

IoT BASED SMART SWITCH CONTROLLER

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This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering

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DHAKA, BANGLADESH

FEBRUARY 2023

APPROVAL

This Project titled “IoT BASED SMART SWITCH CONTROLLER”, submitted by Nur Amin Sabuj, ID No: 182-15-2178 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfilment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 04/02/2023.

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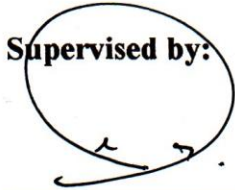
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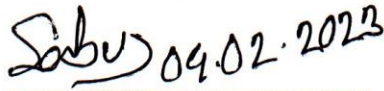
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ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project/internship successfully.

We really grateful and wish our profound our indebtedness to **Dr. S.M. Aminul Haque, Associate professor**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of “IoT and Robotics” to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism , valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. S.M. Aminul Haque, Associate professor**, Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

The use of technology is increasing day by day. Switch are being now used in everywhere like Home, Scholl, Shop, Factory, Outdoor and every places. My Gadget Smart Switch can help in the sectors perfectly connected by the network. I will be controlled any time anywhere with this apps easily. I designed a Smart Switch Board controller using an Android mobile application. I have created a remote button in the android app through which can control the device on / off direction. It also can control automation by using a PIR motion sensor which can control this board automatically by detecting motion in this operating area. I have used Android, C++ and Arduino Programming Language to develop each application and hardware component and electronic chip. The test analysis section below discusses whether the proposed system meet its goals. The potential extensions of the system as well as the performance of the end of the paper are also evaluated.

Keywords: Home automation, Smart Switch, Gadget, Arduino, Switch, Relay Module.

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CHAPTER 1

Introduction

1.1 Introduction

In this time everyone try to innovation new gadget for our community. As a citizens of digital world, we must improve our technology, education, working environment, currently Gadget are used every sector to save our time and money. In order the technology, I have decided to create a Smart Switch with IOT based control by applications and PIR sensor. The application will help the gadget on/off any distance by connecting network and PIR sensor can operate this switch in operating area by sensing the motion movement. It can operate easily. It can make human daily life more helpful.

1.2 Motivation

All over the world, working sectors are being bigger, but need to do it low cost. A man can't move different places at a same time to do work but this gadget can help man to do all of work at a same time in daily life task.

People also get satisfaction to use this gadget

- a) Can make a decision automatically by sensing motion.
- b) Can be control anywhere by using application connected by the network.

1.3 Objectives

People who are busy, unable to move one place to another place easily but it can help them to control this work. It can save time and money in the transformation cost and time. It will be very useful.

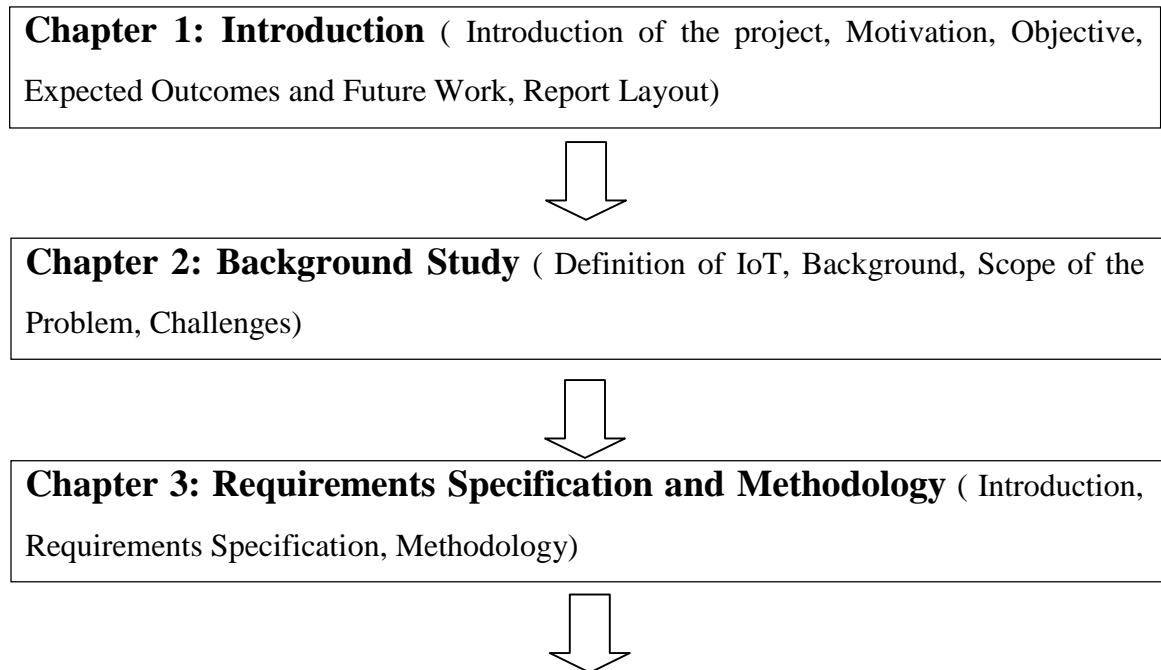
1.4 Expected Outcomes and Future Work

This Smart Switch work in collaboration with ESP 8266 Wi-Fi Module to connect the Android application and PIR motion sensor can control the device by get the movement human motion detections can operate on /off switch operation. Thus, it will contribute to human service.

Our main goal is to connect all important rooms like computer lab room where every student left the room but some time it is untouchable to off all fan switch in this time it will help to control off outside the lab room.

1.5 Report Layout

Pictorial presentation the project in simple way with a figure that describes the whole contents and more. The project report contains of 5 chapters. The outline of all the chapter in the summary is discussed below by presenting the flow diagram.



Chapter 4: Implementation and Result (Implementation, Architecture Diagram, Outcome Result, Final project view, Cost of the project, Result, Limitation)



Chapter 5: Result Discussion (Result, Limitation, Cost of the project)



Chapter 6: Impact on Society, Environment and Sustainability (Impact on Society, Impact on Environment)



Chapter 7: Conclusion and Future Scope (Conclusion, Future Scope)

Figure 1.5: Outline of project

CHAPTER 2

Background Study

2.1 Definition of IoT

IOT (Internet of Things) as a system which work only connected by the network and control many more devices, sensors. It mainly work with machine learning, embedded system and robotics. When we want to make a device smart then we use this type of technology like IOT. It works many application and many more appliances. Now it very popular for its home appliances model. It is very work time easy controlling and setup at any place any device make smart.

