

“Arduino Based Home Automation through Internet of Things(IoT)”

Project report submitted in partial fulfilment of the requirement for the
degree of Bachelor of Technology

In

Computer Science and Engineering

By

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Under the supervision of

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Candidate's Declaration

I hereby declare that the work presented in this report entitled “Home Automation through Internet of Things(IoT)” in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering submitted in the department of Computer Science & Engineering, Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2018 to May 2019 under the supervision of Dr. Ruchi Verma (Associate Professor, Computer science and Engineering).The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Aman Gupta (151371)

This is to certify that the above statement made by the candidates is true to the best of my knowledge.

Dr. Ruchi Verma

Associate Professor

Computer Science & Engineering

Dated:

ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our project guide Dr. Ruchi Verma who helped us in conceptualizing the project and actual building of procedures used to complete the project. We would also like to thank our Head of department for providing us this golden opportunity to work on a project like this, which helped us in doing a lot of research and we came to know about so many things.

Secondly we would like to thank our family and friends who guided us throughout the project so as to complete our project on time.

Thanking you,

Aman Gupta (151371)

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LIST OF ABBREVIATIONS

S No.	Abbreviations	Description
1	IDE	Integrated Development Environment
2	ADT	Android Development Tools
3	DDS	Data Distribution Service
4	AMQP	Advanced Message Queuing Protocol
5	IR	Infrared
6	LED	Light Emitting Diode
7	LDR	Light Dependent Resistor
8	CMOS	Complementary metal-oxide semiconductor
9	DTR	Data Transmission Rate
10	SPI	Serial Peripheral Interface
11	EEPROM	Electrically Erasable Programmable Read Only
12	RFID	Radio-frequency identification Radio Frequency

ABSTRACT

Today, the use of home automation has increased by leaps and bounds. Home automation is one of the most interesting field information technology. Home automation in simple terms is dominating several activities of our home through advance technologies. In this project we will develop a prototype demonstrating various aspects of Home Automation, like controlling electronic devices, using the devices only when needed thus saving energy, switch on/off electrical appliances with mobile phone from distinct places. It permits the person to carry out different acts of home from a distant place. By using various type of sensors we can automate our homes.

The unique feature of home automation is that all the devise in the home are controlled automatically by the help of remote sensor that is connected to the central host PC.

The Wi-Fi which is a wireless technology is used to have a connection between the webserver and the NODEMCU.

The hardware and software components comprise of Arduino IDE, Breadboard, Jumper cables, Arduino Uno, NodeMCU ESP8266, HCSR04, LED Display, and Potentiometer.

1 INTRODUCTION

Human beings are very lazy creatures, we want to do all of our work by just sitting at a one place and not bothering to go out and socialize. Emerging technology has on the other hand is trying its best to fulfil our demand by everyday introducing something new. One of the emerging and interesting field is Internet of Things.

Under Internet of Things we have a small domain called Home automation in which focus is on automating almost every device of our homes. We can make our own security system just by using sensors and doing some code. We can control the devices wirelessly by using Bluetooth or Wi-Fi module. It is all about connecting our devices with the network so that we can control almost anything from anywhere. Unlimited amount of sensors are available in the market and our task is only to deeply understand their functioning and implement them in various areas of concern. One of the examples is of water level sensor, we can use it in our water tanks to measure the level of water and automatically the motor will be turned off when the level exceeds some threshold value.

Need to automate the device can come to any of us but we do not have enough of the knowledge of how to do the things. So the need to study the basic concepts of Internet of Things are important. We can get various ideas related to the innovation by constantly surveying the people by emails or sms etc.

Today Internet of Things is an important part of innovation where constant researches are going on and in Home automation everyday something new is being generated. In our project we will be testing some of the basic sensors and then try to control some of the devices using Bluetooth and Wi-Fi module.

Major issue now a days is the issue of privacy. With recent events like Facebook Cambridge analytica case, privacy of users is becoming of great concern to the state authorities in position. Data from several websites and the data stored on various clouds also has an issue of privacy

due to increasing number of cyber-attacks and increasing cases of data being stolen without the consent of the user. Data from several servers is being stolen and sold to big corporate so that they could easily target their audience and make money out of it.

Recently the Supreme Court of India in Justice K S Puttaswamy vs Union of India & Others stated that privacy is one of the fundamental duties of the citizen of India thus protecting privacy is also a major issue in Internet of Things and in the internet world.

Major economies of the world like Europe, United States Of America, China and many other countries have very strict data protection laws like Europe has General Data Protection Regulation(GDPR) under which user has the choice with whom he/she wants to share its information and also has the right to be forgotten.

There are several types of devices controlled through home automation which are:

Individual Control devices: In this method, each device is controlled individually thus it is very user friendly and handy. It was used in early days of evolution of Internet of Things.

Distributed Control Systems: In this method, the best part is emergency shut down which becomes very useful when it comes to fire detection or any other such danger event.

Centrally Controlled Systems: In these systems, the devices are programmed via computer so that it could handle all kinds of functionality required by the user such as Air Conditioners, heaters, doors, windows, security systems, car parking etc.

1.1 Smart Homes

“Home Automation”, “Connected Devices” and “Internet of Things” are often interchangeable, but they are discrete parts of the Smart Home concept:

- **Automated home:** As earlier discussed this refers to automating most of the devices of you home for example switching off the lights when nobody needs to use it or turning on and off other appliances in the home. Or controlling the lights with your own voice or by mobile.
- **Internet of Things:** Smart homes are made by using Internet of Things. We use various sensors at different places and make them connected to the network so they can communicate with each other and there is no need of asking for the inputs and other details from the user.
- **Connected devices:** These are the intelligent devices which have the ability to connect to the internet and start communicating with the user by use of programming. For example we can use it in our water tanks to measure the level of water and automatically the motor will be turned off when the level exceeds some threshold value.

Why automated homes?

Savings: Internet of Things promoted devices such as learning thermostats, smart sprinklers, Wi-Fi enabled lights, and electricity monitoring outlets as well as water heater modules reduces the energy and water use.



Figure 1: Smart home[5]

Control: We can easily control all the network connected devices almost everywhere around the world, for example we did not turn off the lights but our light system is connected to the network via some sensors and constantly monitoring the status of the lights and giving us the report via sms or any other means. By seeing the status of the lights we can turn it off by sending some command.

Security: This can be achieved by using Wi-Fi enabled cameras, motion sensor which will sense the motion or any activity of any object and by using this in collaboration of alarm we can easily monitor what is going on in the house.

Safety: It can be achieved by using sensors like water sensor which can detect any leakage in the water tank, smoke sensors which can detect fire etc. Using these sensors and connecting them to the network can prevent many tragedies from encountering.

Convenience: This is the most desirable feature or advantage of smart homes. We do not have to do any kind of hard work rather everything happens automatically just by sitting at a corner and giving commands to the devices. Example in voice controlled homes we just need to say that turn off lights and the lights will switch off, or led display on fridge which will display that milk is in the fridge or we need to buy it or if we are out of it can order itself online.

1.2 Internet of Things

IoT is the network of devices (that are mainly various types of sensors attached to many devices) which permits these sensors to collect and communicate with user and transmit over the network. Due to this we can remotely access or control any of our devices and in interaction between the computer world and the physical world is merging as the new innovation which is helping in increasing efficiency economic benefits and accuracy. We can see how it is efficient, economically beneficial by taking this simple example of turning off the lights automatically or automated taps from which water comes only when hands or any other object is beneath the tap, this way our electricity and water which are very crucial resources are not wasted at all. IoT can be used in the following fields:

- Tracking the surrounding or the environment
- Managing the infrastructure
- Home automation
- Business automation
- Hospitals and other medical stores
- Security systems
- For preserving and conserving resources



Figure 2: Uses of Internet of Things[7]

1.3 Objective

- To develop an automated home controlled using Arduino.
- The objective is to conserve energy resources.
- To implement services such as switching on/off lights via mobile, smart car parking etc
- To use Bluetooth to make it wireless.
- To use Wi-Fi module esp8266 to wirelessly control the devices.

1.4 Methodology

In this smart home automation we would have a system which can identify the owner of the house. When someone is at the door it sends the picture of the person to the owner and door automatically opens or closes on the command of the owner. When you enter the room the lightning of the room goes as specified by the user according to his mood.

