IOT Based Privacy Enabled Regulating and Consideration Home Appliance System using Mobile Application

by

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CERTIFICATE OF APPROVAL

The thesis/project entitled as "**IOT Based Privacy Enabled Regulating and Consideration Home Appliance System using Mobile Application**" submitted by **MD TAREKUL ISLAM** bearing Matric ID. **T- 171038** to the Department of Electronic and Telecommunication Engineering, International Islamic University Chittagong, has been accepted as satisfactory in partial fulfilment of the requirements for the degree of Bachelor of Science in Engineering and approved for the examination held on **15th October, 2022.**

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DECLARATION

It is hereby declared that this work has been done by us and no portion of the work contained in this thesis/project has been submitted elsewhere for the award of any degree or diploma.

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Md Tarekul Islam

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In the name of Allah, the most Beneficent and most Merciful

All praises and glory be to Allah (SWT) for blessing us with opportunities and showering upon us His mercy and guidance all through the life.

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ABSTRACT

Traditionally electrical appliances in a home are controlled via switches that regulate the electricity to the devices. As the world gets more and more technologically advanced, we find new technology coming deeper and deeper into our personal lives even at home. Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring real-world objects (things) through the Internet. When it comes to our house, this concept can be aptly incorporated to make it smarter, safer and automated. Security is at most concern for anyone nowadays, whether it's data security or security of their own home. With the advancement of technology and the increasing use of IoT, digital door locks have become very common these days. Digital lock doesn't require any physical key but it uses RFID, fingerprint, Face ID, pin, passwords, etc. to control the door lock. The aim of this research is to develop a Face recognition door lock system. The outcome of this study will improve the home security through the integration of IoT technology that can remotely monitor the house.

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LIST OF ABBREVIATIONS

IoT	Internet of Things
GSM	Global System for Mobiles
WSN	Wireless Sensor Network
WLAN	Wireless Local-Area Network
PWM	Pulse Width Modulation
LCD	Liquid Crystal Display

CHAPTER 1
INTRODUCTION

1.1 Introduction

Internet of Things (IoT) is the network of interconnected devices, mechanical and digital machines, vehicles, home appliances and other objects embedded with sensors, software, switches and connectivity which enable these things to connect to a network and collect and exchange data. The system creates the scope of connecting the non-internet enabled physical devices and machines to be connected over the internet and remotely monitored and controlled. A thing in the Internet of Things can also be a person with a heart monitoring implant or an automobile with obstacle sensor or home appliances connected to an application platform. This is also applicable to industrial machines like drill of an oil rig or a jet engine of an airplane. These things are assigned to an IP address and are able to transfer data over internet. Basically, this is the concept of connecting any devices or machines we can think of today with the internet.

Previously, home-mechanized gadgets were somewhat essential and basic, with choices running from light clocks to programmable indoor regulators. Presently, these frameworks are consolidating information from home exercises, neighbourhood climate frameworks and then some; to acclimate to optimal way of life and help for better deal with home. Even better, they can interface with one another to shape a firm unit to enable to work entire house.

1.2 Internet of Things (IoT)

The concept of Internet of Things (IoT) was introduced by the growth of the widely used global network known as the internet along with the deployment of ubiquitous computing and mobiles in smart objects which brings new opportunities for the creation of innovative solutions to various aspects of life. The concept of Internet of things (IoT) creates a network of objects that can communicate, interact and cooperate together to reach a common goal [1]. IoT devices can enhance our daily lives, as each device stops acting as a single device and become part of an entire full connected system. This provides us with the resulting data to be analysed for better decision making, tracking our businesses and monitoring our properties while we are far away from them.

1.3 Features of IOT

1.3.1 Intelligence

IOT comes with the combination of algorithms and computation, software & hardware that makes it smart. Ambient intelligence in IOT enhances its capabilities which facilitate the things to respond in an intelligent way to a particular situation and supports them in carrying out specific tasks. In spite of all the popularity of smart technologies, intelligence in IOT is only concerned as a means of interaction between devices, while user and device interaction are achieved by standard input methods and graphical user interface

1.3.2 Connectivity

Connectivity empowers the Internet of Things by bringing together everyday objects. Connectivity of these objects is pivotal because simple object level interactions contribute towards collective intelligence in the IOT network. It enables network accessibility and compatibility in the things. With this connectivity, new market opportunities for the Internet of things can be created by the networking of smart things and applications

1.3.3 Dynamic Nature

The primary activity of Internet of Things is to collect data from its environment, this is achieved with the dynamic changes that take place around the devices. The state of these devices change dynamically, example sleeping and waking up, connected and/or disconnected as well as the context of devices including temperature, location and speed. In addition to the state of the device, the number of devices also changes dynamically with a person, place and time

