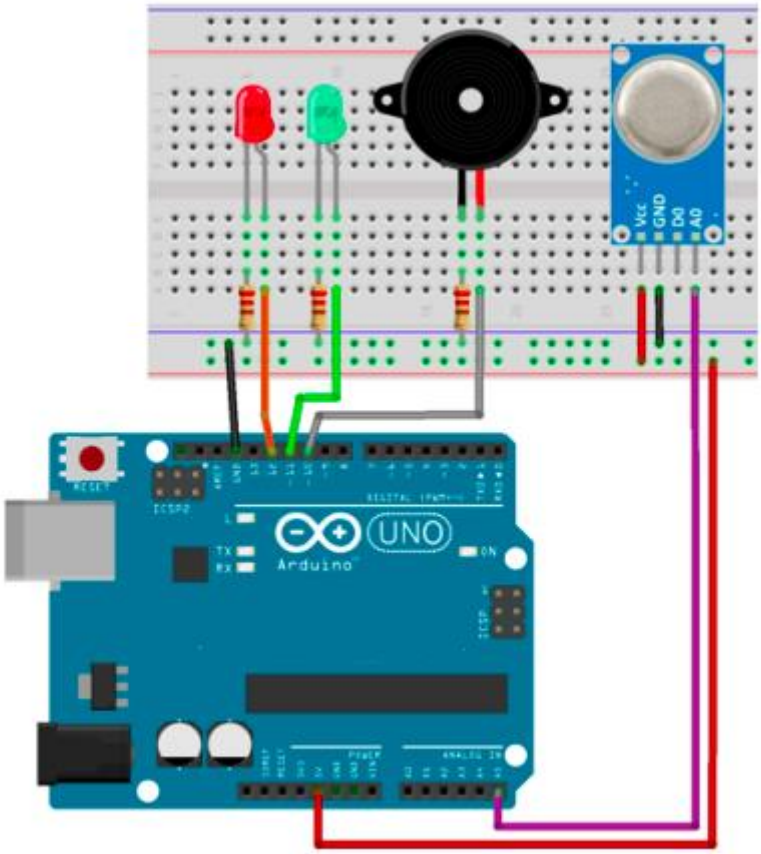

Figure 4. 2 Circuit Diagram of Gas Alarm System Using MQ-2and Arduino

Code 2 :

```
int red_led=12;//indicates gas

int green_led=11;//indicates normal

int buzz=13;//indicates gas

intsmokeA0 = A5;//indicates sensor is connected to A5

int sensorThres=400;//The threshold value

void setup()

{

pinMode(red_led,OUTPUT);//red led as output

pinMode(buzz,OUTPUT);// buzz as output

pinMode(green_led,OUTPUT);//green led as output
```

```
pinMode(A1,INPUT);//sensor as input
Serial.begin(9600);//starts the code
}
void loop()//loops
{
gas_avalue=analogRead(smokeA0);//reads sensor value
if (A0 > sensorThres)//sees if it reached threshold value
{
digitalWrite(red_led, HIGH);//turns on red led
digitalWrite(green_led, LOW);//turns off green led
digitalWrite( buzz, HIGH);//turns on buzzer
}
else//if it hasn't reached threshold value
{
digitalWrite(red_led, LOW);//turns red led off
digitalWrite(green_led, HIGH);//turn green led on
digitalWrite( buzz, LOW);//turns buzzer off
}
delay(100);//delay 0.1 sec
}
```

4.1.3 Fire Detection System using Arduino

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire.