2.2 Background

Its background is not more interesting. Day by day human are honey to innovation. They want new and more compact for human day life. By conquering human innovation automation in different places. But this time want to make this automation at home, then it named by home automation. In this model all home appliance convert to smart by using this type of technology. Now home automation is a very common gadget in this time. Everyone use one kind of gadget like smart Bluetooth music devices, IR remote and many more. Now this time all home appliances connect Arduino or esp8266 devices to make it smart sometime use many sensors for collecting data or automation system.

So, it will be more impact for human.

2.3 Scope of the problem

The aim of home automation makes smart to established wireless connection of all home appliances. In this way here many mores model can generate to convert all appliances. Automation is popular for easy to use and use it for a low cost.

The automation can be use anywhere where networks available. Most use of this in auto industry. But now it most popular for home automation. Man wants new and advance technologies to human life make more comfortable and compact.

The development of technology friendly environment. Incorporate uses this technology increasing day by day.

Home automation makes human life easy to easier.

2.4 Challenges

I face a lot of big problems early on when I started working with this home automation. Surveys on how this home automation will be controlled, ranging from choosing the type of day-to-day work of age-appropriate people. Sensor selection based on different functions and research on sensor performance. It was very difficult to measurement the sensing area by the sensor. Above all, maintain the balance of the home automation by connecting all the sensor to operate the home automation was a big problem.

CHAPTER 3

Requirements Specification and Methodology

3.1 Introduction

Through this project I have tried to make human life easy and effective. For this purpose I have created a home automation module. I assembled sensor based on motion function. I have tried to manage this home automation by programming with microcontroller. A project report or thesis paper, the analysis zone empowers the security to survey the overall credibility and trustworthiness of an investigation in a general context.

The features of the Home Automation:

- It can make a wireless connection by smart switch.
- It used Wi-Fi to connect wireless control and it range in indoor about 15 meter.
- PIR sensor are automatically sense 1-24 feet.
- It's security system very good managed by SSL over TCP, SSH.
- Simple can be install any place where network connected.
- Low cost.

3.2 Requirements Specification

The following components have been used to implement my project.

These are:

- 1) Arduino (Microcontroller)
- 2) ESP8266 (Node MCU)
- 3) PIR motion sensor
- 4) 5v Relay module
- 5) AC Switch
- 6) AC Bulb Holder

- 7) AC Bulb (5W)
- 8) Some jumper cable (Male-female, Male- Male, Female-Female)
- 9) Some AC Cables

3.2.1 Arduino

Arduino is a common microcontroller based open-source computing platform. Here the microcontroller is mounted on a board of various pins are pulled out with the help of a header too easy to connect to any external equipment or parts. Arduino can be used with many types of switches and sensors. Creating a unique project with Arduino can be done in the same way, or it can be done by communicating with a program on the computer. There are many kinds of Arduino boards. Such as Arduino Nano, Arduino UNO, Arduino MEGA and so on. Arduino is able to communicate with keys, LEDs, Engines, Microphones, GPS devices, Cameras and Internet and even smartphone or television. Here I have used Arduino Mega.



Figure 3.1: Arduino[ref 9]

Arduino Pins:

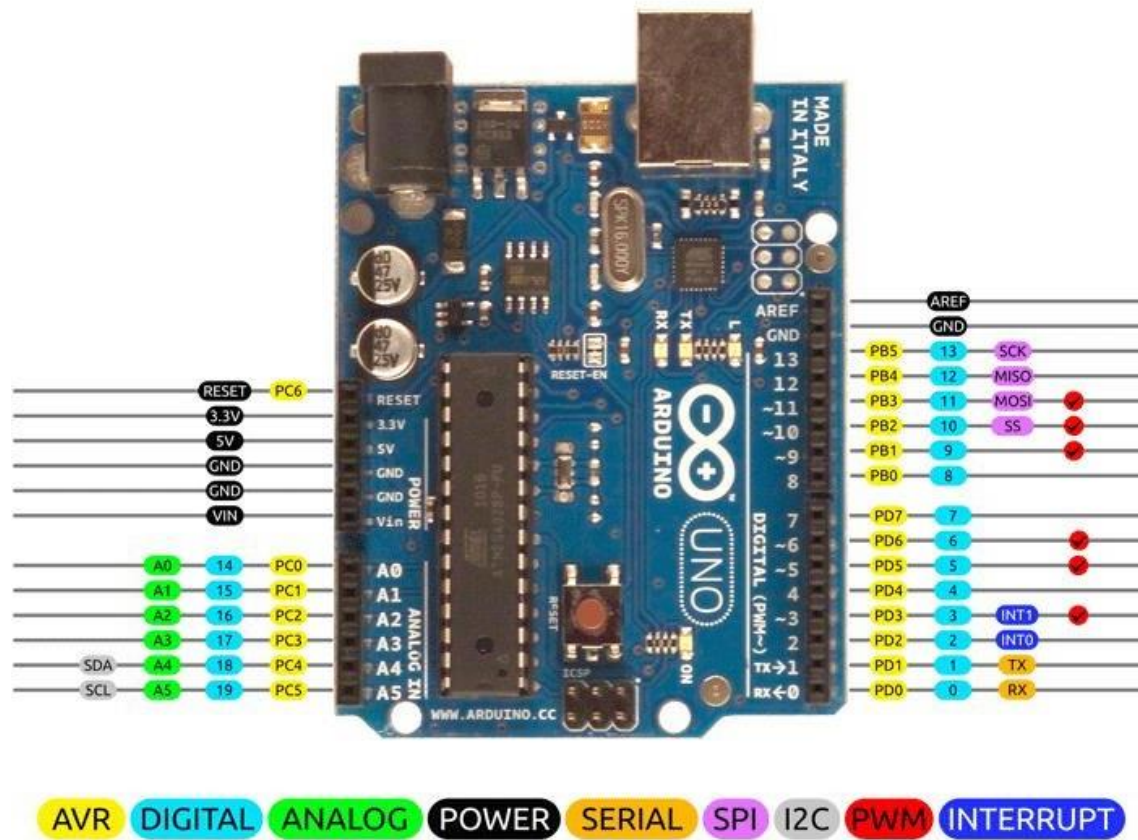


Figure 3.2: Arduino pins[ref 9]

