OFFICE AUTOMATION THROUGH IOT

A MINOR PROJECT REPORT

Submitted in partial fulfilment of the

Requirements for the award of the degree

Of

Bachelor of Technology

In

COMPUTER SCIENCE AND ENGINEERING

BY

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DECEMBER, 2017

CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project Report entitled "**Office automation through IOT**", in partial fulfilment of the requirements for the award of the **Bachelor of Technology in Computer Sc. & Engineering** and submitted to the Department of Computer Sc. & Engineering of National Institute of Technology Raipur is an authentic record of my own work carried out during a period from July 2017 to December 2017 under the supervision of **Dr. Sarsij Tripathi**, Assistant Professor, CS&E Department.

The matter presented in this thesis has not been submitted by me for the award of any other degree elsewhere.

Signature of Candidate

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Signature of Supervisor(s)

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National Institute of Technology Raipur CG

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ACKNOWLEDGEMENT

We have taken much efforts to complete this project. However, it would have not been possible without the kind support and help of many individuals. We would like to extend our sincere thanks to all of them.

Firstly we would like to express our deep sense of respect and gratitude towards our guide and advisor, Dr. Sarsij Tripathi, for his guidance and constant supervision in completing the project. We would like to thank him for giving us the opportunity to work under him and introducing us to the world of Internet of Things.

We also express our sincere gratitude to Dr. Dilip Singh Sisodia, Head of the Department, Computer Science and Engineering for allowing access to all the essential facilities. We would also like to thank all the research scholars in our department who assisted us to complete this project in specified time.

I am obliged to the staff members of Department of Computer Science Engineering, for the valuable information provided by them and their help in lab.

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ABSTRACT

In this rapidly growing population, IoT technology provides significant enhancement to the quality of life. Internet of things is the system of interrelated connecting devices that have the ability to transfer data over the network. There are more devices connected on the internet than the people present on the earth. The applications of IoT varies from operating devices present in home to monitoring the meteorological activities in space. IoT has also created a huge revolution in health care. People have limited time, attention and accuracy of the data collected is getting reduced. To ease the daily life activities, many smart objects and automation systems are being made. Internet being the global network connecting millions of computers across different countries, has become driving force in improving Internet of things. IoT has major impact on energy efficiency. Many applications such as smart homes, smart fridges and automation systems play a major role in conservation of energy. In many organisations, finding a way to reduce energy has become a tough job. Office automation is one of the best solution in reducing energy consumption and cutting operation costs. Office Automation is a process in which all the devices are connected to the internet and data is collected through the sensing devices. By using this technology all the appliances present can be controlled and managed. Using the infrared radiations emitted by human beings, the presence of the person in the room can be detected. In this project, we are trying to develop an automation system in which appliances can be controlled in the absence of the person. This type of automation system can help a lot in the resource management and also conservation.

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INTRODUCTION

1. INTRODUCTION

1.1 INTRODUCTION

Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. This chapter gives an idea about internet of things along with its characteristics, objectives and applications of it daily life.

1.2 INTERNET OF THINGS (IoT)

Internet of things as defined by IEEE is a network that connects uniquely identifiable things to the internet. The things have capabilities such as sensing, actuation and potential programming. Through the exploitation of unique identification and sensing, information about the thing can be collected and the state of the thing can be changed from anywhere, anytime, by anything [1]. By 2020, 30 billion connected things with 200 billion intermittent connections are forecast.

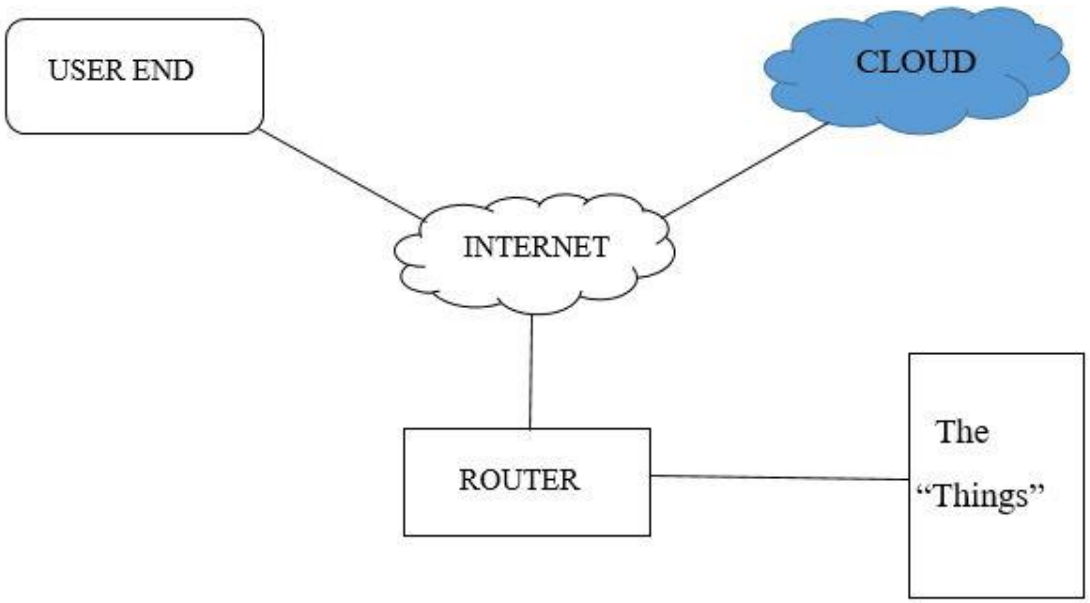

Figure 1.1: Block diagram of IoT

The figure 1.1 shows the block diagram of Internet of things with major components including router, the "Things" which are connected to the internet and the cloud.

The first generation of IoT products were the automated teller machines (ATMs) when they started coming online in 1974. As the years passed, the internet connected devices have become more than human beings present on the earth. One of the first steps towards IoT was the internet coke machine, developed in 1982 by students from Caregie Mellon University [2]. It was an internet-connected soda vending machine that allowed customers to check availability status remotely.

In 1999 The Internet of Things term was coined by Kevin Ashton, executive director of the Auto-IDCenter, MIT [3]. They also invented a global RFID-based item identification system in the same year. Billy Joy gave idea about device to device communication in his taxonomy of internet [4].

An efficient, scalable, secure, market oriented computing and resourcing of storage is essential for fulfilling the complete IoT. The technology in IoT can be explained as a connection between humans and computer things. In our day to day life, many equipment's we use can be controlled using Internet. The environment of IoT allow users to manage and optimize electronic and electrical equipment's using the internet. Many benefits are shown by IoT though some smart gadgets are more about Excellency than efficiency.

The main challenges for IoT are security and privacy. A lot of personal data about people is collected by these devices and systems. The smart meter used in homes knows when you are home and what devices you use. This data is held in the databases by the companies. Enough measures are not being taken to build security and privacy into IoT at these early stages. To prove this point many devices like monitors and automated machines have been hacked. But IoT is more than the smart homes and connected appliances. It scales up to including smart cities and connected traffic signal system that monitor utility use. Even smart bins that signal when they need to be emptied and connected sensors in industries also add to its vastness.

The use of automated machines and smart objects is more efficient that is use of less energy. As conventional sources of energy are fast depleting, it is necessary to conserve electricity and power. Hence the government is also encouraging energy companies to develop smart systems. This motivates us to develop an automation system which helps in conserving energy and resources.

Following chapters will give an insight into Internet of things and working of the project in developing an automation system.