1.3.4 Enormous Scale

The number of devices that need to be managed and that communicate with each other will be much larger than the devices connected to the current Internet. The management of data generated from these devices and their interpretation for application purposes becomes more critical. Gartner (2015) confirms the enormous scale of IOT in the estimated report where it stated that 5.5 million new things will get connected every day and 6.4 billion connected things will be in use worldwide in 2016, which is up by

30 percent from 2015. The report also forecasts that the number of connected devices will reach 20.8 billion by 2020

1.3.5 Sensing

IOT wouldn't be possible without sensors that will detect or measure any changes in the environment to generate data that can report on their status or even interact with the environment. Sensing technologies provide the means to create capabilities that reflect a true awareness of the physical world and the people in it. The sensing information is simply the analogue input from the physical world, but it can provide a rich understanding of our complex world

1.3.6 Heterogeneity

Heterogeneity in Internet of Things as one of the key characteristics. Devices in IOT are based on different hardware platforms and networks and can interact with other devices or service platforms through different networks. IOT architecture should support direct network connectivity between heterogeneous networks. The key design requirements for heterogeneous things and their environments in IOT are scalabilities, modularity, extensibility and interoperability.

1.3.7 Security

IOT devices are naturally vulnerable to security threats. As we gain efficiencies, novel experiences, and other benefits from the IOT, it would be a mistake to forget about security concerns associated with it. There is a high level of transparency and privacy issues with IOT. It is important to secure the endpoints, the networks, and the data that is transferred across all of it means creating a security paradigm.

1.4 Advantages of IOT

1.4.1 Communication

IOT encourages the communication between devices, also famously known as Machine-to-Machine (M2M) communication. Because of this, the physical devices are able to stay connected and hence the total transparency is available with lesser inefficiencies and greater quality.

1.4.2 Automation and Control

Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure, there is a large amount of automation and control in the workings. Without human intervention, the machines are able to communicate with each other leading to faster and timely output.

1.4.3 Information

It is obvious that having more information helps making better decisions. Whether it is mundane decisions as needing to know what to buy at the grocery store or if your company has enough widgets and supplies, knowledge is power and more knowledge is better.

1.4.4 Monitor

The second most obvious advantage of IOT is monitoring. Knowing the exact quantity of supplies or the air quality in your home, can further provide more information that could not have previously been collected easily. For instance, knowing that you are low on milk or printer ink could save you another trip to the store in the near future. Furthermore, monitoring the expiration of products can and will improve safety.

1.4.5 Time

As hinted in the previous examples, the amount of time saved because of IOT could be quite large. And in today's modern life, we all could use more time.

1.4.6 Money

The biggest advantage of IOT is saving money. If the price of the tagging and monitoring equipment is less than the amount of money saved, then the Internet of Things will be very widely adopted. IOT fundamentally proves to be very helpful to people in their daily routines by making the appliances communicate to each other in an effective manner thereby saving and conserving energy and cost. Allowing the data to be communicated and shared between devices and then translating it into our required way, it makes our systems efficient.

1.4.7 Automation of daily tasks leads to better monitoring of devices

The IOT allows you to automate and control the tasks that are done on a daily basis, avoiding human intervention. Machine-to-machine communication helps to maintain

transparency in the processes. It also leads to uniformity in the tasks. It can also maintain the quality of service. We can also take necessary action in case of emergencies.

1.4.8 Efficient and Saves Time

The machine-to-machine interaction provides better efficiency, hence; accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

1.4.9 Saves Money

Optimum utilization of energy and resources can be achieved by adopting this technology and keeping the devices under surveillance. We can be alerted in case of possible bottlenecks, breakdowns, and damages to the system. Hence, we can save money by using this technology.

1.4.10 Better Quality of Life

All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life.

1.5 IOT Technologies and Protocols

Several communication protocols and technologies cater to and meet the specific functional requirements of IOT system.

1.5.1 Bluetooth

Bluetooth is a short range IOT communication protocol/technology that is profound in many consumer product markets and computing. It is expected to be key for wearable products in particular, again connecting to the IOT albeit probably via a smartphone in many cases. The new Bluetooth Low-Energy (BLE) – or Bluetooth Smart, as it is now branded – is a significant protocol for IOT applications. Importantly, while it offers a similar range to Bluetooth it has been designed to offer significantly reduced power consumption.

1.5.2 Zigbee

ZigBee is similar to Bluetooth and is majorly used in industrial settings. It has some significant advantages in complex systems offering low-power operation, high security,

robustness and high and is well positioned to take advantage of wireless control and sensor networks in IOT applications. The latest version of ZigBee is the recently launched 3.0, which is essentially the unification of the various ZigBee wireless standards into a single standard.

1.5.3 Z-Wave

Z-Wave is a low-power RF communications IOT technology that primarily design for home automation for products such as lamp controllers and sensors among many other devices. A ZWave uses a simpler protocol than some others, which can enable faster and simpler development, but the only maker of chips is Sigma Designs compared to multiple sources for other wireless technologies such as ZigBee and others.