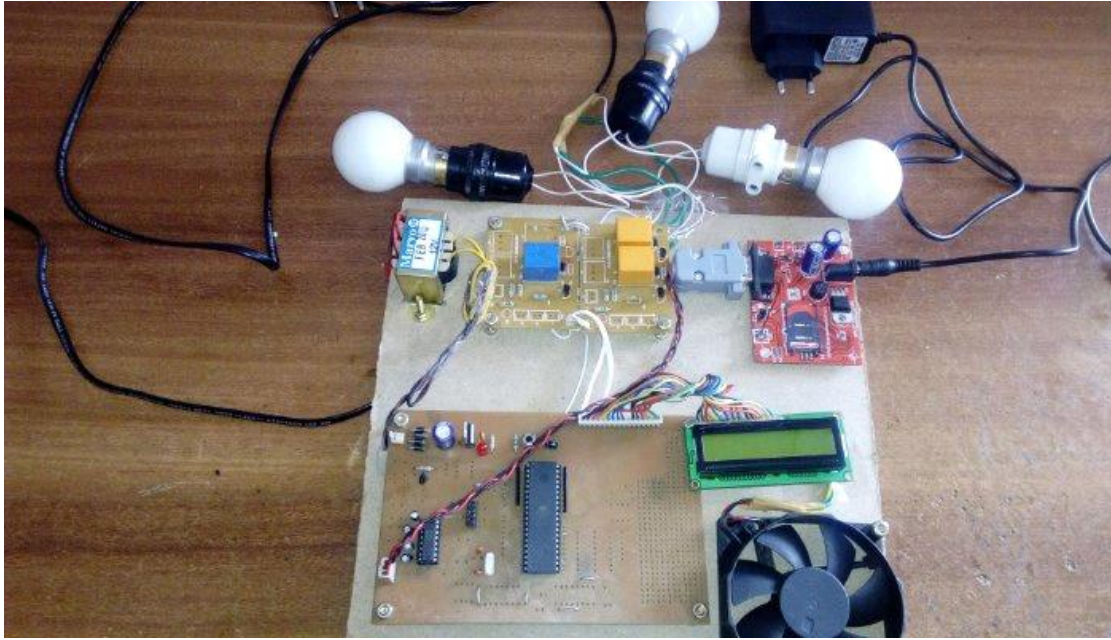
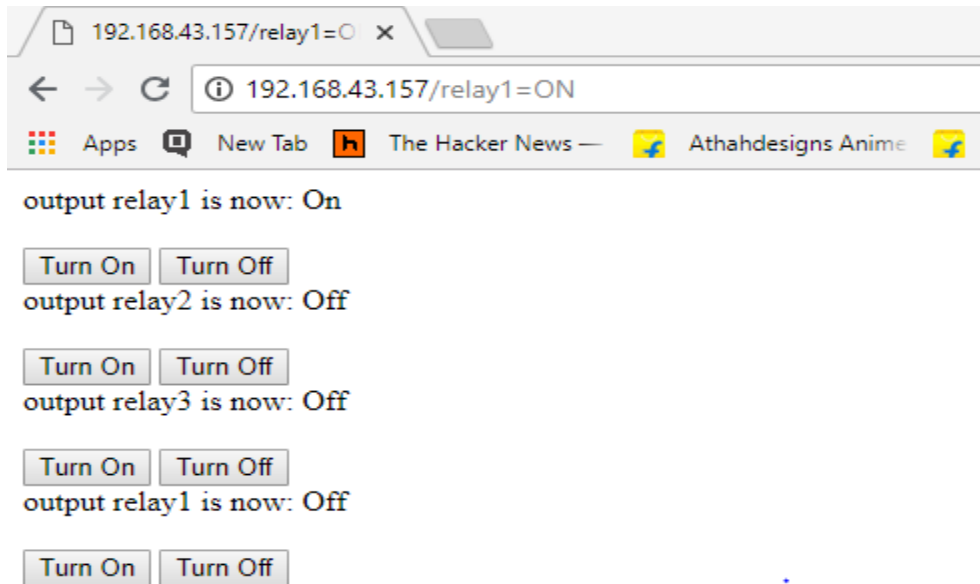


Figure 3: Methodology

To achieve all of the above we will build an html page accessible from every device which will all the functionalities needed to automate the home. Using esp8266 module we will create a web server and http requests will be send to perform a particular task. It will look like this:



We will use relay here to connect to the appliances working on high voltage. Relay is kind of switch which will switch from 5v to the high voltage.

2 LITERATURE REVIEW

2.1 Home Automation through IOT : Vinay Sagar, KN. Kusuma, SM. (2013)

Today the automated home systems face four primarily four challenges; challenges include: elevated possession worth, inflexibility, poor flexibility, what is more as issue in achieving security. The foremost aim of this project is to vogue and make an automated home system mistreatment IoT technology that is apt of dominating and automating the appliances or devices inside the home through a straight forward and controllable web interface. The kind of the system talked about throughout this paper, encompasses a pleasant flexibility of mistreatment Wi-Fi technology to interconnect the distributed sensors to home automation system server.

Another major issue nowadays is the issue of privacy. With recent events like Facebooks Cambridge analytica case, privacy of users is becoming of great concern to the state authorities in position. Data from several websites and the data stored on various clouds also have an issue of privacy due to increasing number of cyber-attacks and increasing cases of data being stolen without the consent of the user. Data from several servers is being stolen and sold to big corporate so that they could easily target their audience and make money out of it.

- **Ramani, R. Olatunbosun, A. (2010) Internet of Things (IoT)**

One of the truism within the info Technology is web of Things (IoT). It is the future of technology which will transform the simple objects into the smart ones. The technology want to unify everything and not only want us to control the things but also remain informed about the state of the device. This particular paper tells about the overview of this new technology that is IoT, architecture and how it is vital in our daily life.

“The most profound technologies area unit those who disappear. They weave themselves into the material of daily life till they are indistinguishable from it” was Mark Weiser’s central statement in his seminal paper in scientific Yankee in 1991. After the arrival of this new technology many new changes are seen in day today’s life. This concept is becoming popular with times as there are several applications of this. Internet of Things need is increasing everyday due to the large automation demands by the large firms, as everything becomes super easy if the concept of Internet

of things is implemented in industries. The ability to do every task that can be automated with great precision, high speed and minimum errors has allowed various industries to be more productive and efficient. So it can be seen that Internet of Things is the technological revolution which has made everyday life very easy with knowledge of sensors, programming etc.

There are several examples of how an automated machine has made our lives much easier and comfortable. Some examples of home automation includes:

Switching off the lights or fans even if a person is away from his/her house

Switching on AC so that when a person reaches he/she has the required room temperature

Improving the security of the home by providing real time feed of the house

Helping especially abled people as well as old people since a machine can do a task as many times as asked since it is programmed to do so while on other hand a person may get frustrated by same demands

- **Reza, K. Ahsanuzzaman, S. (2010) Advanced Research in Computer Science and Software Engineering**

The paper pacts with the automated home systems based on visual authentication. It allows the owner to grant entry to any of the visitors to his home after viewing his or her image. Arduino Uno has been used as a system processor. The whole system was the wireless. A webcam would constantly monitor whose entering the house and would capture the picture of the visitor and would send to the owner. As the traveller arrives and desires to enter the house, the digital camera unceasingly keeps on looking for any changes in its read and it takes the image of the traveller. There will a message sent to the user's phone asking regarding he needs to look at the image or not, once the owner gives the confirmation, it will receive the image from IP address of the digital camera via Bluetooth pairing. After about five millisecond of delay a message is going to be presented to the owner to ask to open the door or not. If owner desires to open the door a sign are going to be sent to electronic lock via Arduino. If owner answers negatively the complete program are going to be terminated there itself. Like this manner our system can work.

3 SYSTEM DEVELOPMENT

3.1 Tools and Technologies used

3.1.1 Hardware Used

1. Arduino Uno

The Arduino Uno may be an ATmega328P microcontroller. It includes of fourteen digital Output/Input pins out of that six square measure used for PWM output, 6 square measure analog output pins, 16 MHz quartz, a USB association, further power jack, alongside ICSP header and push. It is everything that is needed to regulate a microcontroller. The Uno board and one. 0 version square measure nothing however reference, which square measure currently evolved to newer versions and capabilities. Furthermore The Uno Board is 1st asynchronous of USB Arduino board and additionally a reference model for the platform.

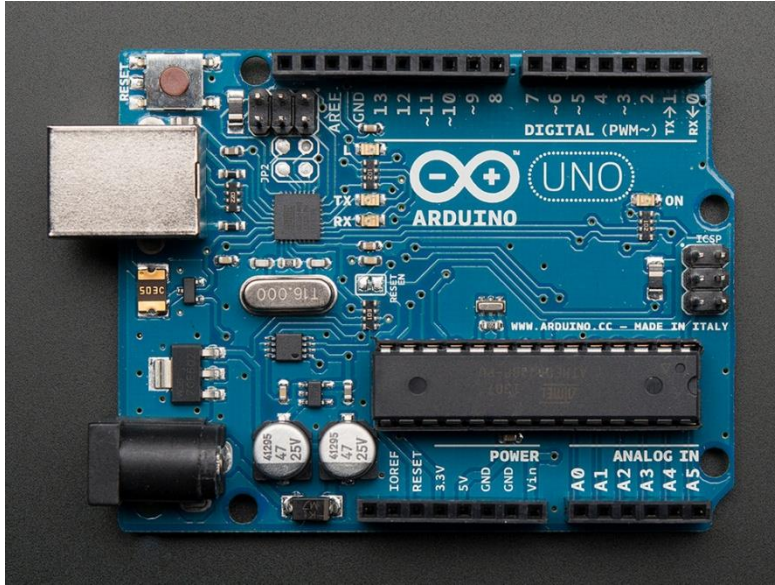


Figure 4: Arduino Uno[7]

Table 1: Technical Specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V
Digital pins	14
PWM Digital Pins	6
Analog I/P Pins	6
DC current per pin	20mA
Flash Memory	32KB
SRAM	2KB
EEPROM	2KB
Clock speed	16MHz
Length	68.6mm
Width	53.4mm
Weight	25g

•Power

- VIN.
 - 5V
 - 3V
- GND
- IOERF
- **Memory**

The ATmega238P has a memory of 32KB and comprises of 2KB of SRAM and 1KB of EEPROM.