1.3 ARCHITECTURE OF IOT

There are different layers in the architecture namely perception layer, transport layer, processing layer, application layer and business layer.

a) **Perception layer:**

This is the physical layer which consists of the sensors and collects data from the sensors about the environment. It detects physical parameters present in the environment and identifies smart objects.

b) **Transport layer:**

This layer is used for transferring data from perception layer to processing layer and vice versa through networks such as wireless, LAN, Bluetooth, RFID and NFC.

c) **Processing layer:**

It stores, analyzes, and processes huge amounts of data that comes from the transport layer. It can manage and provide a diverse set of services to the lower layers. It employs many technologies such as databases, cloud computing, and big data processing modules.

d) **Application layer:**

This layer is used for delivering application specific services to the user. It defines various applications in which IoT is used.

e) **Business layer:**

This layer manages the whole system including applications, business and profit models and users' privacy.

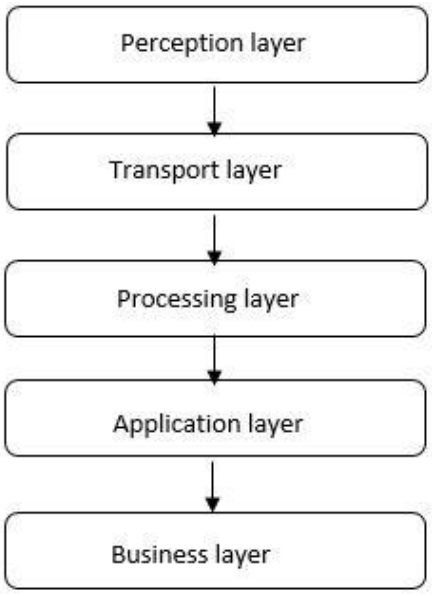

Figure 1.2 Layers of IoT

1.4 CHARACTERSTICS OF IOT:

The major characteristics of internet of things are listed as follows-

i. Interconnectivity: things can be connected to each other through the global infrastructure.
ii. Heterogeneity: The devices connected have different hardware platforms and software interfaces and can interact with each other through different networks.
iii. Things-related Services: it provides services with constraints of things such as privacy and consistency.
iv. Dynamic changes: various factors affecting the connections change dynamically such as sleeping/waking up, connected/disconnected, location, speed and number of devices.
v. Enormity of scale: there is a massive number of devices and communication within the devices.

1.5 OBJECTIVES OF IOT:

In the fast paced modern world, many dimensions in the global scenario are influenced by IoT. Hence, the major objectives of IoT include:

i. Solutions for existing technological barriers: speed and privacy are important factors. Moreover the devices need to be run automatically.
ii. Exploring the potential of integration: Iot architectures can be integrated with Cloud solutions and big data services.
iii. User acceptability validation: focusing on applications which require research but not in operation today.
iv. Promotes innovation on software platforms: innovation is needed for communication of non-experienced users with sensor objects.
v. Demonstrating cross use case issues: to validate the concepts of generic technologies.

1.6 APPLICATIONS OF IOT:

The applications of IOT extend from smart connected homes to wearables to health care. They not only provide comforts but also give control over daily routine work life. They help in maintaining balance between personal life and work life. The major applications of IOT are as follows:-

a. Smart Homes

Smart Homes is in the top position among the most searched applications of IOT. Smart homes are intended to save energy, time and money. They have turned out to be a success among the residential spaces.

Figure 1.3 Smart home

b. Wearables

Wearables are the devices connected over a network with sensors and software installed for collecting and transferring the data. The main prerequisites for wearable application is to be highly energy efficient and small sized. These are mainly seen in fitness, health and entertainment requirements.

Figure 1.4 Smart wearable

c. Smart City

Smart cities mainly aim at relieving life of city people with the help of traffic management, water distribution, waste management, environment monitoring and many more.

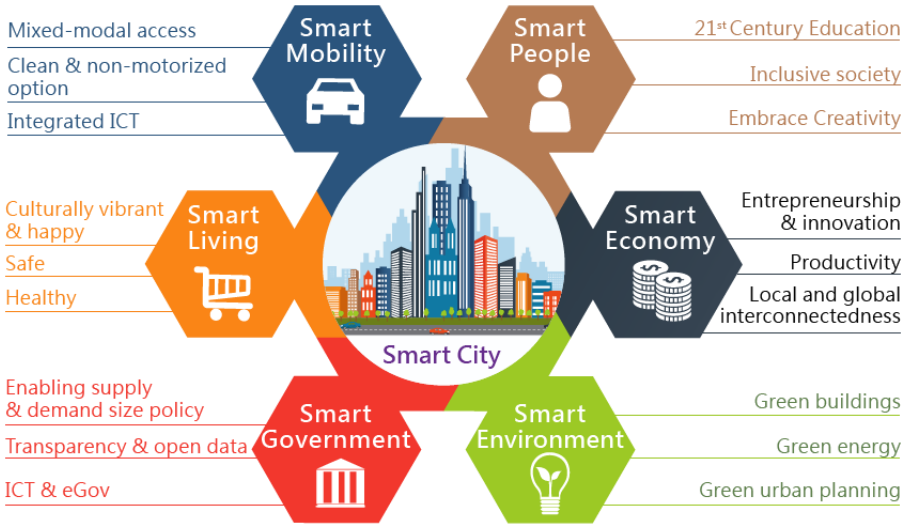

Figure 1.5 Components of smart city

d. Smart grids

Smart grids use the information about the behaviour of the suppliers and consumers to improve the efficiency of electricity. The study of information is done in an automated way.

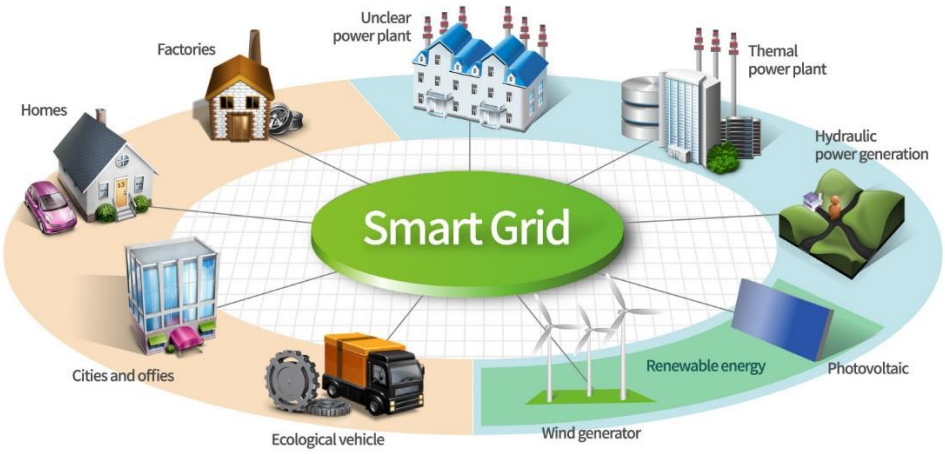

Figure 1.6 Smart Grid

e. IoT in Health care

IoT in health care is going to revolutionize treatment and medical facilities. The data collected using the IoT technology will help in analysis of individual's health conditions for better treatment. Connected health system and smart medical devices play a major role.