Flame Sensor Pin Wiring to Arduino Uno

A0 to A5

D0 to D9

GND to GND

VCC to 5V

Relay module to Arduino Connection

GND to GND

VCC to 5V

IN to D4

other components

D11 to +ve of buzzer

GND to -ve of buzzer

Circuit Diagram:

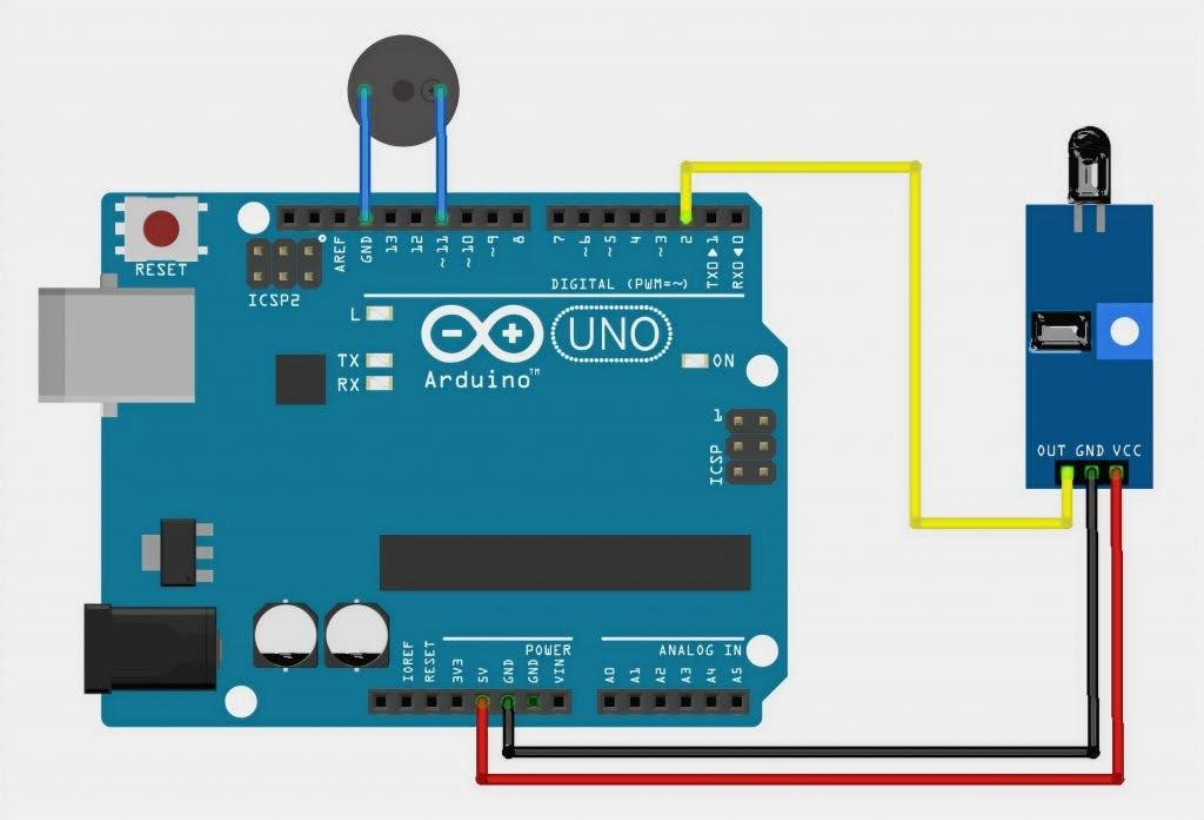

Figure 4. 3 Circuit Diagram of Fire Detection System Using Flame Sensor and Arduino