• Input/output

Every 14 digital pins of UNO can be used for input as well as output using various modes like-

Pin Mode ()

Digital Write ()

Digital Read ()

All these operate at 5 volts. Every pin can handle 20mA in operating condition which has inside resistance of 50k ohm. Maximum value is 40mA to avoid damage to the controller.

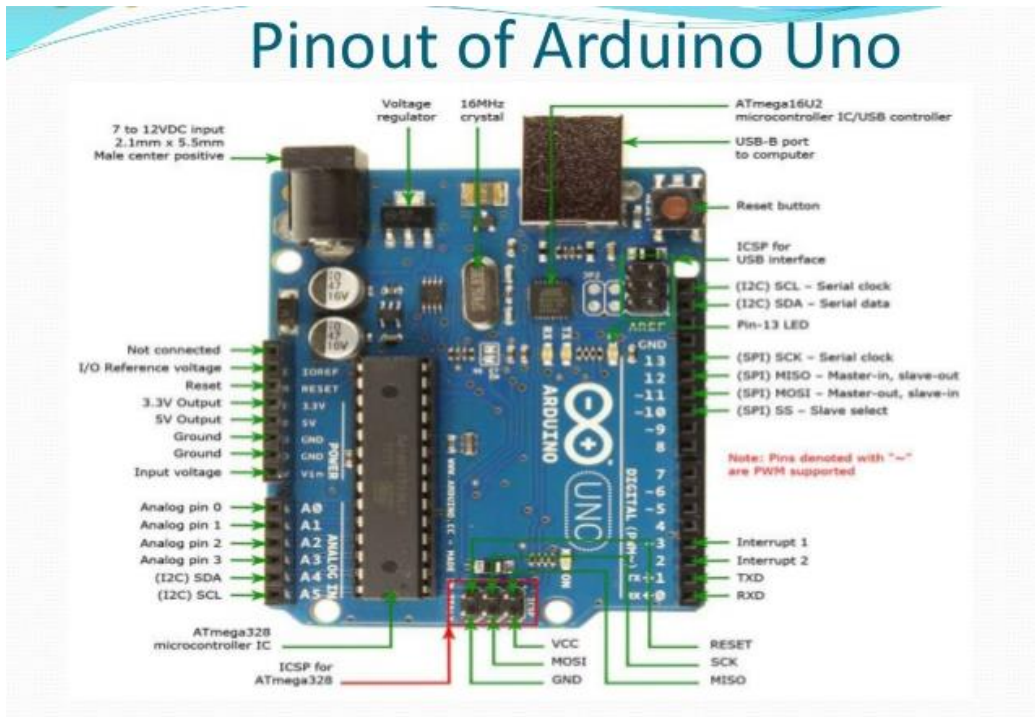


Figure 5: Arduino Pin out[6]

2. Bluetooth Module V2.0

HC-05 is a very easy to handle Bluetooth SPP (Serial Port Protocol) module, which is designed for clear wireless serial connection setup.

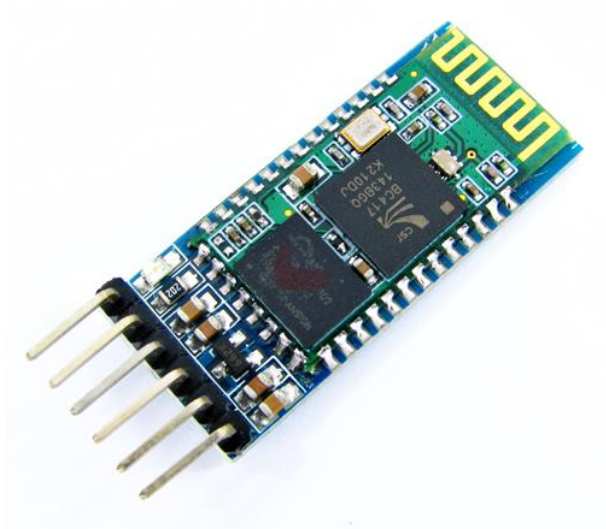


Figure 6: Bluetooth Module[6]

Hardware Features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation , 1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

Software Features

- Default Baud rate: 38400, Data bits: 8, Stop bit: 1, Parity: No parity.
- Data control: has supported baud rate: 9600, 19200, 38400, 57600, 115200, etc.
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately.
- When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2 times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:”0000” as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

Serial port Bluetooth module is completely chartered Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with full 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04- External single chip Bluetooth system with CMOS technology and with Adaptive Frequency Hopping Feature.

3. Wireless Sd Shield

Bluetooth staged on wireless shield The Wireless SD shield permits an Arduino board to share wirelessly using a wireless module. The module can exchange/communicate up to 30.48 m indoors or 94.44m outdoors (with line-of-sight). It can be handled-down as a serial/USB substitution or you can settle it into a command sate and set it for a various type of broadcast and mesh networking options.

4. Sensors

- **Water level sensor**

Water Sensor is a simple to handle, low cost and high level/drop recognition sensor, which is made by having a series of parallel wires bare traces measured droplets/water volume in order to see the water level. The sensor is used to check the water level and accordingly can be used in the project to set the alarm if the water level exceeds the threshold value.



Figure 7: Water-Level Sensor[6]

- **Light Sensor(LDR)**

A **Light Dependent Resistor (LDR)** is a light dependent resistor whose resistivity depends on the amount of photons or we can say the light intensity falls on it. The relation between the light intensity and the resistance is inverse relation, with increase in light the resistance decreases and vice-versa. LDR is in various applications, example in street lights to automate on and off of the lights.

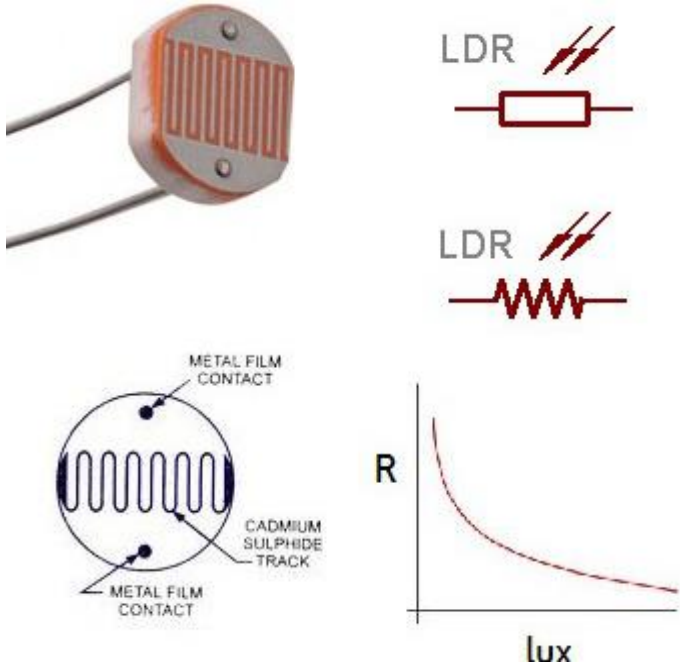


Figure8: Light Sensor[6]

- **Temperature Sensor (LM35)**

LM35 is a basic temperature sensor that can be used for many important purposes. It gives the readings in centigrade (degree Celsius) and its output is directly proportional to the temperature. We will not go into the details of how it works but where we can use it in our project. We can note down the temperature of our room and send the data to the esp8266 web server through which one can see what the temperature in the room is and can direct to on or off the AC accordingly.