Arduino Specification:

Table 3.1: Specification of Arduino Board

Microcontroller	Atmega2560
Voltage of Operating	5V
Voltage of Input	7V-12V
USB	YES
DC power	YES
Current Rating pre input/output pin	20mA
Dawn of current from chip	50mA
Digital Input/output pin	54

Digital PWM(~)	15
Analog pin	16
Memory	256KB
RAM	8KB
ERROM	4KB
Oscillator of Crystal	16MHz
Attached LED	YES
WI-FI support	NO

3.2.2: ESP8266 (Node MCU)

Node MCU is a microcontroller with inbuilt Wi-Fi module for connected any network. Here the microcontroller is mounted on a board and its various pins are pulled out with the help of a header too easy to connect any external equipment or parts. Node MCU can be used with many types of switches and sensors. Node MCU used for variety of tasks, including connect with blink application with WI-FI. Creating a unique project with Node MCU can be done in the same way, or it can be done by communicating with a program on the computer. There are many kinds of Node MCU boards. Such as Official Amica Node MCU, Official Amica Node MCU on bassed Board, Lolin Node MCU etc. Here I have used Lolin Node MCU.

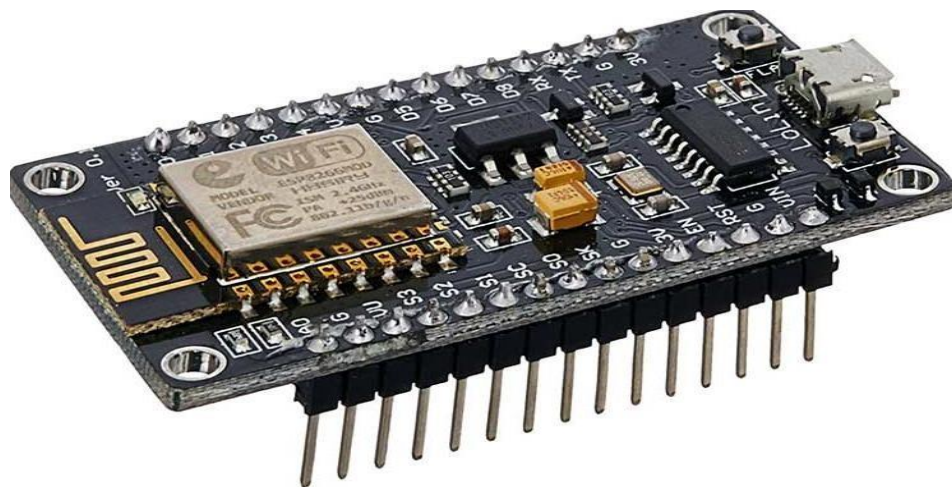


Figure 3.3: Node MCU [ref 10]

Node MCU Layout:

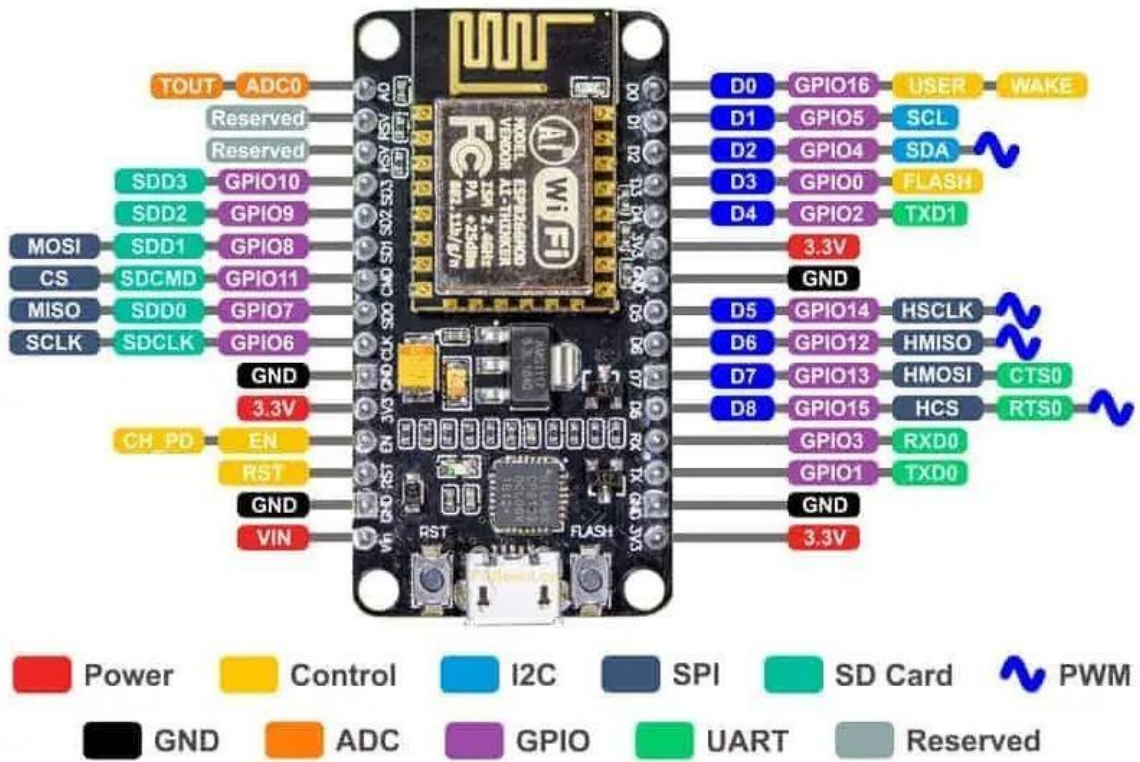


Figure 3.4: Node MCU Pins [ref 10]

Node MCU Specifications:

Table 3.2: Specification of Node MCU

Microcontroller	Lolin Node MCU
Node MCU Model	Clone Lolin
Node MCU Size	58mm × 32mm
Pin Spacing	1.1”(27.94mm)
USB	Micro USB
Working Voltage	3.3V
Voltage Input	4.5V-10V

Memory	4MB
RAM	64KB

3.2.3: PIR Motion Sensor

PIR sensor mainly work by make infrared rays which can sense motion of any kind of object. For security purpose or any kind of information it can be used. Here I used PIR to detect human motion.