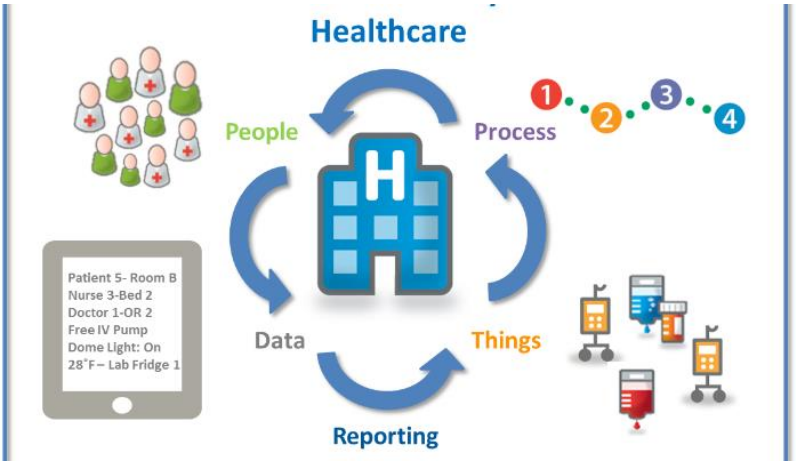

Figure 1.7 Connected Health care

f. Smart farming

The main functions of smart farming are the monitoring of large number of livestock and saving the costs in farming operations. Environmental monitoring also helps in smart farming. Smart farming is going to predominate in the near future in exporting agricultural products.

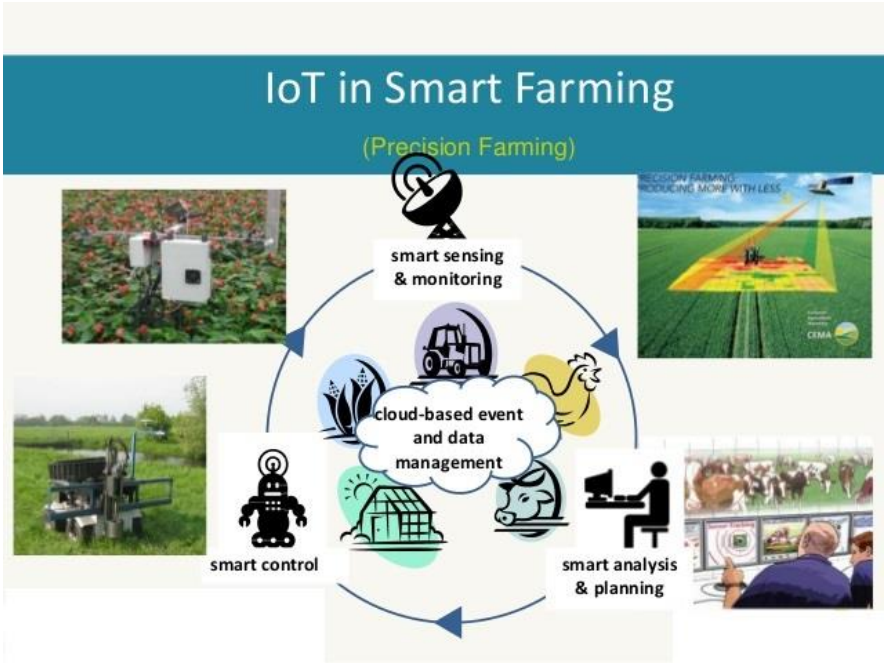

Figure 1.8 Smart farming

CHAPTER 2

METHODOLOGY

2. METHODOLOGY

2.1 INTRODUCTION

This chapter gives a brief description about the hardware and software components used. Logic and process flow of the system is also described.

2.2 HARDWARE COMPONENTS

The following hardware components are used in making the system:

i. **Breadboard:**

A breadboard acts as a base for the prototyping circuits. Generally a solderless breadboard is used. It usually consists of a block of plastic with nickel/silver/tin alloy pins underneath. They are called tie points or contact points. The spacing between the clips is 0.1 in. The holes are used for inserting wires and other circuit components. The board is made up of two type of areas called strips.

a) Terminal strip:

It's the main area and is the major place for holding components. There is a notch running in the middle to provide cooling effect. The columns are numbered, generally around 56-65. The five rows on left are marked A,B,C,D,E while those on the right are marked as F,G,H,I,J.

b) Bus strip:

This is used to provide power to the circuit.

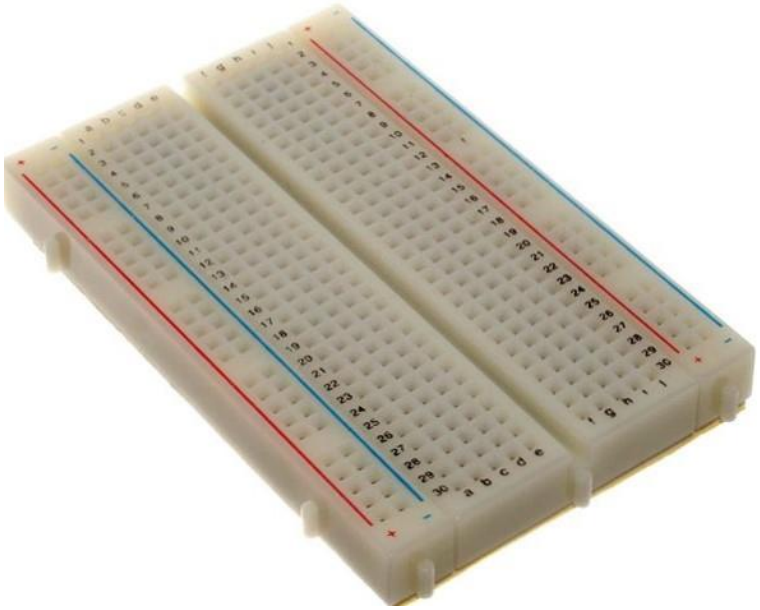

Figure 2.1 breadboard with rows and columns numbered

ii. **Jump wires:**

Jumper wires are the electrical wires with copper tinned ends used for connecting the components of the breadboard or any prototype circuit. There are two types of jump wires namely male and female jump wires. Male wires have pins at the end to insert while female wires do not.

Figure 2.2 Male and female wires

iii. **Arduino UNO:**

Arduino Uno is a microcontroller with 14 digital input/output pins, 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It is connected to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

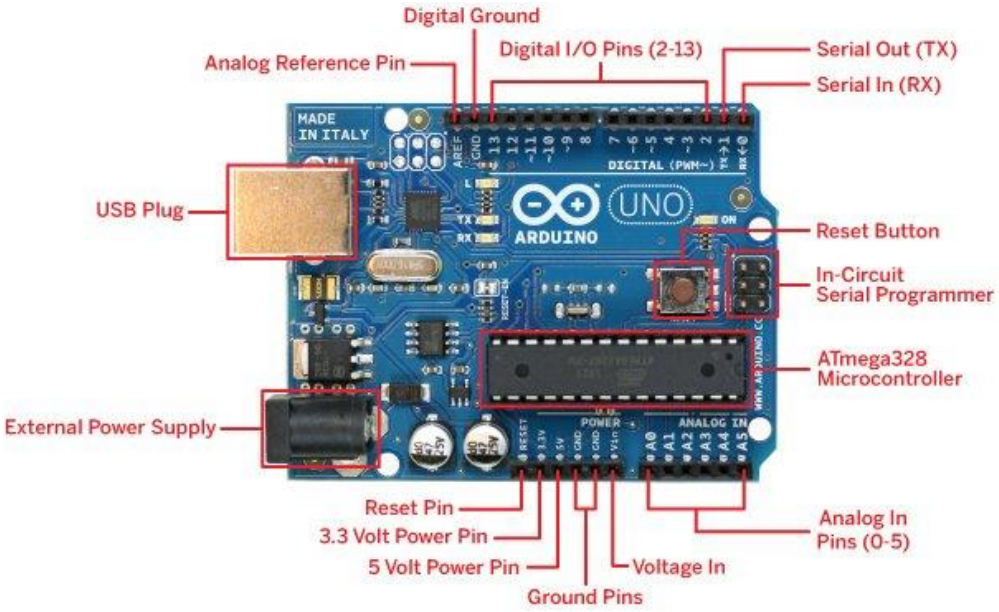

Figure 2.3 Arduino UNO

iv. PIR sensors:

Pyroelectric (passive) infrared sensors. PIR sensors allows us to detect motion and whether a human has moved out of the sensor range. They are lightweight, cheap, consume less power and easily usable. Every warm body emits radiation. PIR sensors work in a way by detecting this radiation and generating differential potential.