Code 3:

```
int relay = 4 ;// define relay pin
int flamedigital = 9; // define the flame sensor digital pin
int flameanalog = A3; // define the flame sensor analog pin
int buzzer = 11; //define buzzer pin
int val ; // define numeric variable val
float sensor; //define floating variable sensor
void setup ()
```

```
{
  pinMode (flamedigital, INPUT) ;// input interface defines the flame sensor
  pinMode (flameanalog, INPUT) ;// input interface defines the flame sensor
  pinMode (relay, OUTPUT); //output interface defines the relay
  pinMode (buzzer, OUTPUT); //output interface defines the buzzer
}
void loop ()
{
  sensor = analogRead(flameanalog); //read flameanalog value and assigne it to sensor variable
  val = digitalRead (flamedigital) ;// read flamedigital value and assigne it to val variable
  if (val == HIGH) // When the flame sensor detects a signal relay is on and buzzer sound (void alarm)
  {
    alarm();
    digitalWrite (relay, HIGH); //close the relay circuit
  }
  else
  {
    digitalWrite (relay, LOW); //open the relay circuit
  }
  delay(1000);
}
void alarm()  {
  tone(buzzer, 400, 500); //the buzzer emit sound at 400 MHz for 500 millis
  delay(500); //wait 500 millis
  tone(buzzer, 650, 500); //the buzzer emit sound at 650 MHz for 500 millis
  delay(500); //wait 500 millis
}
```

4.1.4 Bidirectional Visitor Counter Project with Arduino

The system counts the number of people who entered the room, and it will turn on the room light. As that person leaves the room, room light is automatically off.

This information should be presented on a 16×2 LCD display, and with the use of the Arduino, the electronic part was greatly reduced, facilitating the installation of the project in a model.

LCD display to Arduino Connection

LCD RS pin to digital pin 12

LCD Enable pin to digital pin 11

LCD D4 pin to digital pin 6

LCD D5 pin to digital pin 5

LCD D6 pin to digital pin 4

LCD D7 pin to digital pin 3

LCD R/W pin to ground

LCD VSS pin to ground

LCD VCC pin to 5V Connect

10K variable resistor

First to +5V and ground

Second to LCD VO pin (pin 3)

Last to GND

Relay module to Arduino Connection

GND to GND

VCC to 5V

IN to D2

Circuit Diagram:

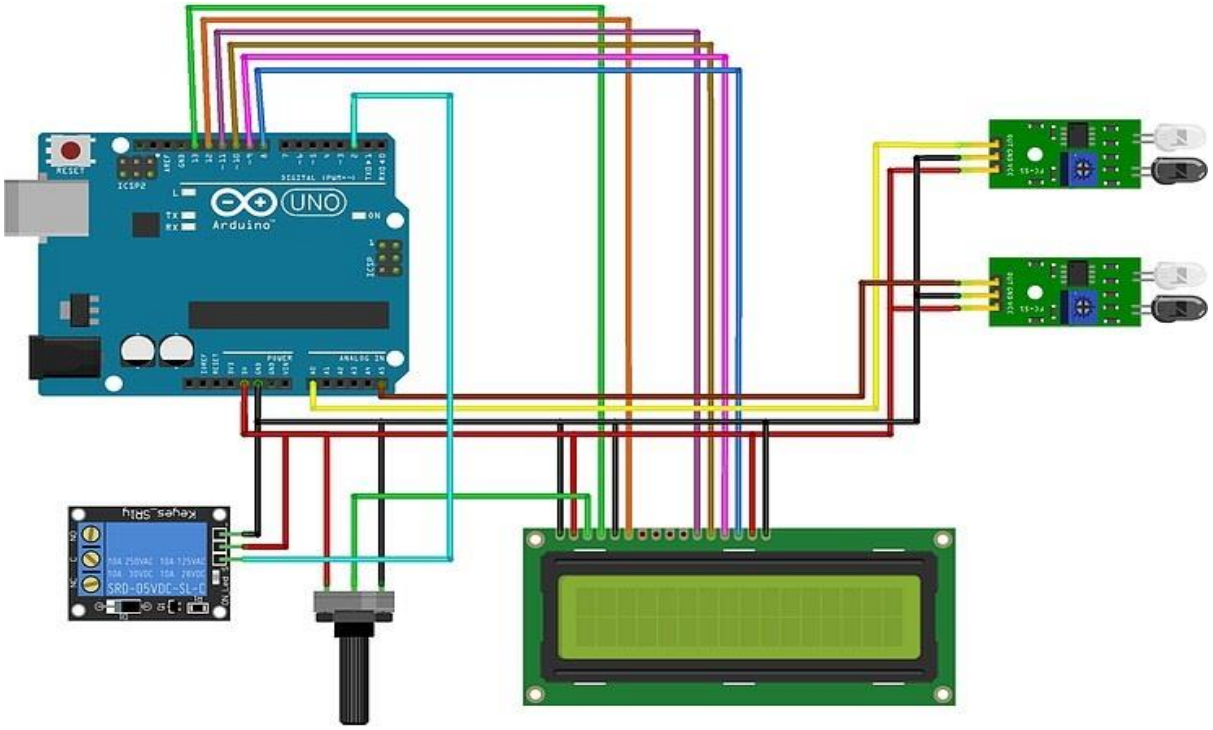

Figure 4. 4 Circuit Diagram of Bidirectional Visitor Counter

Code 4:

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(2,3,4,5,6,7);
#define in 8
#define out 9
#define fan 10
int count=0;
void setup()
{
  lcd.begin(16,2);
  lcd.print("Visitor Counter");
  delay(2000);
  pinMode(in, INPUT);
  pinMode(out, INPUT);
  pinMode(fan, OUTPUT);
  lcd.clear();
  lcd.print("Person In Room:");
  lcd.setCursor(0,1);
  lcd.print(count);
}
```

```
void loop()
{
  int in_value = digitalRead(in);
  int out_value = digitalRead(out);
  if(in_value == LOW)
  {
    count++;
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
    lcd.print(count);
    delay(1000);
  }
  if(out_value == LOW)
  {
    count--;
    lcd.clear();
    lcd.print("Person In Room:");
    lcd.setCursor(0,1);
    lcd.print(count);
    delay(1000);
  }
  if(count==0)
  {
    lcd.clear();
    digitalWrite(fan, LOW);
    lcd.clear();
    lcd.print("Nobody In Room");
    lcd.setCursor(0,1);
    lcd.print("Fan is Off");
    delay(200);
  }
  else
  {
    digitalWrite(fan, HIGH);
```

}

}

4.4.5 Voice Controlled Home Automation System using Arduino and Bluetooth module

App uses voice recognition in android mobiles to pass voice commands to central control. It pairs with Bluetooth modules and sends the voice commands in the form of a string.

Bluetooth module	**Pin Wiring to Arduino Uno**
Arduino Pins	Bluetooth Pins
RX (Pin 0)	TX
TX (Pin 1)	RX
5V	VCC
GND	GND

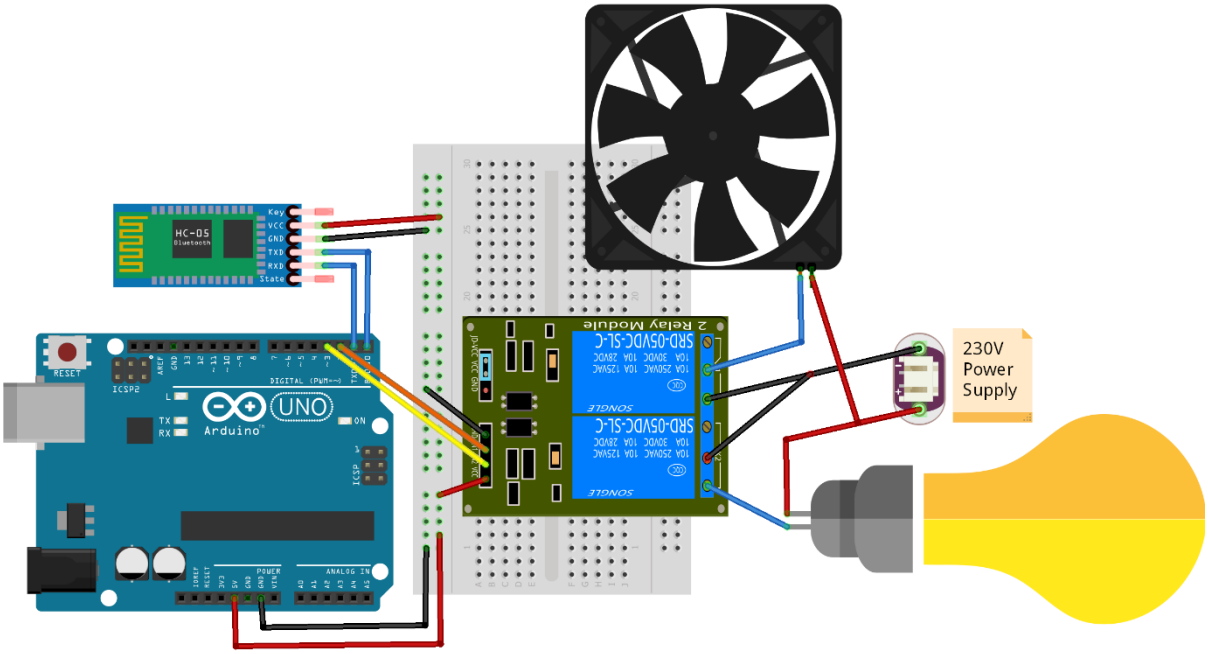

Figure 4. 5 Circuit Diagram of Voice Controlled Home Automation System using Arduino and Bluetooth module

Code 5:

```
#define fan 2
#define bulb 3
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
```

```
  pinMode(fan, OUTPUT);
  pinMode(bulb, OUTPUT);
}
void loop() {
  // put your main code here, to run repeatedly:
  if(Serial.available() == 1)
  {
    String val = Serial.readString();
    Serial.println(val);
    if(val == "fan on")
    {
      digitalWrite(fan, HIGH);
    }
    if(val == "fan off")
    {
      digitalWrite(fan, LOW);
    }
    if(val == "bulb on")
    {
      digitalWrite(bulb, HIGH);
    }
    if(val == "bulb off")
    {
      digitalWrite(bulb, LOW);
    }
    if(val == "all on")
    {
      digitalWrite(fan, HIGH);
      digitalWrite(bulb, HIGH);
    }
    if(val == "all of")
    {
      digitalWrite(bulb, LOW);
      digitalWrite(fan, LOW);
    }
```

}}

4.4.6 Garage system using servo motor and ultrasonic sensor

When something is in front of the sensor, (assuming it would be a car because this is for an automated parking gate) the ultrasonic will send the data to the Arduino board stating that something is near it, thus enabling the servo motor to start and letting the car pass.

Distance Sensor Pin Wiring to Arduino Uno

Trig pin to D8

Echo pin to D9

VCC to +5v

GND to GND

Servo pin connect to D10

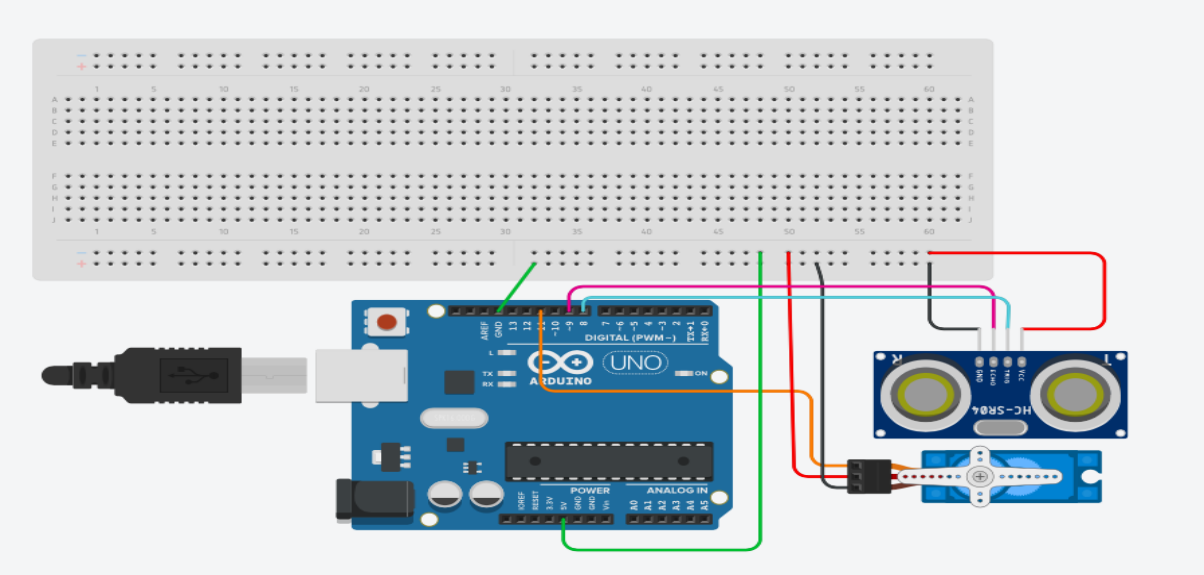

Figure 4. 6 Garage system using servo motor and ultrasonic sensor

Code 6:

```
#include<Servo.h>
int trig=8;
int echo=9;
int dt=10;
Servo;
//int distance,duration;
void setup() {
  // put your setup code here, to run once:
pinMode(trig,OUTPUT);
```

```
pinMode(echo,INPUT);
Serial.begin(9600);
servo.attach(11);
}
void loop() {
  // put your main code here, to run repeatedly:
if (calc_dis()<10)
{
  for (int i=0;i<=540;i++)
  {
    servo.write(i);
    delay(1);
  }
  delay(100);
  for (int i=540;i>=0;i--)
  {
    servo.write(i);
    delay(1);
  }
  delay(100);
}
}

//This code is written to calculate the DISTANCE using ULTRASONIC SENSOR

int calc_dis()
{
  int duration,distance;
  digitalWrite(trig,HIGH);
  delay(dt);
  digitalWrite(trig,LOW);
  duration=pulseIn(echo,HIGH);
  distance = (duration/2) / 29.1;
  return distance;
}
```

Chapter No.5

Conclusions

5.1 Conclusions

In this project, we introduced a safety and security system. Main purpose of home automation system is to provide ease to people to control different home appliances with the help of the android application present in their mobile phones and without android application to save electricity, time, and money. This system also helps the user to protect their homes from burglars when they are away from the home by using alarm as the alarm will start ringing whenever a burglar tries to enter the house. This system is also used to display the count of number of persons entering the house on LCD screen.
Smart systems are a designation that is given to the people which make their lives easier to improve the quality and execution, This system, though primarily aimed to reduce human effort, will be of much importance to old aged people and physically handicapped people. It will enable them to control their home devices with ease, without going through much pressure or stress of moving about. Smart systems are a designation that is given to the people which make their lives easier to improve the quality and execution, This project aims to provide a new hybrid solution for smart houses that is combine mobile application and an Arduino, because Smart houses are always focusing on leveling up the usability security as well, with the use of this solution for giving people the chance to control their own houses it will be a helpful method to achieve the goal of our system.

5.2 Future Scopes of the Work

Open systems can be used in corporate and commercial applications such as offices, warehouses and other areas reserved for authorized personnel only or in other important areas such as large and secure MNC Internet server . With stolen corporate data The system can be upgraded to include additional security features such as cameras, search markers, and more. This process can be advanced adding a camera and using image processing try to find out known and unknown face. If detect known face system can send SMS and email with picture and information about this face which is store in previous. We can make the web application more users friendly. Can be added voice commands technology. Adding some safety issues like when gas leakage or smoke found the system automatically takes necessary steps to reduce the losses.

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