Figure 3.5: PIR motion sensor [ref 11]

PIR Sensor Pins and Controls:

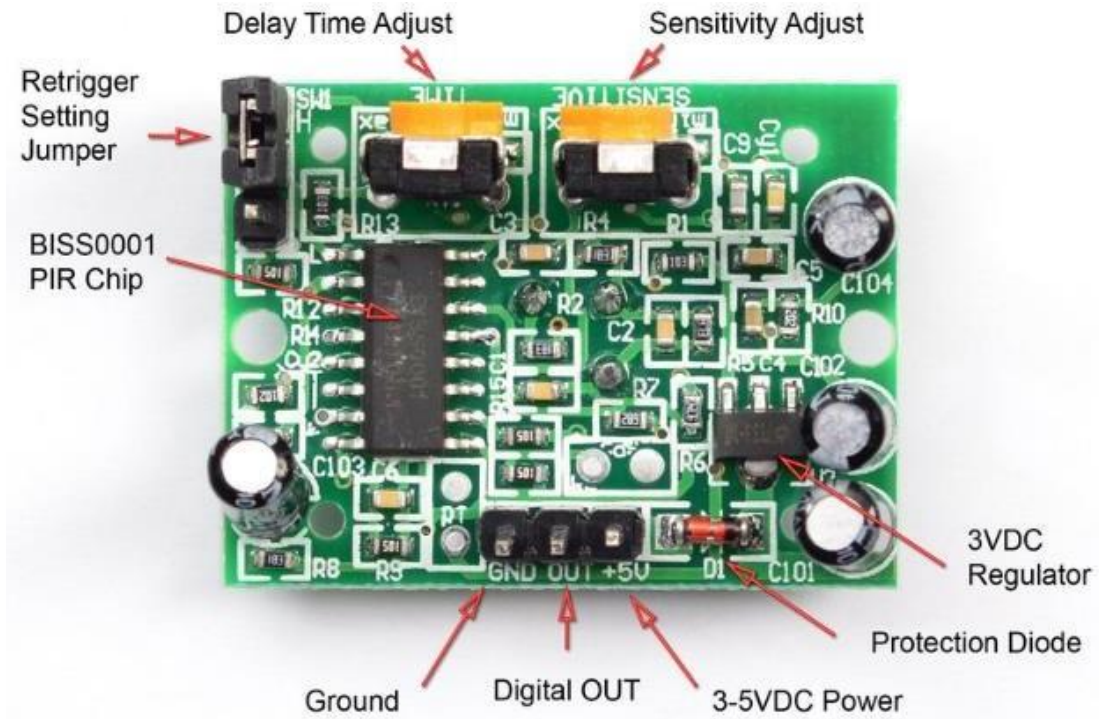


Figure 3.6: PIR sensor pins [ref 11]

PIR Sensor Specifications:

Table 3.3: Specification of PIR sensor

Sensor name	PIR sensor
Working voltage	04V-20V
Power use	0.066mA
Working distance	1-24 Feet
Output	3.3V TTL type (signal)
Dimension (L×W×H)	(32×24×18)mm
Working Temperature	-20 up to 80
Detect Angle	<138°
Delay time	5 to 200 seconds

3.2.4: Relay Module

It like a smart switch which convert the direction of power line. It has two different mode one always connect another can to converted by an order which can give into by any third object like Arduino, Node MCU, PIR sensor many more. It has triggering part which trigger the switch and another is switching part which switching the voltage of power. Here, I used 5V 2Chanel relay for a device. It works AC250V 10A or DC30V 10A.

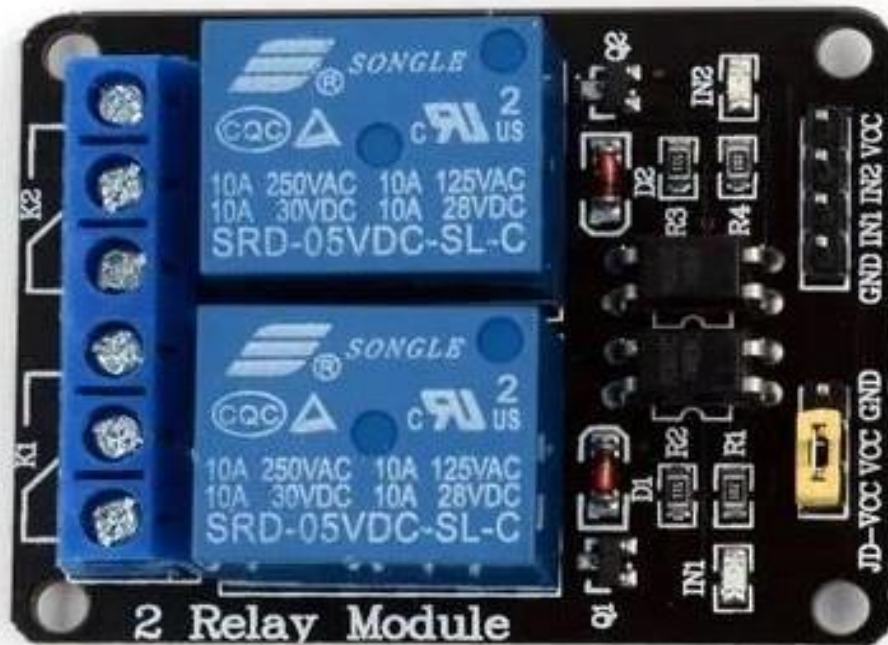


Figure 3.7: Relay module [ref 12]