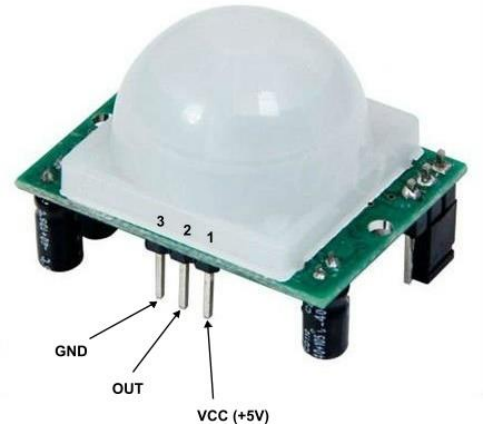

Figure 2.4 PIR sensor

v. **Magnetic Reed switch:**

Reed switch is an electrical switch operated by an applied magnetic field. It consists of a pair of ferrimagnets. The contact between the magnets will occur when a magnetic field is present. The connection is said to be closed when they are in contact. Once the magnet is pulled away, the switch will go back to its original position.

Figure 2.5 magnetic reed switch

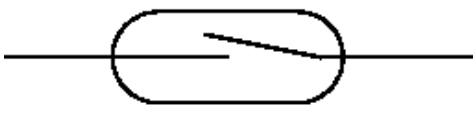

Figure 2.6 Circuit symbol of reed switch

vi. Ethernet Shield:

The Ethernet shield allows you to connect your Arduino to the internet using an Ethernet library. It is a plug-in module which connects via a RJ45 cable. Also, it consists of a SD card slot, which enables to store on the SD card via an SD library.

Figure 2.7 Ethernet shield

vii. Relay:

Relay is a device that provides an electrical connection between two or more points in response to the application of a control signal. The most fundamental control of any equipment is the ability to turn it “ON” and “OFF”.

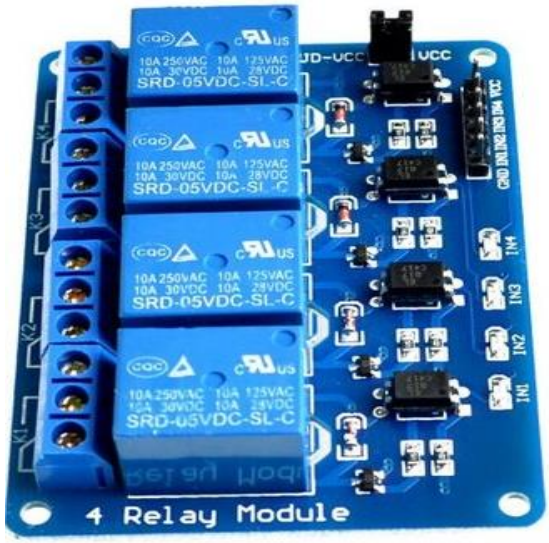

Figure 2.8 four relay module

2.3 SOFTWARE REQUIREMENTS

A brief introduction about the software components used:

i. ARDUINO IDE:

Any software application made with Arduino, an IDE is used which contains source code written in programming language. A program written in Arduino IDE is called a sketch. Sketches are saved as text files with extension .ino. The IDE supports c++. The IDE is cross platform with the application written in Java. The Arduino IDE is used to write, upload and compile the computer code to the Arduino board.

ii. PHP:

PHP (Hypertext Preprocessor) is a scripting language used for web development. The PHP application is also used to process the POST request sent by Arduino and is used to store and access the database. It is also used to display the values of the database using graphics.

iii. MySQL:

MySQL is the database management system. It is used to store the timestamp, sensor and PC states. It also helps in visual representation by processing the user's queries. MYSQL works with many operating systems and with many different programming languages.

iv. Processing IDE:

Processing development environment (PDE) makes it easy to write processing programs, these programs are written in the Text Editor and started by pressing the Run button. This program is called a sketch.

v. HTML and CSS:

Hypertext mark-up language is the acronym for HTML which is a scripting language used for developing web pages. These are generally run on the web browsers like internet explorer, Mozilla Firefox, opera, google chrome, etc. HTML is just the basic and building block for many other web languages. Cascading style sheet is the acronym for CSS. These are the styling sheets which makes the skeletal HTML pages to responsive web pages. Though HTML is used for developing the web pages, CSS is

needed to style those web pages. HTML and CSS are used for the front end development.

2.4 LOGIC AND PROCESS FLOW

In this section, we will discuss about the process flow of the project and the step by step procedure to be followed to achieve the objective of the system to determine the presence of the person in the room and control the appliances.

Step 1: This is the initialisation step in which all the required connections amongst the breadboard, Arduino, sensors and relay devices are made. Sketch is loaded to the Arduino board. Connection between Ethernet shield and Arduino board is also made in which pins of Ethernet shield acts as pins of Arduino board.

Step 2: The sensors connected takes input. The PIR sensor is used to detect the motion. It has two slots when the room is empty it detects equal amount of Infrared rays. When a warmer body like human enters the region it affects only one slot which causes a positive differential change and when human leaves the other slot is affected causing negative differential.

Step 3: After the sensor collects the input which is in the form of Analog signals, the Arduino converts the analog signals into digital form and then Arduino stores it that is the Arduino both converts and store the signals.

Step 4: Now that the data has been stored, by making use of the Ethernet Shield, Arduino sends data to web server, and for that we make use of PHP file for storing data in database.

Step 5: The Arduino board checks whether the human is present in the room or not according to the data collected by the sensors.

Step 6: If the status of the human presence is 0 i.e. human is absent then we implement the algorithm in PHP. The delayedfactor.php file is called and average time is calculated. It is then written into a file called avg.txt.

Step 7: The processing IDE listens from php file and writes the data to Arduino IDE. The processing IDE also reads the average time from avg.txt file and then makes the system delay for that particular time and then writes the state ‘A’ to the Arduino which denotes Arduino must automatically take the decision to switch off or on the appliances.

Step 8: Now, status of the sensors is checked after which we take decision. If the human is not present then appliances in the room will be switched off.