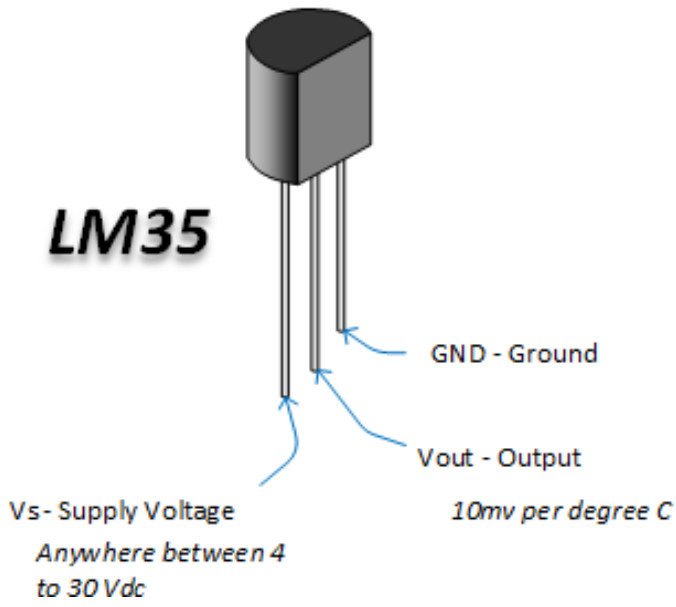


Figure 9: Temperature Sensor, LM35[11]

- **IR Motion Detection Sensor**

An infrared sensing element is a device that emits so as to sense some aspects of the environment. AN IR sensing element will live the warmth of AN object additionally as detects the motion. These sorts of sensors live solely infrared emission.

IR sensors are important tool in many of the Internet of Things projects. In Home automation this sensor can be used to provide home security. By placing the sensor at a place with high privacy like the safes, and setting threshold value after which the user will informed that someone has crossed the threshold and a check need to be made.

- **Esp8266 Wi-Fi Module**

It is one of the main sensor used in this home automation project. By using this sensor we can control most the devices using Wi-Fi.



Figure 11: Esp8266 Wi-Fi Module[13]

Pin out of the module

VCC (3.3V)

GND (0V)

RX (Receive data bit x)

TX (Transmit data bit x)

CH_PID

RST

GPIO 0

GPIO 2

5. Potentiometer

Potentiometer is a three terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.

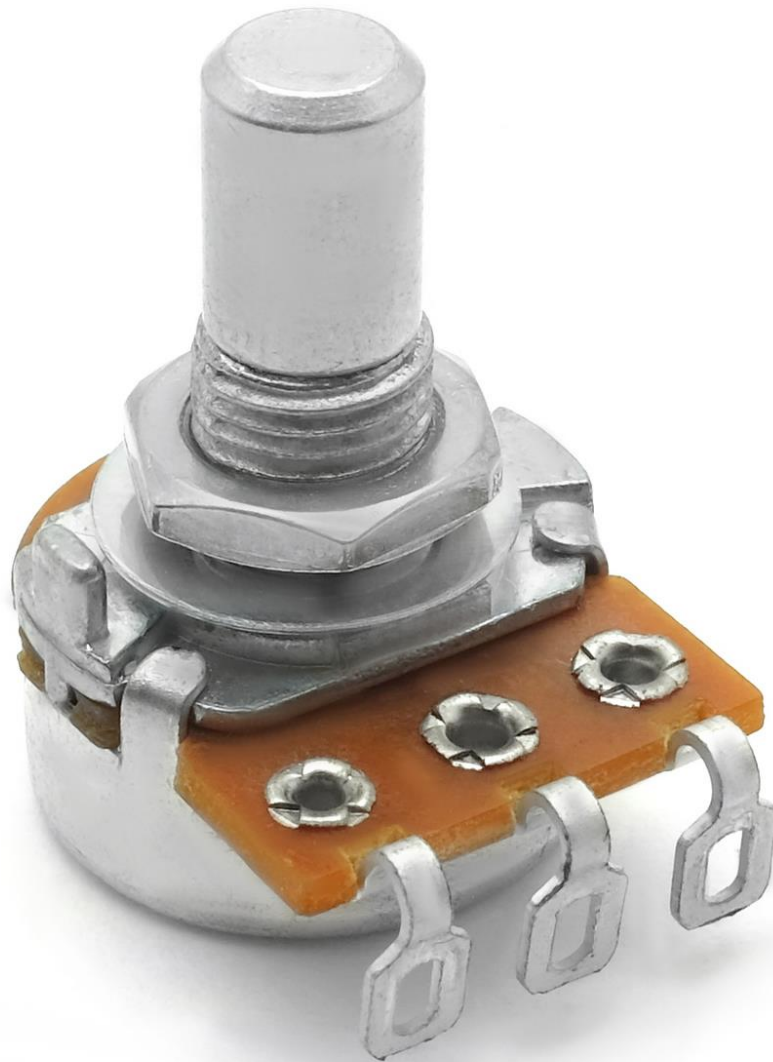


Figure12: Potentiometer[12]

6. LED Display

It is a flat panel display which uses an array of light emitting diodes as pixels for a video display. The brightness allows them to be used outdoors where they are clearly visible.

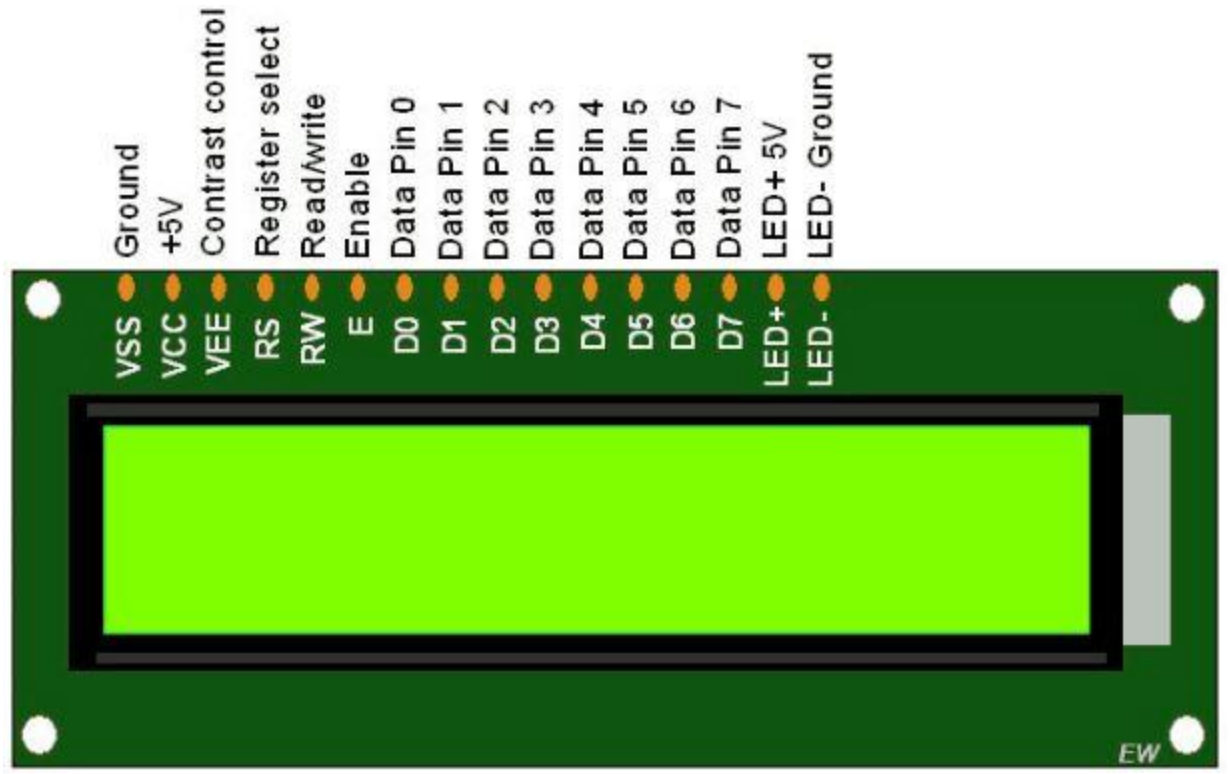


Figure13: LED Display[7]

3.1.2 Software Used

1. Arduino Integrated Development Environment (IDE)

Arduino Integrated Development Environment (IDE) is the software where the code is written and uploaded to the Arduino board or any other board that is being used in the project. The software comes with some of the default libraries which can be used while writing the code. Other than the default libraries we can include other libraries according to our requirement. The project file is stored with .ino extension. It also provides a serial monitor where the output of the code can be seen. The code written is first compiled and then uploaded to the board, if any error occurs than those are notified so that we can look over them and rectify the same.