Relay Module layout:

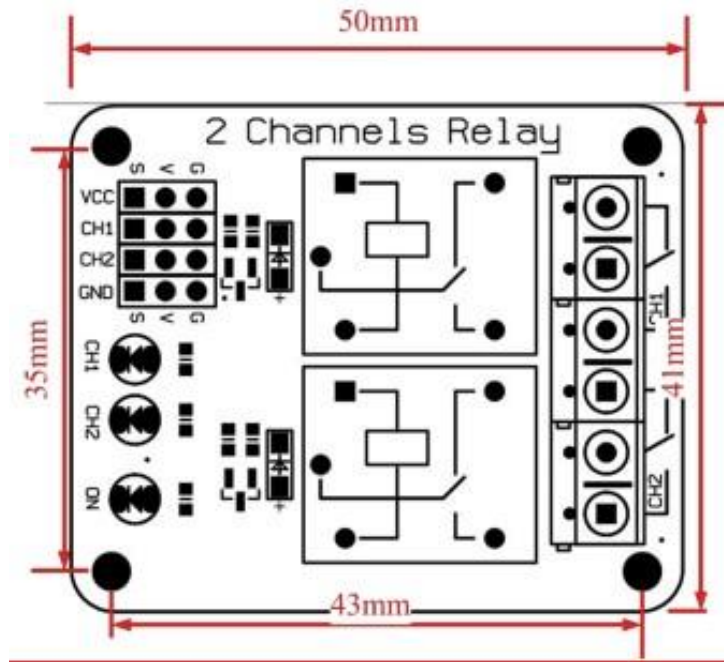


Figure 3.8: Relay module pins [ref 12]

Relay Module Specifications:

Table 3.4: Specification of Relay module

Operating Voltage	3V up to 5V DC
Triggering Voltage	5V DC
Triggering Current	20mA
Switching Voltage	250V AC 10A
Switching Voltage	30V DC 10A
Operating Temperature	-40°C up to 85°C
Size (L×W×H)(mm)	43×26.3×14
Weight	0.018 kg

3.2.5: AC Switch

Here I used AC switch for power supply control to the relay module. I can control on/ off by switching this switch.



Figure 3.9: AC Switch [ref 13]

Working Method:

Mainly, It work AC 80V to 250V 10A. It use for power on off.

5.2.6: AC Bulb Holder

Here I used holder to connect a bulb. This bulb will be control by two Relay with PIR and application both.



Figure 3.10: AC bulb holder [ref 14]

Working Method:

This holder can hold on Bulb to power on. It works 80V up to 250V 10A. Here can be used (5-500) W of bulb, sample I use 5W bulb.

3.2.7 : 5W AC Bulb

Here I used 5W bulb to show my project. It takes 220V and 0.02A at using



Figure 3.11: AC bulb [ref 15]

Working Method:

This bulb just a sample for use. It will work maximum 250V 0.02A.

3.2.8 : Jumper cable

This cable just use for IoT appliance connection. There are many types of cable. Such as Male- Female, Male- Male, Female- Female.



Figure 3.12: Jumper cable [ref 16]

3.2.9 : Cables

Here I use few cable to AC power supply to bulb.



Figure 3.13 Cables [ref 16]

3.3 Methodology

The method is a primary selection of my mind after all of the project. Here all sensor connection to Arduino and Node MCU via Computer.