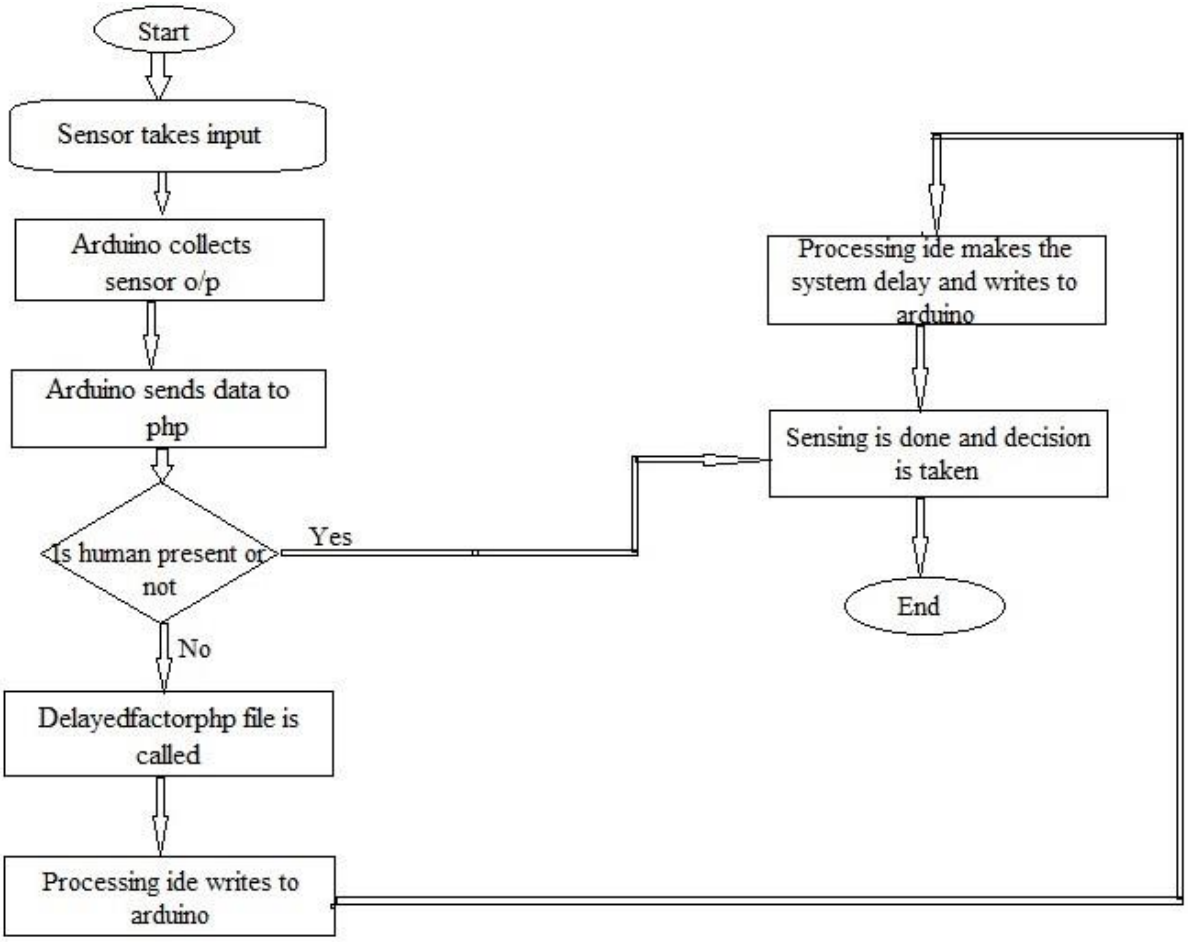

Figure 2.9 Process flow diagram

CHAPTER 3

IMPLEMENTATION

3. IMPLEMENTATION

3.1 INTRODUCTION

This chapter describes the algorithm implemented, hardware connections and software development. At hardware level, we shall discuss about the connections made amongst the sensors, Arduino and breadboard.

3.2 ALGORITHM IMPLEMENTED

Calculation of average delay time:

Step 1: All the entries from the database are taken as input.

Step 2: The timestamp of first occurrence of human presence is stored (status=1).

Step 3: While there are continuous occurrences of human presence, difference between the timestamps of the firs occurrence and last occurrence is calculated.

Step 4: Average of the differences calculated called average delay is calculated.

Step 5: This delay is written into a file called avg.txt file.

3.3 HARDWARE CONNECTIONS

i. Connection of PIR to Arduino:

a. vcc/+ve- it is connected to 5v pin of Arduino.

b. out-it is connected to digital input pins of Arduino 8 and 9.

c. gnd/-ve- the ground pin is connected to the ground pin of Arduino.

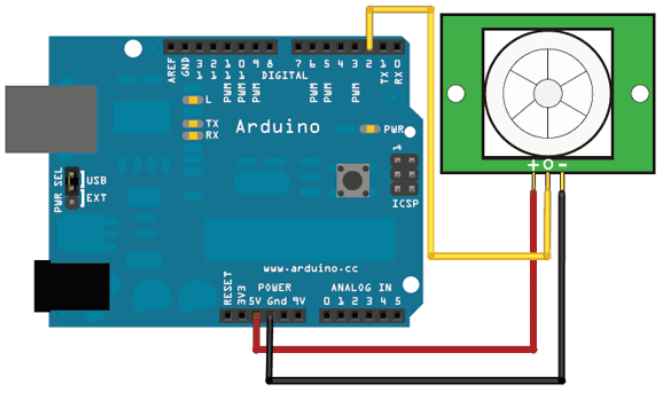

Figure 3.1 connection of PIR to Arduino

ii. Connection of Arduino and sensor using breadboard:

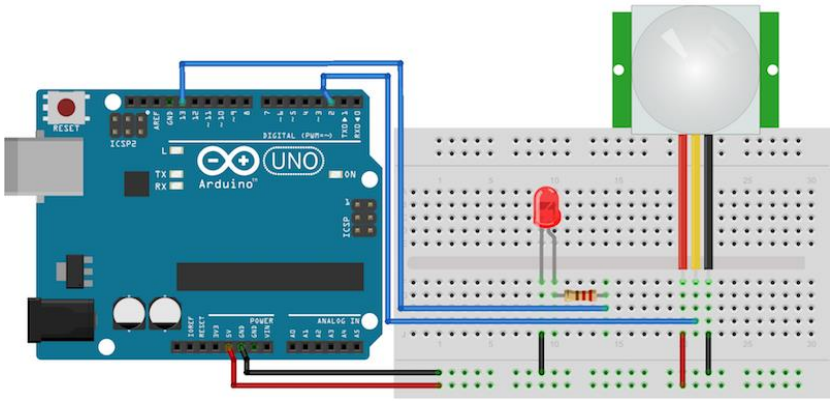

Figure 3.2 shows the pin diagram of connection of breadboard and Arduino

a. +ve power rail of breadboard is connected to 5v pin of Arduino.

b. –ve power rail of breadboard is connected to negative of Arduino.

c. output pin of sensor is connected to pin 8 and pin 9 of Arduino.

d. +ve/vcc pin of sensor is connected to positive power rail of breadboard.

e. –ve/gnd pin of sensor is connected to negative power rail of breadboard.

iii. Connection of Arduino and Ethernet Shield:

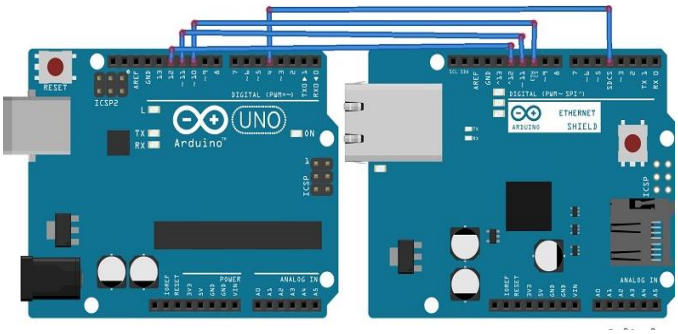

Figure 3.3 Pin diagram of connection of Arduino and Ethernet shield

The Ethernet shield is mounted on Arduino and the pins of Ethernet shield act as pins of Arduino. Figure 3.3 shows the pin diagram.

iv. Connection between relay and Arduino using breadboard:

a. Output of relay is given to positive terminal of the appliance.

b. Negative of the appliance is given to GND of Arduino.

c. Input to relay is given from positive of Arduino.

d. The main positive and negative of Arduino are given to main positive and negative of relay respectively.

e. Digital output of Arduino is given to digital input of relay.