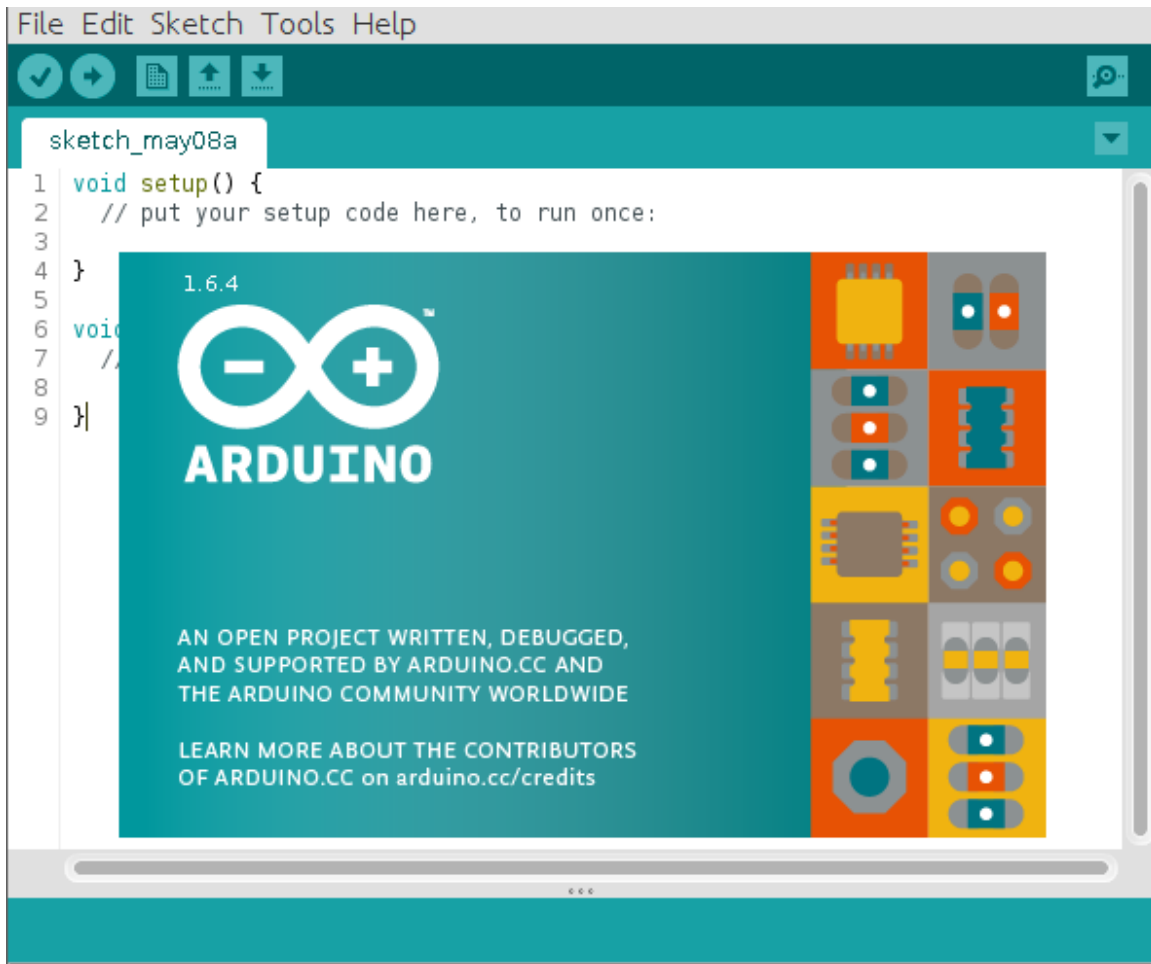


Figure14: Arduino IDE[7]

2. Proteus8 Professional

Proteus is a software for doing the simulation of the project. The software comes with some of the built in sensors and other electronic components and other non-inclusive components are too included explicitly by downloading certain libraries and including in proteus's library section. It is a great tool to simulate various projects before implementing in hardware.

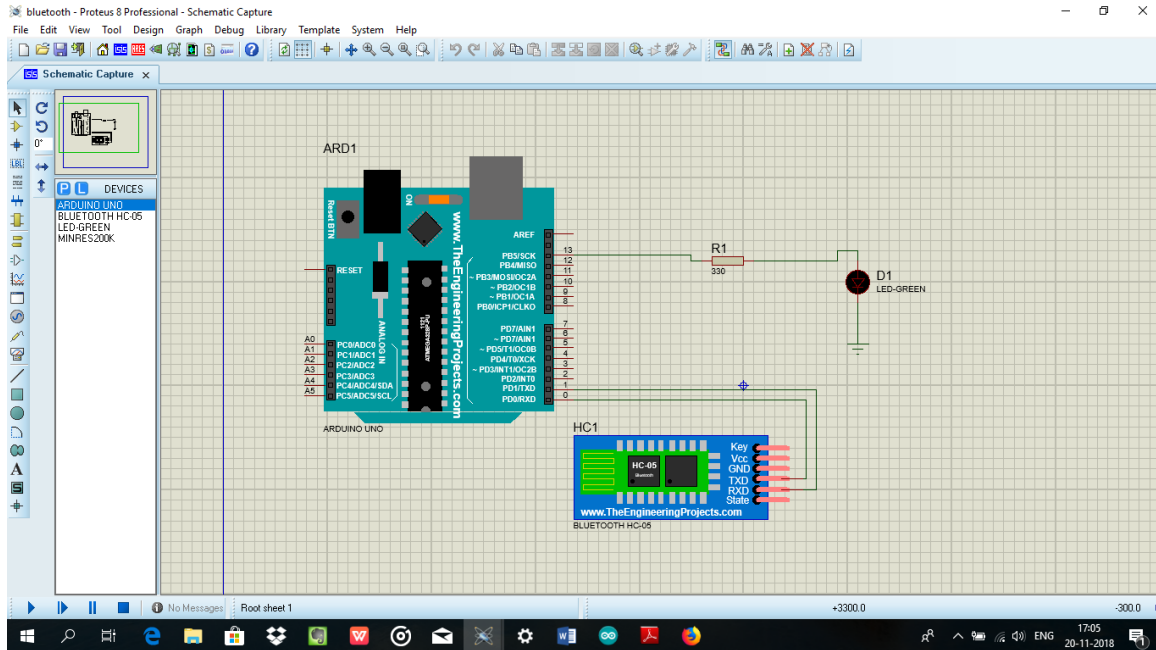


Figure15: Proteus8 Professional[8]

3.2) Design

3. Blynk Application

Blynk is a Platform with IOS and Android apps to control **Arduino** the likes over the Internet. It is a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

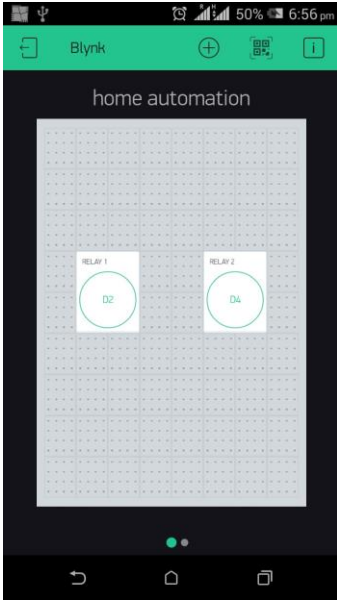


Figure 16

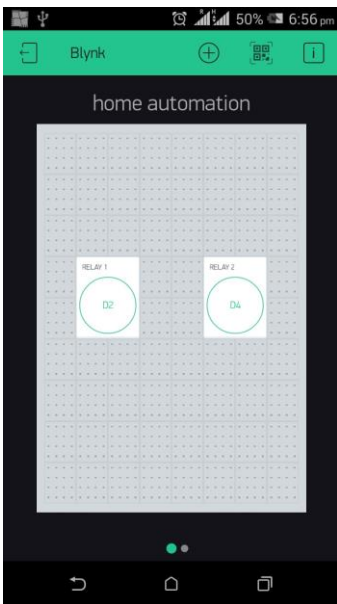


Figure 17

4. IFTTT

If This Then That, also known as IFTTT, is a free web-based service to create chains of simple conditional statements, called applets.

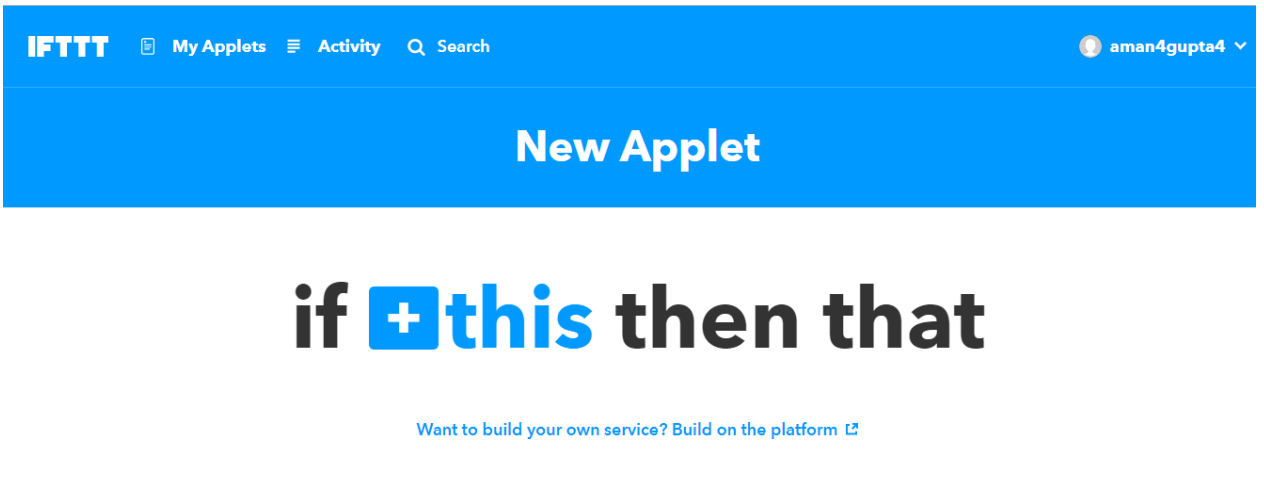


FIGURE 18: IFTTT

Say a simple phrase

This trigger fires when you say "Ok Google" to the Google Assistant followed by a phrase you choose. For example, say "Ok Google, I'm running late" to text a family member that you're on your way home.