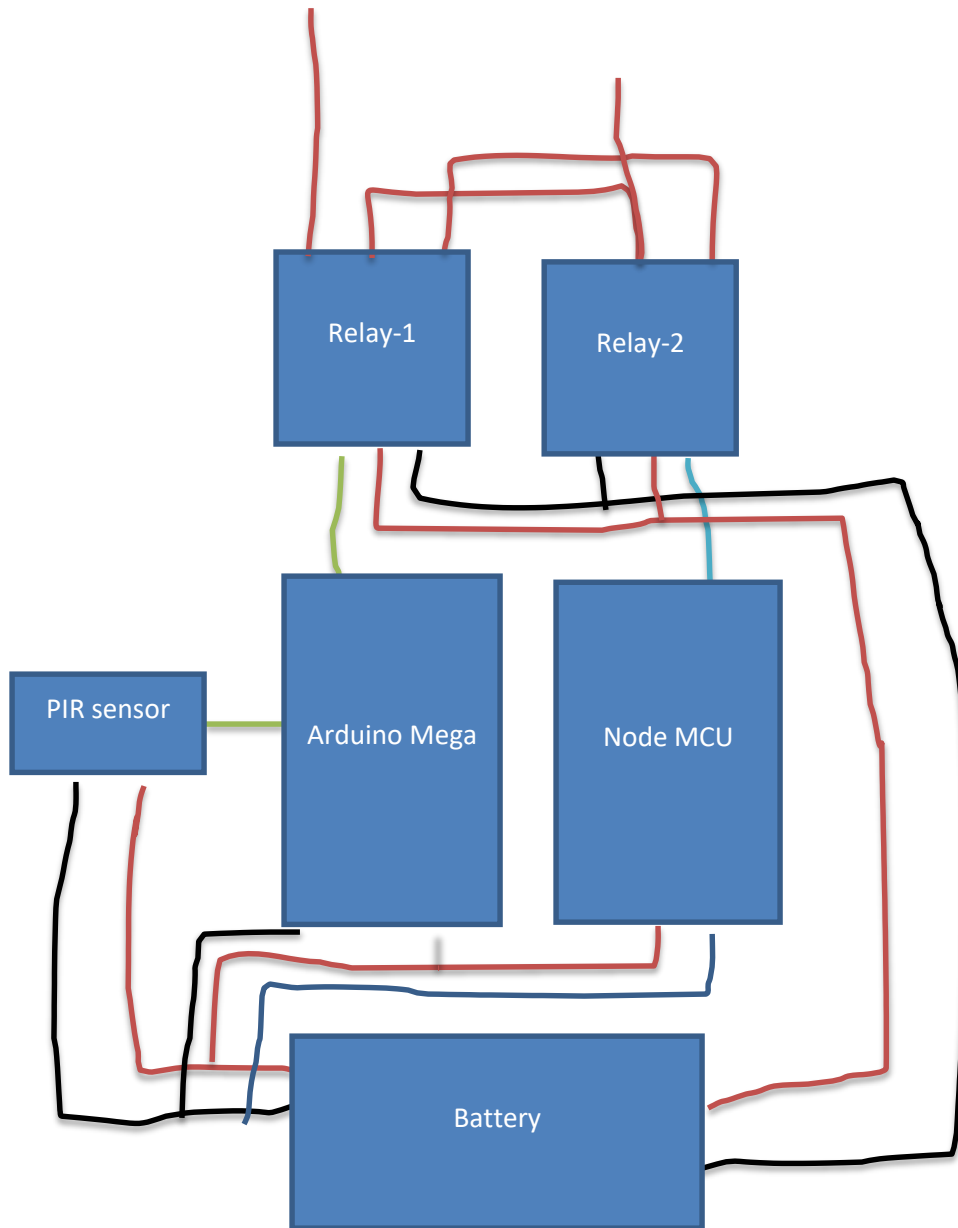


Figure 3.14: Project prototype

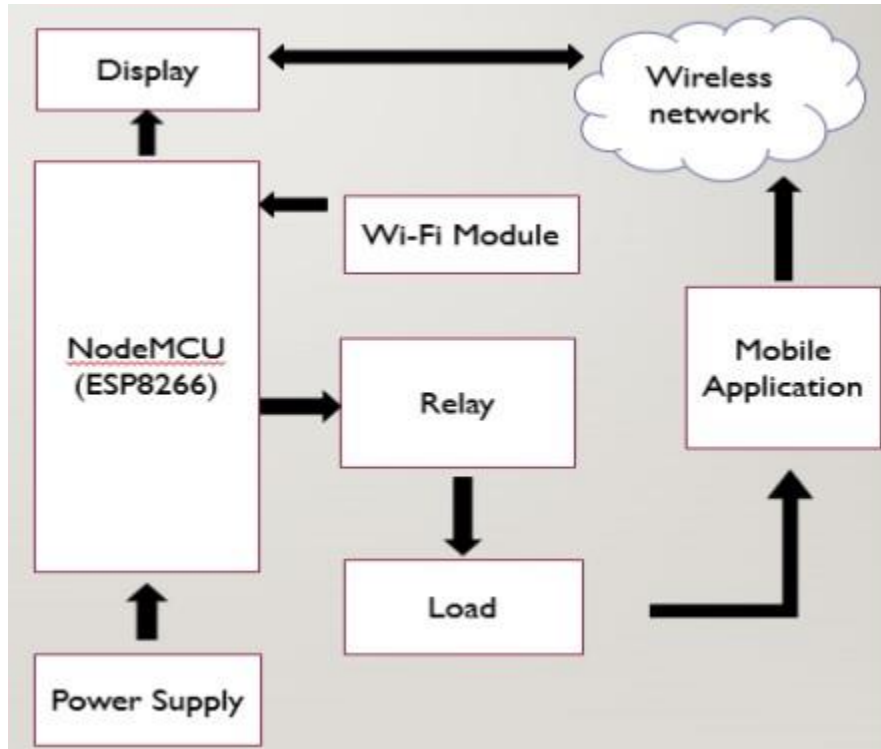


Figure 3.15: WI-FI and application connection [ref 4]

CHAPTER 4

Implementation Results and Discussion

4.1 Implementation

After all arrangement I sit and make all connection of every components. Then reread and rechecked. Make all connection perfect. PIR motion sensor connect to Arduino then Arduino connect to relay. Other side used a Node MCU to use WI-FI module to control relay by application. After complied all of task then the final view will be.

Here,



Figure 4.1: Implementation of project

4.2 Architecture Diagram

I can easily control this automation by using Blink application by phone. First, I download a blink application, then make an account, then create a control panel to control my appliance by WI-FI network. It can be control anywhere by connected with network.

1. Download Blink Application:

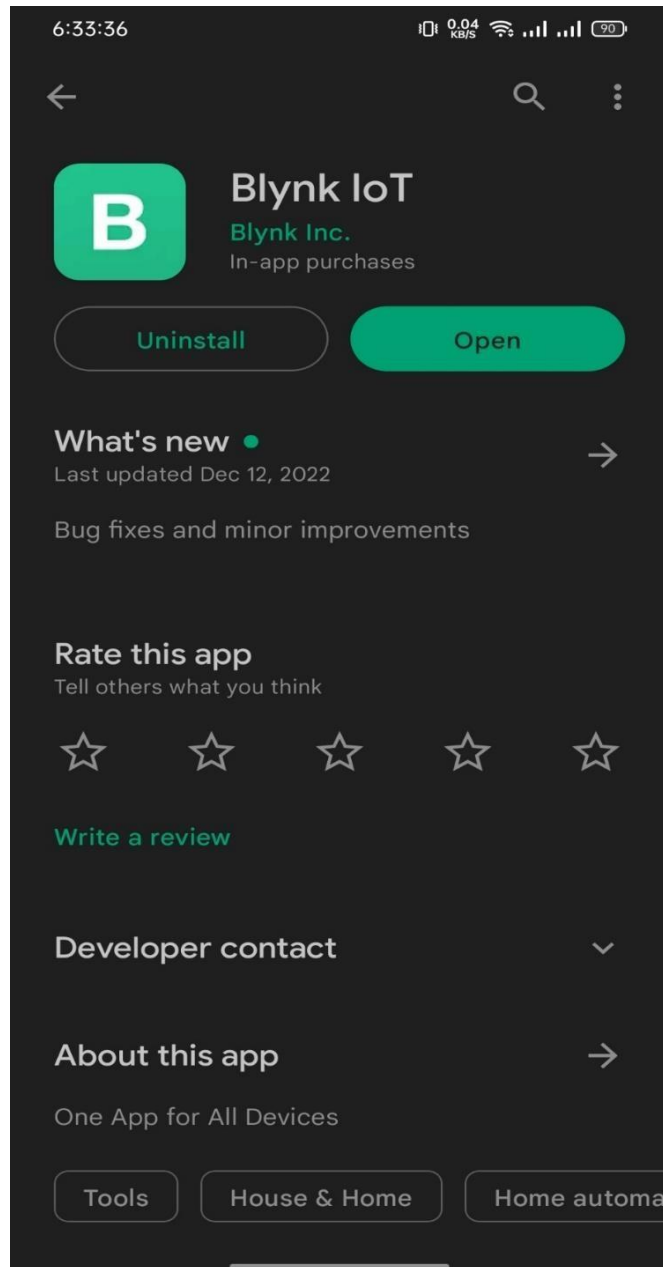


Figure 4.2: Blink application download [ref 17]