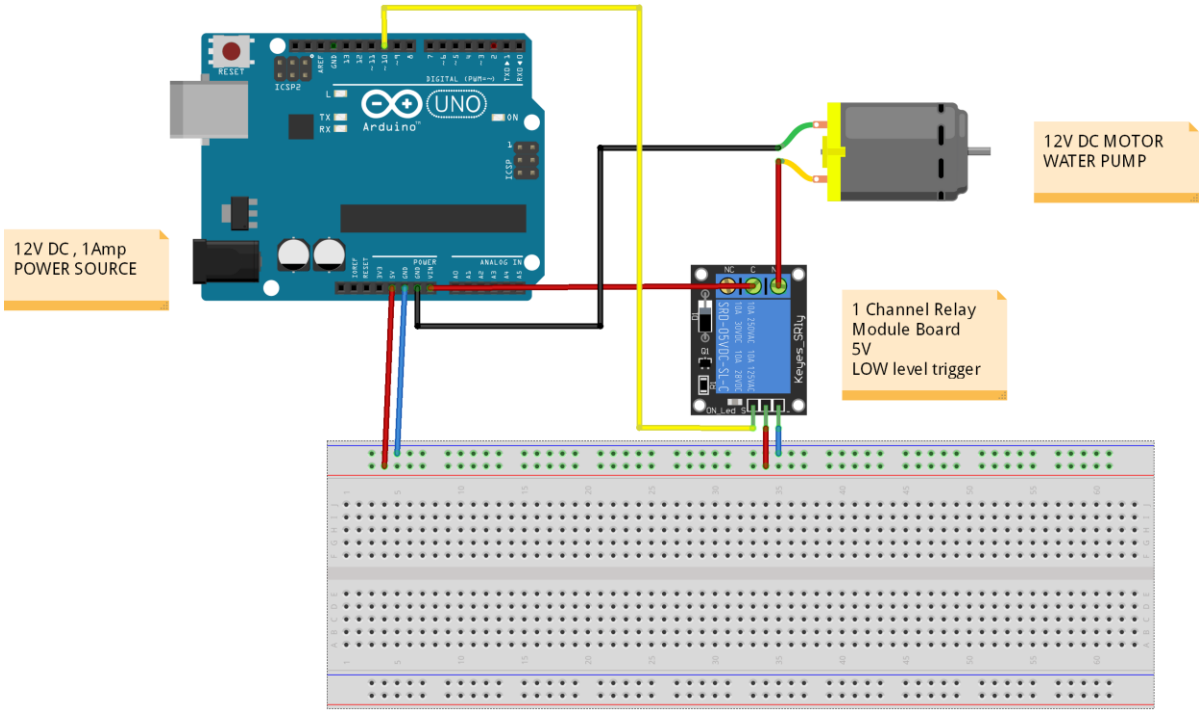

Figure 3.4 Connection of Relay and Arduino

v. **Connection of Reed switch and Arduino using breadboard:**

a. One pin of reed switch to positive of Arduino.

b. Other pin reed switch, one pin of resistor and GND are connected together.

c. Other pin of resistor is given as digital input to Arduino.

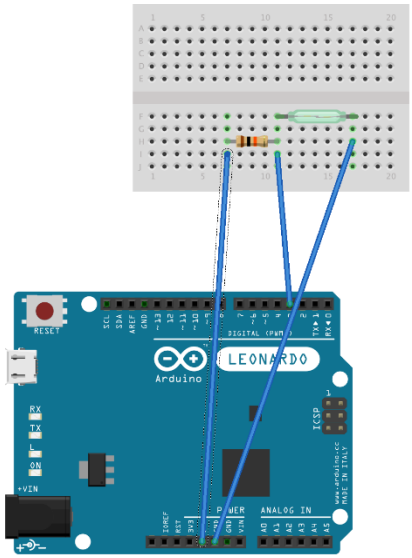

Figure 3.5 connection of reed switch and Arduino.

3.4 LIBRARIES

The major libraries used are:

i. **Ethernet.h**

This library is used to work with the Ethernet Shield. It is used to connect the Arduino board to the Internet. Some of the functions from this library are client.connect(), client.available(), client.connected(), client.println().

ii. SPI.h

Arduino communicates with the shield using the SPI bus. The Serial Peripheral Interface(SPI) is a synchronous serial data protocol used by microcontrollers to communicate with different peripheral devices, In our case we use it to connect Arduino with Ethernet shield.

3.5 FUNCTIONS USED

This section lists the various functions used in the project.

The major functions of Arduino are:

i. **setup():**

This function is used to configure arduino. It is in this function we set input and output pins of arduino.

This function is also used to set Ethernet shield by setting IP and starting Ethernet shield.

ii. loop():

This function is used to execute some steps repeatedly, like we want the sensor data continuously and send the data to web server.

iii. connectClient():

This function is used to connect client to server. User defined function, it uses a pre defined function client.connect().

iv. client.connect(server,port):

This function is used to connect client to server. Pre-defined function. It takes two parameters server and port.

Server is either IP address of server or domain name of server.

Port is the port number of server with which connection is made.

v. client.available():

This function is used to determine if there is any byte of response remaining to be read. It returns the number of bytes available to read or 0 if nothing.

vi. **client.connected()**:

This function is used to know whether a client is connected to server or not. If a client has any number of bytes to read the client is considered connected.

vii. client.stop():

This function is used to disconnect client from server.

viii. **postData()**:

This function is used to send data from Arduino IDE to webserver. Once client is connected to server it uses client.println() to send the data to server. Data can be sent via two methods, POST request and GET request. After sending the data from to server and processing of data at server, server sends response, this function prints the response on Serial Monitor.

ix. **postAvg():**

After calculation of delay according to the algorithm in php file, the delay is written into the avg.txt file.

x. **client.println():**

This function is used to write data on web server and get response back. This function returns number of bytes written on client.