What do you want to say?

turn on light one

What's another way to say it? (optional)

turn on first light

And another way? (optional)

turn on first relay

What do you want the Assistant to say in response?

Okay, turning on light one

FIGURE 19

Say a simple phrase

This trigger fires when you say "Ok Google" to the Google Assistant followed by a phrase you choose. For example, say "Ok Google, I'm running late" to text a family member that you're on your way home.

What do you want to say?

turn on light two

What's another way to say it? (optional)

turn on relay two

And another way? (optional)

turn on second light

What do you want the Assistant to say in response?

okay, turning on|

FIGURE 20

Make a web request

This action will make a web request to a publicly accessible URL. NOTE: Requests may be rate limited.

URL

`http://188.166.206.43/authkey/update/D7`

Surround any text with "<<>>" to escape the content

Add ingredient

Method

PUT



The method of the request e.g. GET, POST, DELETE

Content Type

application/json



Optional

Body

FIGURE 21

5. LED APPLICATION

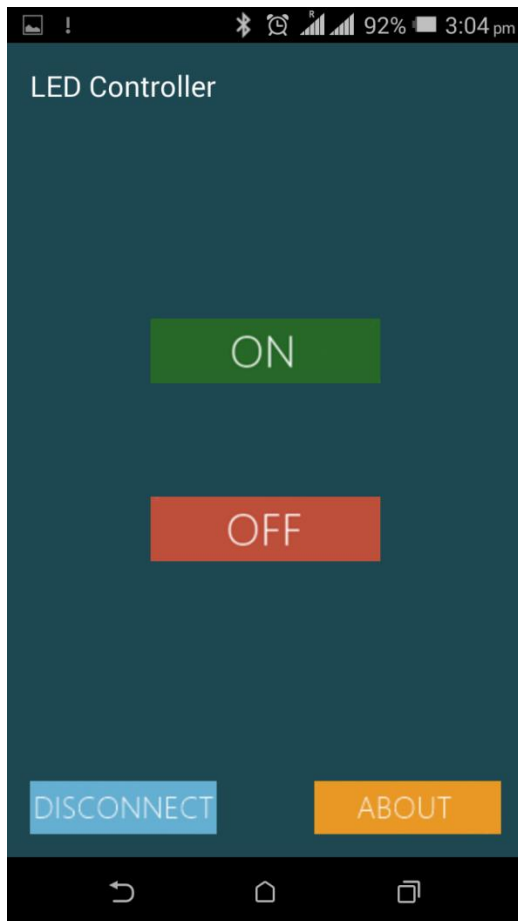


FIGURE 22: LED APPLICATION

3.3) Development:

1. Smart car parking:

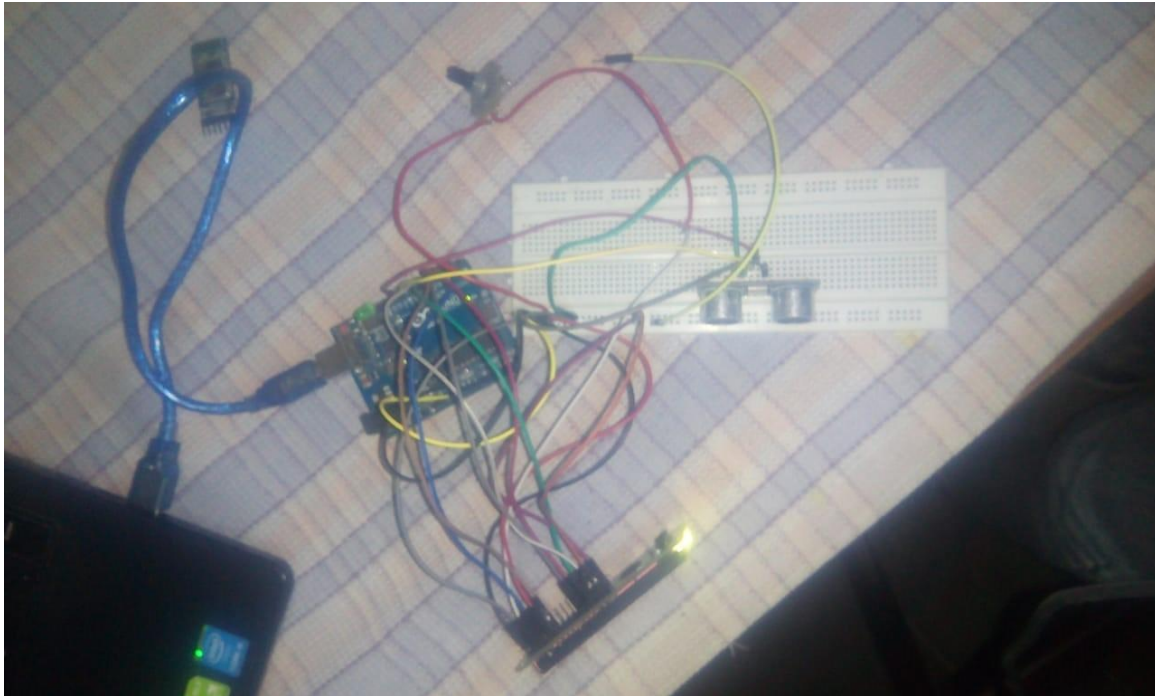


FIGURE 23: Smart car parking prototype

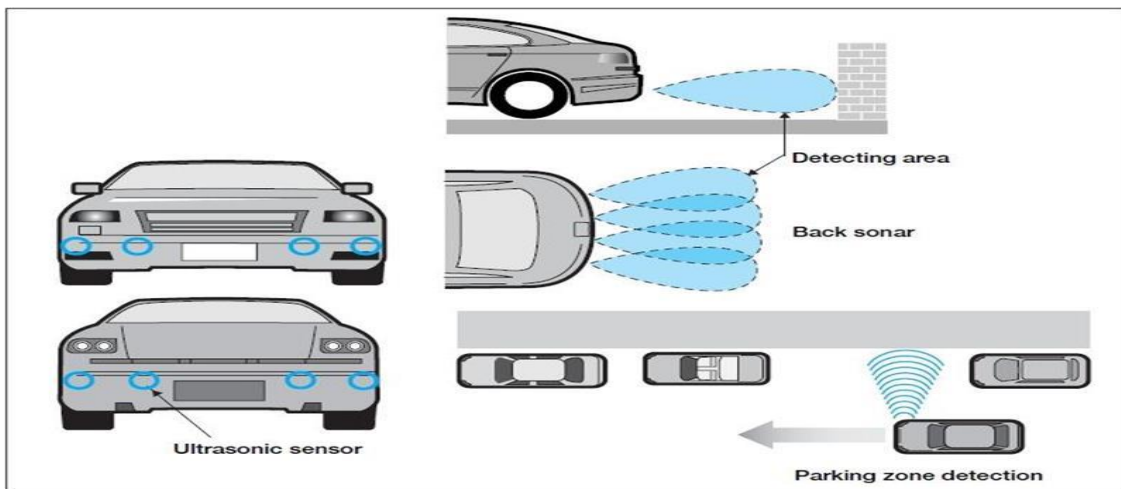


FIGURE 24: Smart car parking prototype[11]