2. Blink application installation and creating a project:

After download, I make an account and create a project. Here I also setup my project into this application and connect to my network. Here I will give the details of button. Here application can notified me when the appliance connected with Wi-Fi then I can manage the appliance by this application. Here as a sample I create only two button but for home appliance I can create all of button of all home appliances.

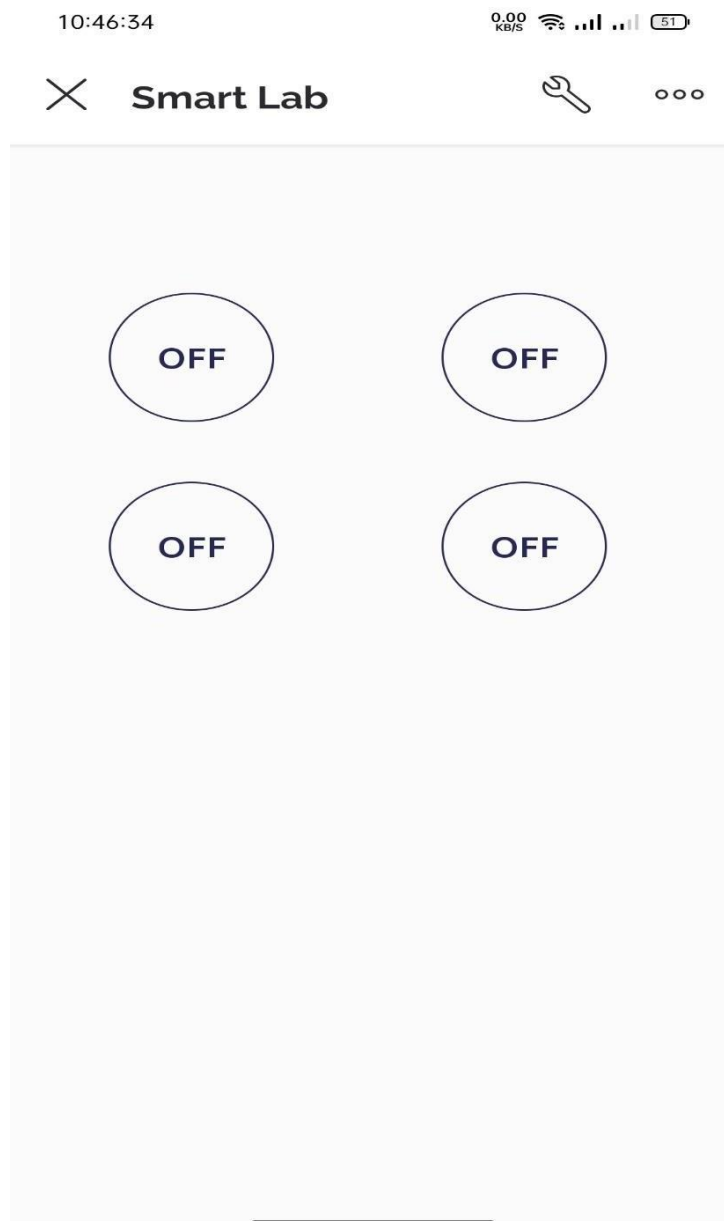


Figure 4.3: Blink install and create a project [ref 17]

4.3 Result Outcome

This gadget can work automatically by using PIR sensor, When it sense a motion in plantation area like home rooms, school rooms, lab rooms, factories and many more places.



Figure 4.4: Result outcome

This gadget can be controlled by blink application.

4.4 Final Project View

I have tried to make my home automation like a smart gadget. This is the final look of my project.

i. Control by an application:

Here, I used blink application to control this project.



Figure 4.5: Control by an application

ii. Control by PIR motion sensor:

Here, I used PIR motion sensor to sense the motion. When it sense any kind of motion then it will be work. After sense it will be sent a signal to Arduino then, Arduino sent a signal to relay and finally relay switch can control bulb power on or off.