3.6 PROJECT CONNECTIONS

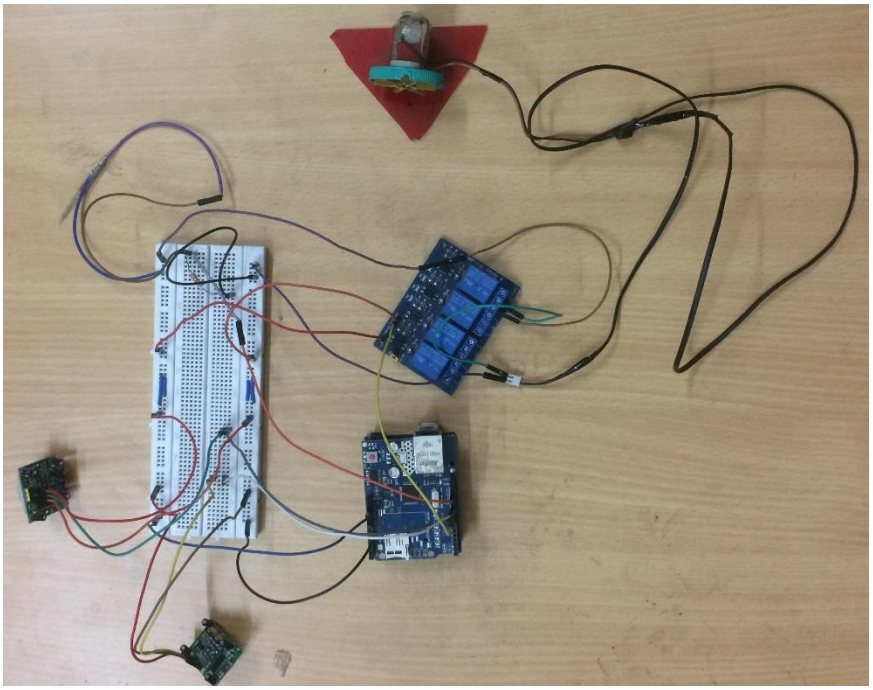

Figure 3.6 Connections amongst Arduino, relay, sensors and breadboard

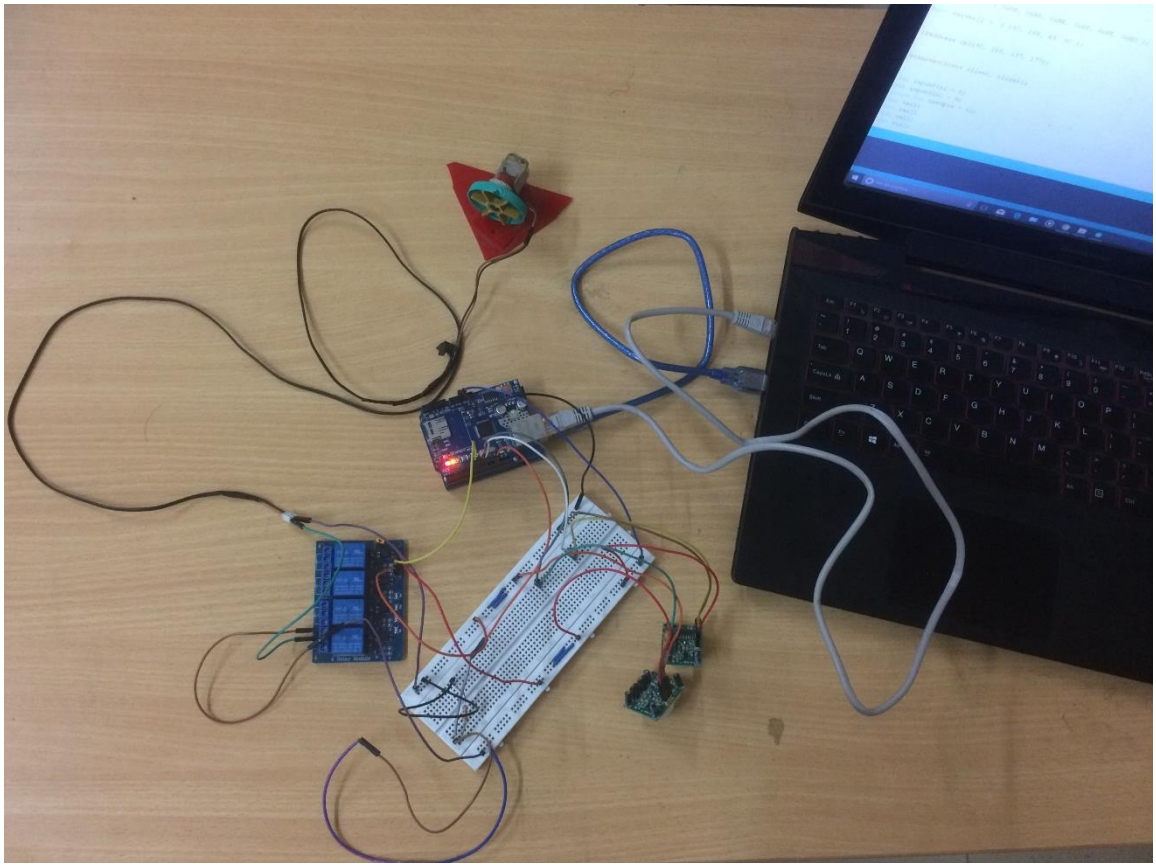

Figure 3.7 Connections with the server

CHAPTER 4
RESULTS

4. RESULTS

4.1 INTRODUCTION

This chapter shows the status of the sensors received while implementing the system. The calculated delay times and timestamps are stored in the database and can be seen in this chapter.

4.2 SCREENSHOTS

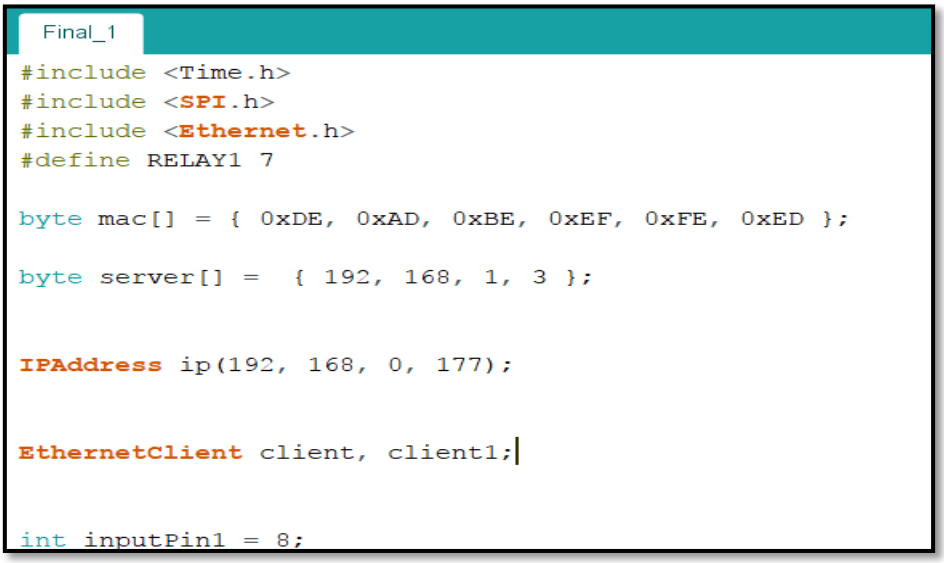

FIGURE 4.1 IP address of the Arduino is assigned statically.

The figure 4.1 shows that the static IP address is assigned to the Arduino. The IP address changes whenever the system is connected to a new network.

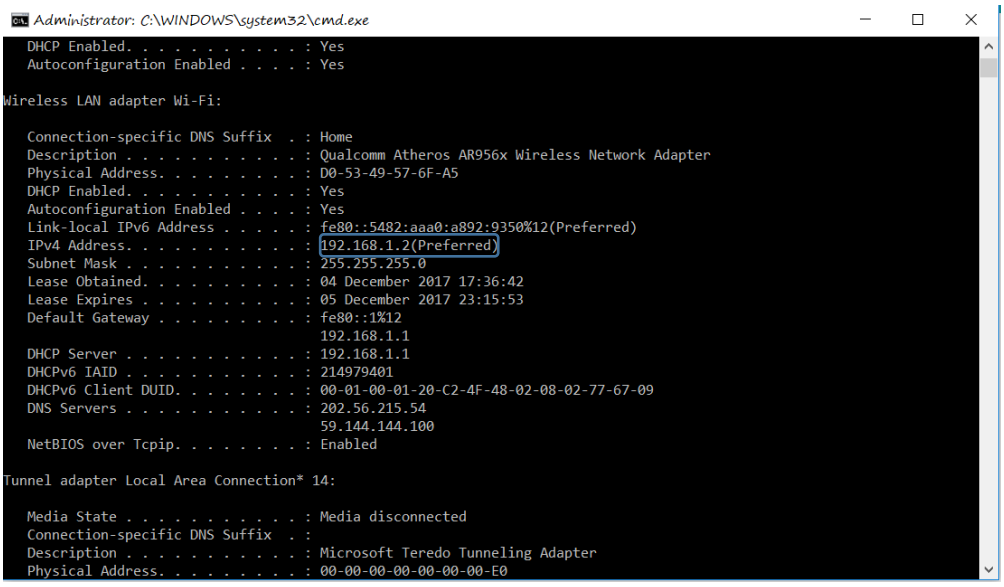

Figure 4.2 IP address of the server

Figure 4.3 Calldelayedfactor method is called

In the above figure the Arduino IDE calls the delayedfactor method and a value is returned from which Arduino takes further decision.