2. Wi-Fi controlled lights:

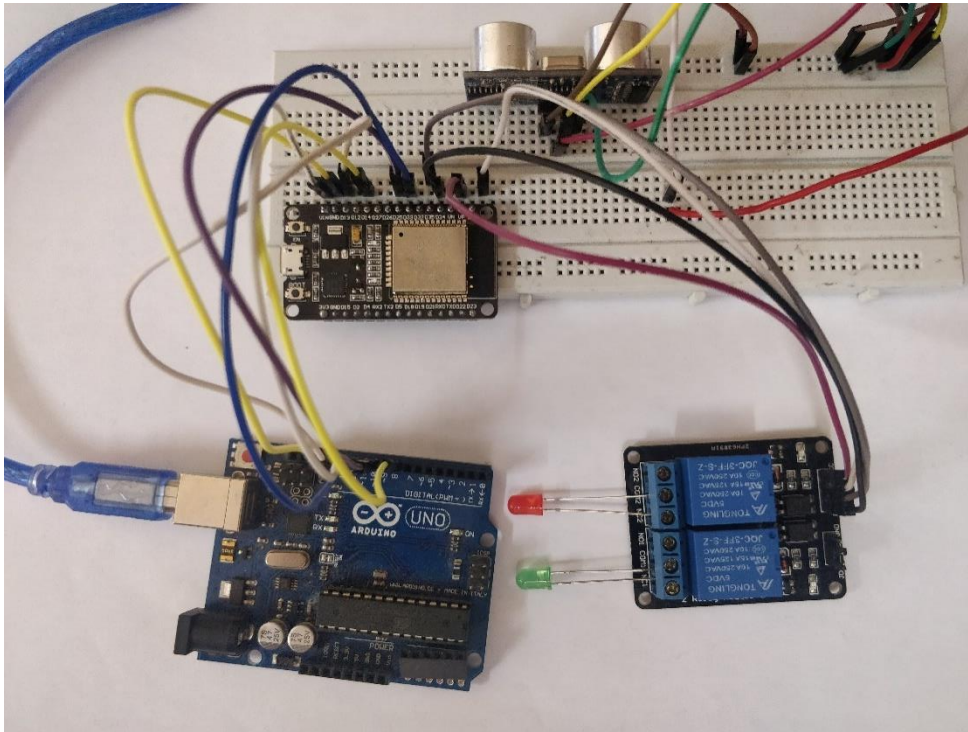



Figure 25: Wi-Fi controlled lights

3.4) Algorithm:

1. Smart Parking:



The screenshot shows the Arduino IDE interface with a sketch named 'sketch_may02a'. The code is as follows:

```
File Edit Sketch Tools Help
sketch_may02a
#include "LiquidCrystal.h" //Please replace the single quote characters (') with the parenthesis character (<>)
LiquidCrystal lcd(1, 2, 4, 5, 6, 7); // Creates an LCD object. Parameters: (rs, enable, d4, d5, d6, d7)

const int trigPin = 9;
const int echoPin = 10;
const int reqDist=3
long duration;
int distanceCm, distanceInch;

void setup() {

  lcd.begin(16,2); // Initializes the interface to the LCD screen, and specifies the dimensions (width and height) of the display
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);

}

void loop() {

  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  duration = pulseIn(echoPin, HIGH);
  distanceCm= duration*0.034/2;
```

Done Saving.

41 Arduino/Genuino Uno on COM4
ENG 6:39 PM
INTL 5/2/2019


```
sketch_may02a | Arduino 1.8.9
File Edit Sketch Tools Help
sketch_may02a
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);
distanceCm= duration*0.034/2;

lcd.setCursor(0,0); // Sets the location at which subsequent text written to the LCD will be displayed
lcd.print("Distance: "); // Prints string "Distance" on the LCD
lcd.print(distanceCm); // Prints the distance value from the sensor
lcd.print(" cm");
if(distanceCm>reqdist)
{
  lcd.print("HIGH");
}
else
{
  lcd.print("LOW");
}

delay(10);
lcd.setCursor(0,1);
lcd.print("Distance: ");
lcd.print(distanceInch);
lcd.print(" inch");
delay(10);
}

Done Saving
Arduino/Genuino Uno on COM4
ENG 6:39 PM
INTL 5/2/2019
```

2. Controlling of lights via Wi-Fi

```
ESP8266_Standalone | Arduino 1.8.9
File Edit Sketch Tools Help
ESP8266_Standalone $
/* Comment this out to disable prints and save space */
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

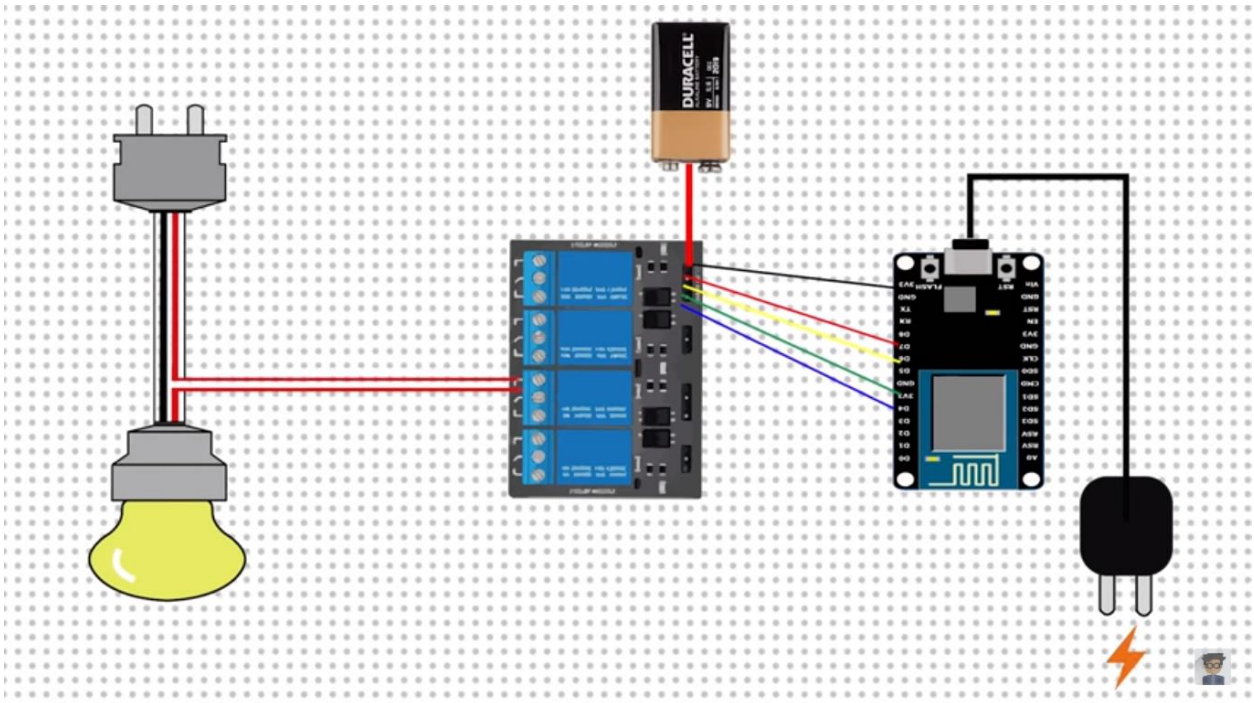
// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "YourAuthToken";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "The Network";
char pass[] = "abcd1234";

void setup()
{
  // Debug console
  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);
}

void loop()
{
  Blynk.run();
}
```



4 PERFORMANCE ANALYSIS

The various factors found responsible for affecting the overall performance of the ESP8266 NODEMCU chip are as follows:

Loss for a given system is given by:

$$PL \text{ (dB)} = 10 \log_{10} (P_t/P_r)$$

This formula tells us the amount of variation in signal to noise ratio (SNR).

We have used IFTTT for connecting between our Wi-Fi module and our android application

It gives us the facility of measuring different sensors which are used in our project.

Composition of various sensors, actuators, chips, automation devices, identifying devices and other electronic components collectively make up a perfect IOT model or prototype.

Important characteristics of a system are:

1. Coding must be approachable: In Node MCU the coding part is more convenient so that we can test our module from around the globe which gives us the performance analysis of our system.
2. Security: It is one of the most crucial function of any system which should be kept in mind while optimizing the working of the model or prototype. We should also preserve the privacy of the data while using the data in our system
3. Intelligence: IoT is the combination of various algorithms and data which is being put to compute a specific output which the help of hardware so as to make the system more and more intelligent.
4. Connectivity: IoT is all about connecting one devise with another so as to give us the desired output. With this connectivity many new markets in Asia and around the world are being developed.

Artificial intelligence is one of the vast growing market in the world of Internet of Things since it makes the devices smart and increases their lifetime by the use of the data.