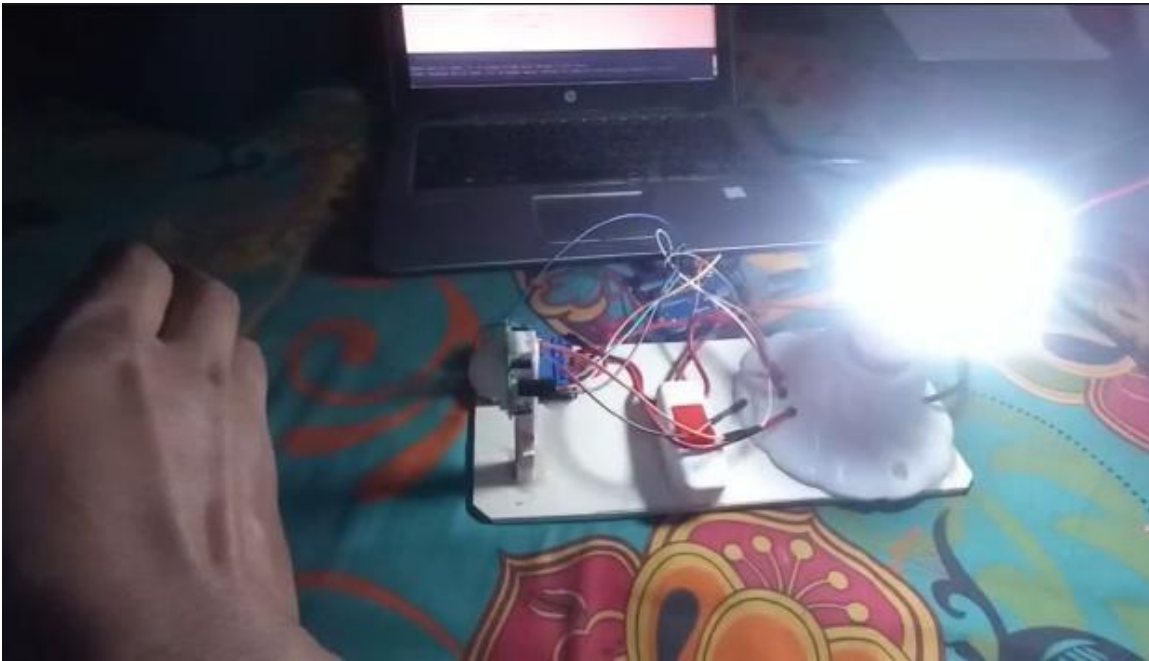


Figure 4.6: Control by PIR motion sensor

CHAPTER 5

Result Discussion

5.1 Result

My project give me perfect result as I wish. This project I can control blink application by anywhere connected with network. Secondly it has automation system that can sense the motion and work. It motion taken ability continuously and result give in a small delay.

So, overall I am extended about my project.



Figure 5.1 Result

5.2 Limitation

Everything have limitation in this planet. So my project have some limitation. Firstly need a good network to connect this application by this project. Without network it will be control by only PIR sensor.

Overall it has small limitation to overcome.

5.3 Cost of the project

Table 5.1: Cost of the project

	Components	Quantity	Price (TK)
1.	Arduino	1	1100
2.	Node MCU	1	350
3.	PIR motion sensor	1	100
4.	2 Channel relay	1	150
5.	AC switch	1	40
6.	AC bulb holder	2	120
7.	AC 5W bulb	1	50
8.	Jumper wire (male- female, male- male, female- female)	10	20
9.	Cable	3	90
10.	USB cable	1	80
11.	Socket	1	50
Total			2150

CHAPTER 6

Impact on Society and Environment

6.1 Impact on Society

As a human being we love to live in a society and also try to always ensure our capability. So, to make sure that we are living with full home automation and control system. This smart switch will be very popular in our society very soon. Everyone can be use it to their home. At all age of human can control it by anywhere connected with network. Parents can control their child uses WI-FI, Computer and many more devices. On the other hand, motion detect system is proved to be also useful as it detects any unusual movement from any out sider sand give alarm and notification. So, in this way, this system is also ensuring a good controlled home Security and also making sure that there is no miss management or criminal works happen in people's home and people of the society can live there with great peace and security.

6.2 Impact on Environment

Whatever we do, we are impacted by the environment and environment also get impacted by our work. So here home automation system like using CC camera and motion detection system is not only securing our home but also securing our environment as well. These automation systems are also very important for business people and business environment. A Secured business environment defines where there will be no corruption or miss-leading works happen or that environment Where Everyone can manage their business in their own way without having no issues of security. Doing business with a better controlled and Security is a blessing. So, security system like CC camera and motion detection system exactly ensures that our business environment and other surroundings environment will remain secured and healthy for us. So, these home security systems have also a great impact on our environment surely.

CHAPTER 7

Conclusion and Future Scope

7.1 Conclusion

It is good news that this type of important gadget can make very cheaply cost. After manufacturing it will give huge usages without mention its low cost. Everyone will be like it without any conditions for its huge usage of home appliances. It can control all kind of home appliances like light, fan, air conditioner, water pump and many more appliances.

I actually make it for my computer lab where everyone left the room whiteout switch off of fan, light and computer. Now I can off all appliance outside the room by using this application.

7.2 Future Scope

In this time this type of home automation have huge market. Everyone like this type of gadget for its huge usages and easy controlling. Everyone can control this by a glance of learn. Here I can add many more mode like security purpose, monitoring temperature and humidity, make alarm system and many more.

So, I can see a huge scope of this type home automation.

Reference:

- [1] “Smart Energy Efficient Home Automation System using IOT”, by Satyendra k. Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra.
- [2] “IOT Based Smart Security and Home Automation”, by Shardha Somani, Parilkshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Latukar.
- [3] “A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System”, by Tui-Yi Yang, Chu-Sing Yang, Tien-Wen Sung; in 2016 Third International Conference on Computing Measurement Control and Sensor Network.
- [4] “ Enhance Smart Home Automation System based on Internet of Things”, by Tushar Churasia and Prashant Kumar Jain; in Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019) IEEE Xplore Part Number:CFP19OSVART; ISBN:978-1-7281-4365-1
- [5] Visual Machine Intelligence for Home Automation”, by Suraj, Ish Kool, Dharmendra Kumar, Shovan Barman.
- [6] “A Low Cost Home Automation System Using Wi-Fi based Wireless Sensor Network Incorporating internet of Things”, by Vikram.N, Harish.K.S, Nihaal.M.S, Raksha Umesh, Shetty Aashik Ashok Kumar; in 2017 IEEE 7th International Advance Computing Conference.
- [7] Wikipedia (2009). Home Automation. From https://en.wikipedia.org/wiki/Home_automation
- [8] About IOT from <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>
- [9] About Arduino from <https://components101.com/microcontrollers/arduino-uno>
- [10] About Node MCU from <https://lastminuteengineers.com/esp8266-nodemcu-arduino-tutorial/>
- [11] <https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor>
- [12] <https://lastminuteengineers.com/two-channel-relay-module-arduino-tutorial/>
- [13] <https://alif.com.bd/product/IPL-Spuer-1-way-Bed-Switch-qsTYV>
- [14] <https://f.ixit.com.bd/product/off-white-color-ac-250-volts-6-ampere-e27-lamp-light-bulb-holder>
- [15] <https://businesscity.com.bd/electric-market/7946-rg-5-watt-led-bulb-non-guarantee-aaae-code-7946.html>
- [16] <https://www.radiogearbd.com/product/male-male-jumper-wire-40p-set/>
- [17] <https://buildbari.com.bd/paradise-0-75-sq-mm-pvc-insulated-single-core-cable-90-mtr-black/>

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