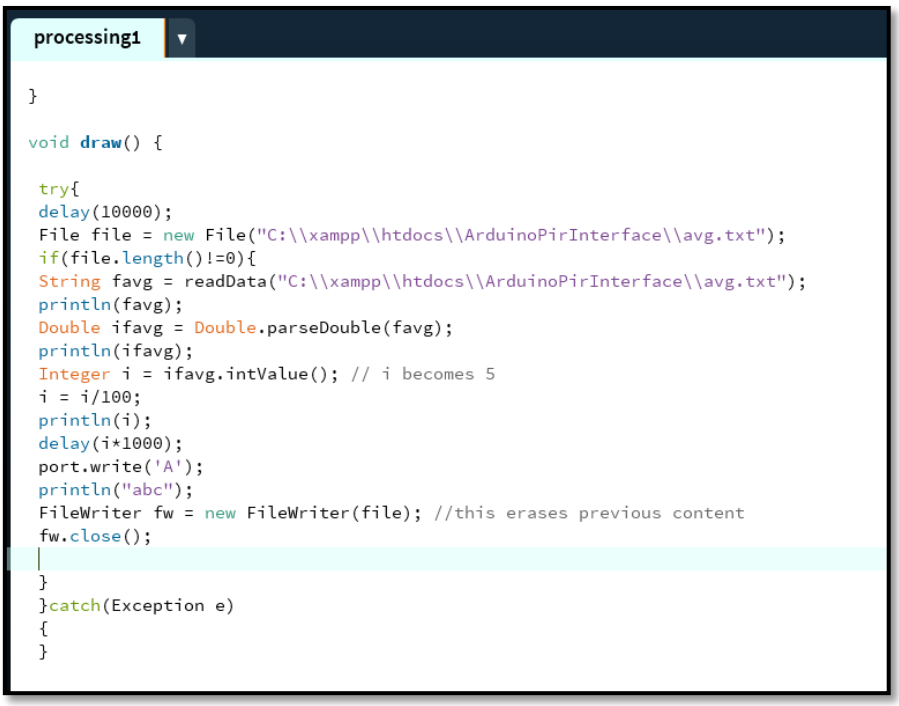

Figure 4.4 processing IDE which generates delay and writes to Arduino

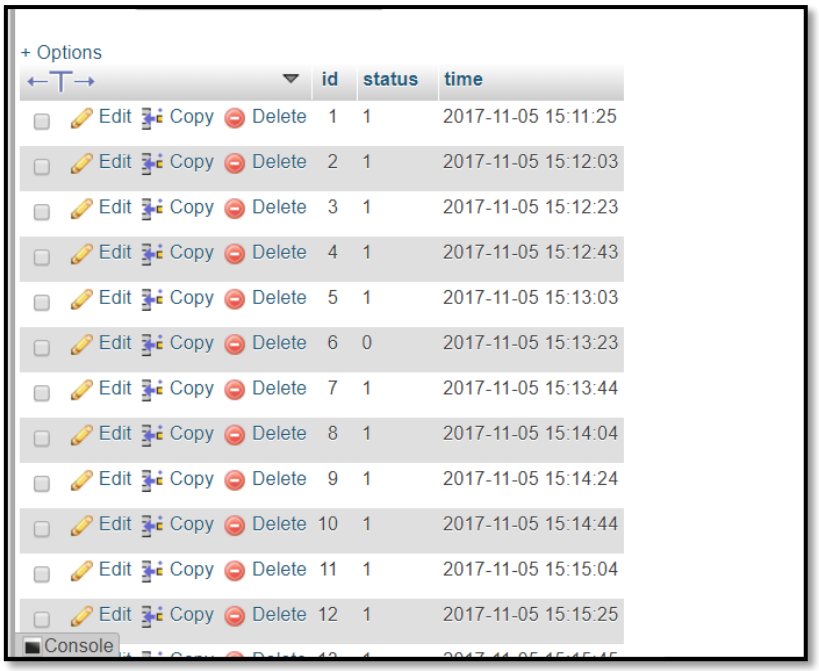

Figure 4.5 Status of the sensors stored in the database

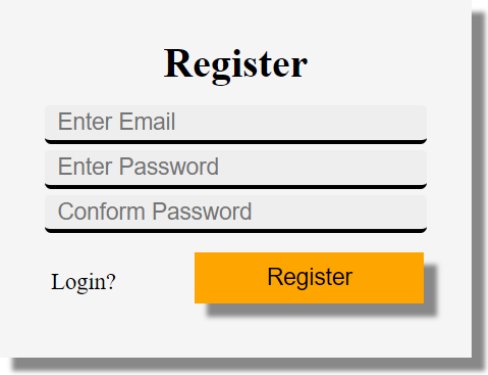

Figure 4.6 Remote user register

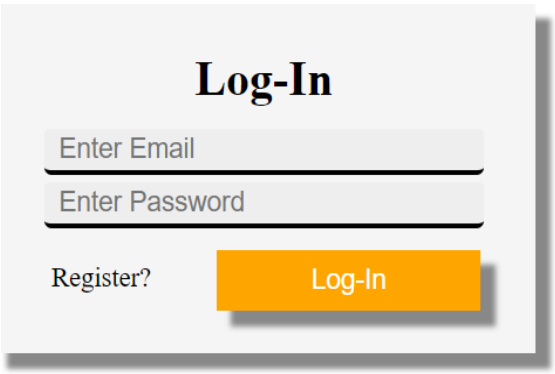

Figure 4.7 Remote Login page

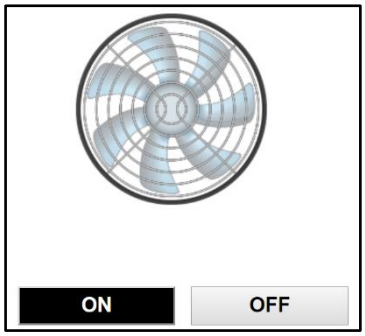

Figure 4.8 Remote control of appliance

CHAPTER 5
CONCLUSION AND FUTURE WORK

5. CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

The project controls the electrical appliances by determining the state of the room. The project has been designed in a way to be user adaptive.

Based on the possibilities, which can be that whether human is present or not present, the state of the room is determined. Considering that state, decision is made whether to switch on or switch off the electrical appliances. Before switching off any appliance, the system is delayed for a dynamic time period which is estimated by monitoring the presence of the user in the room. This makes the system user adaptive.

By using this office management system, one can monitor the presence of human in the room, identify the time period for which there is human presence in the room, get an indication when the door is open or closed.

The project has been built by making use of sensor technology and IoT and system configuration. The proposed system, being energy efficient has great economic and social benefits.

5.2 FUTURE WORK

In future, the system can be built and implemented on a large scale. The system can be made more user adaptive by improving the algorithm for calculating the dynamic time delay.

Remote on or off facility for controlling the electrical appliances has to be implemented. The whole system has to be interfaced with more sensors such as Magnetic Reed Switch to make the sensing process more accurate.

The system should generate more data so that analysis can be done considering various factors through which more energy efficiency can be achieved.

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