4.1 Tabular and Graphical analysis

1) Temperature Module Analysis

Table 2: Data for LM35

Temperature(°C)	Voltage(mV)
16	159mV

24	240mV
28	277mV
29	290mV

2) Light sensor Output

Table 3: Data for LDR

Light Intensity	Voltage(mV)	LDR Resistance
Natural light	88	343 Ω
Room light	68	364 Ω
Large light intensity	103	328 Ω
Dark	3.5	5.7k Ω
Extreme dark	1.23	12M Ω

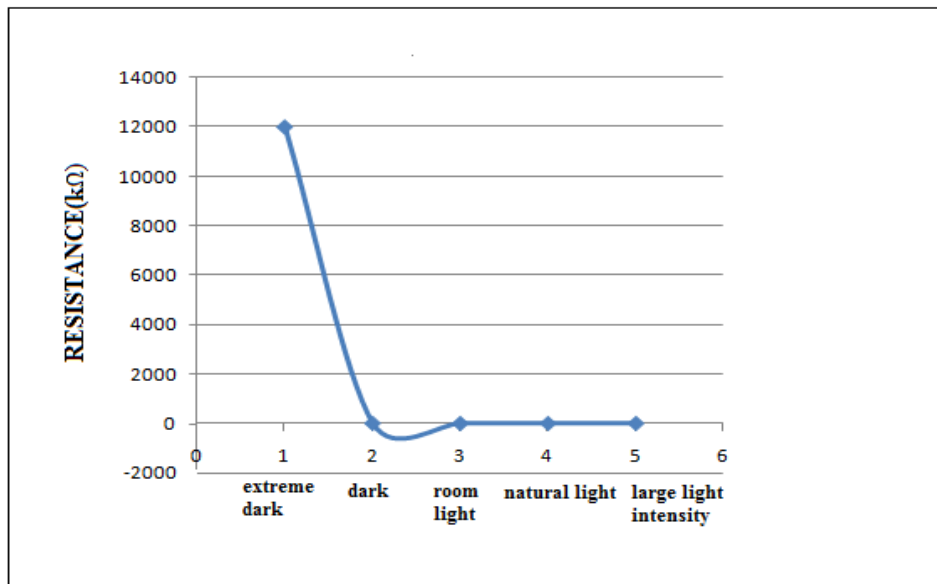


Figure 26: Light Intensity vs. Resistance graph

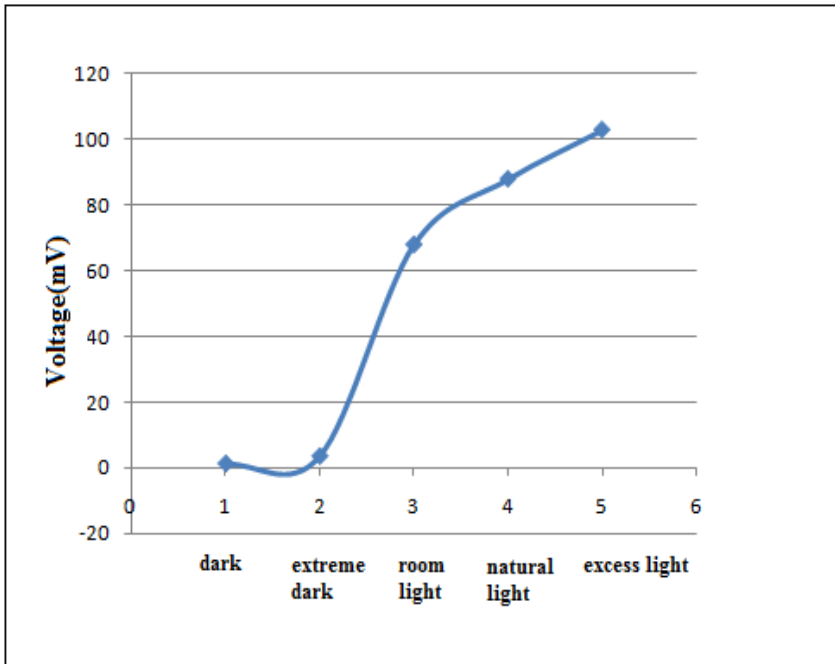


Figure 27: Light intensity vs. Voltage graph

Resistance of an LDR showed a declining trend with increasing light intensity as per the photoconductivity principle.

Voltage across an LDR increased with increasing light intensity.

Figure 30: Led Monitor

Controlling lights via Bluetooth module:

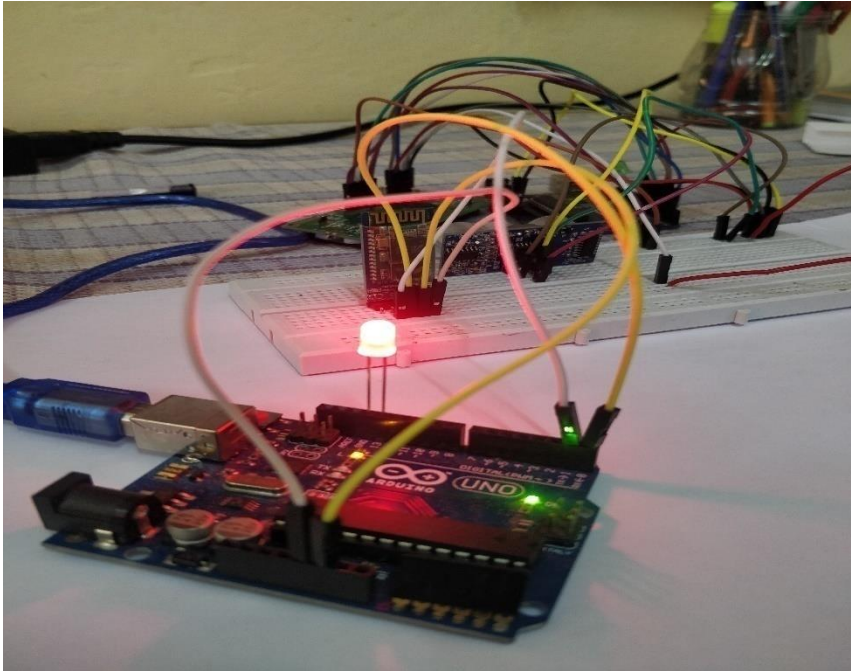


FIGURE LED ON

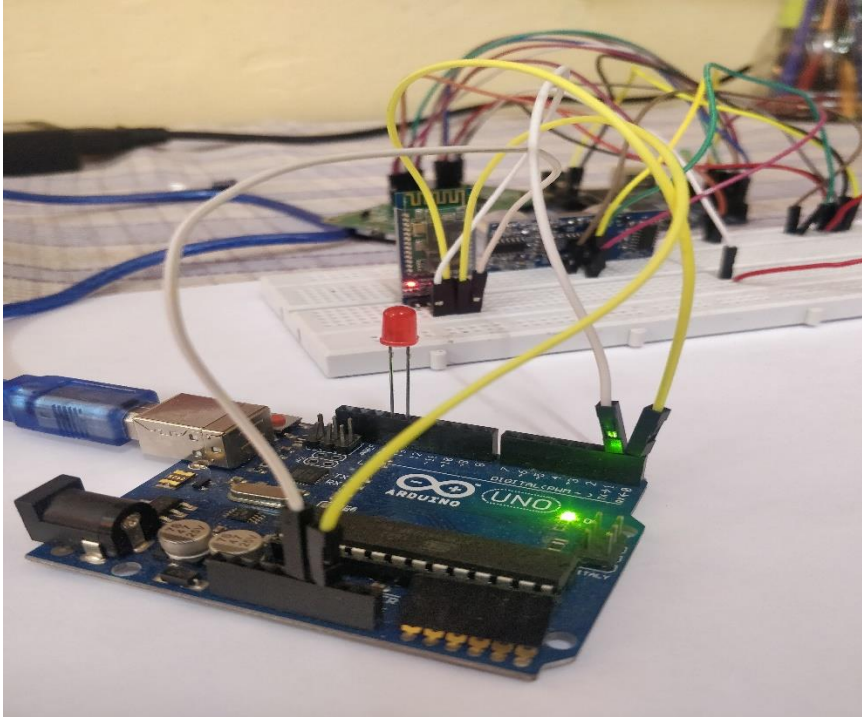


FIGURE LED OFF

5 CONCLUSION

The home automation via Internet of Things is experimentally proven to work satisfactorily by connecting simple appliances to Arduino and the appliances were successfully controlled. The designed system along with monitoring the sensor data, like temperature, light, motion sensors, also actuates a process according to the requirement, for example switching on the light when it gets dark. This will help the user to analyse the condition of various parameters in the home anytime and work his things out accordingly.

Smart homes are huge system that includes multiple technologies and applications that can be used to provide security and control of the home easily.

The project is of great help for each and every age group of society especially for the especially abled persons and old age people since they are the ones who suffer the most for day to day things which other people can do easily.

People with special needs can use google assistant for switching on or off several appliances and people who cannot speak can use Bluetooth enabled application to switch on or off their home appliances.

5.1 FUTURE WORK:

By using the current system, in future it will be further developed and modified to include other home security options like capturing the photo of a person who enters the home and sending it to the owner through WhatsApp, email or any other platform. This will not only increase the security but also enable the user to keep a check on his home from anyplace at any given time. This kind of a system with required changes can be implemented in the hospitals for disable people or in industries where human invasion is quite impossible or fatal to life. Thus, resulting in a complete automated and easy to use system.

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APPENDIX

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