1.5.4 Wi-Fi

Wi-Fi connectivity is one of the most popular IOT communication protocol, often an obvious choice for many developers, especially given the availability of Wi-Fi within the home environment within LANs. There is a wide existing infrastructure as well as offering fast data transfer and the ability to handle high quantities of data. Currently, the most common Wi-Fi standard used in homes and many businesses is 802.11n, which offers range of hundreds of megabit per second, which is fine for file transfers but may be too power-consuming for many IOT applications.

1.5.5 Cellular

Any IOT application that requires operation over longer distances can take advantage of GSM/3G/4G cellular communication capabilities. While cellular is clearly capable of sending high quantities of data, especially for 4G, the cost and also power consumption will be too high for many applications. But it can be ideal for sensor-based low-bandwidth-data projects that will send very low amounts of data over the Internet.

1.5.6 NFC

NFC (Near Field Communication) is an IOT technology. It enables simple and safe communications between electronic devices, and specifically for smartphones, allowing consumers to perform transactions in which one does not have to be physically present. It helps the user to access digital content and connect electronic devices. Essentially it

extends the capability of contactless card technology and enables devices to share information at a distance that is less than 4cm.

1.5.7 LoRaWAN

LoRaWAN is one of popular IOT Technology, targets wide-area network (WAN) applications. The LoRaWAN design to provide low-power WANs with features specifically needed to support low-cost mobile secure communication in IOT, smart city, and industrial applications. Specifically meets requirements for low-power consumption and supports large networks with millions and millions of devices, data rates range from 0.3 kbps to 50 kbps.

1.6 Internet of Things Application

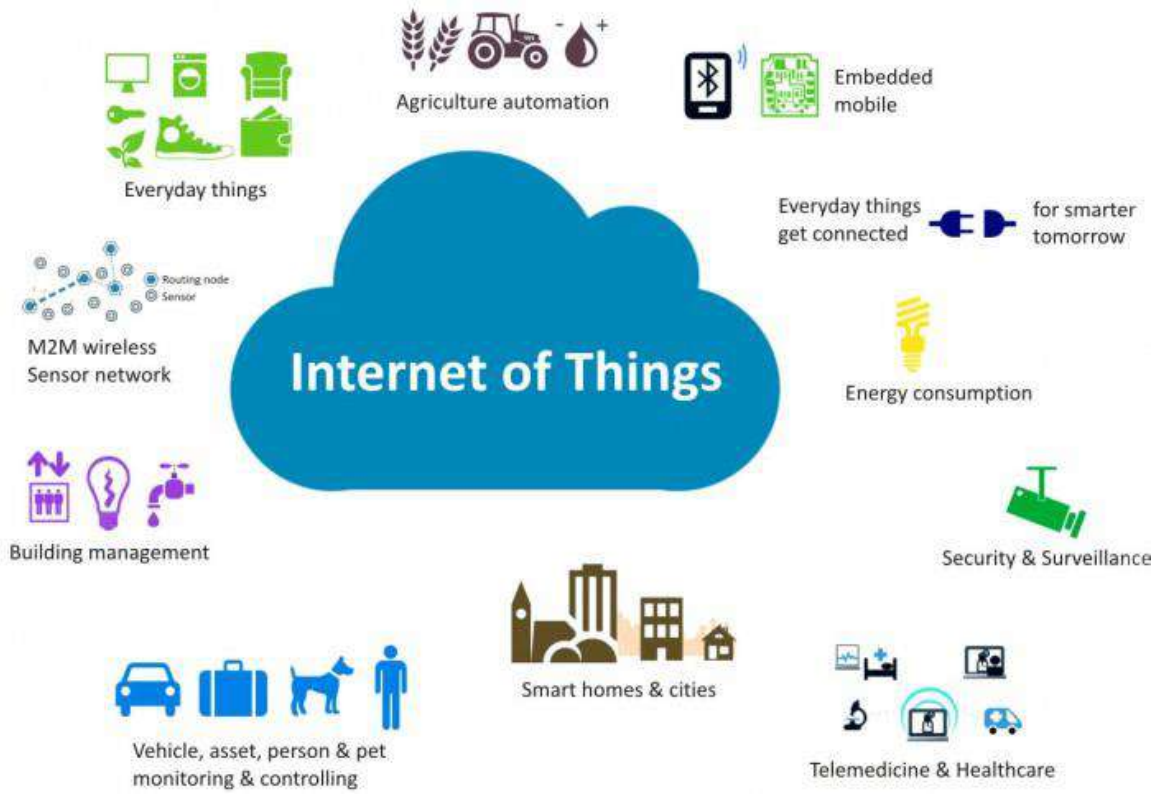


Fig 1.1 IoT Applications [6]

As the paradigm of IoT is growing, it is stepping into every aspect of our lives. This leads to an easier life through wider range of applications, such as electronic health care solutions [2] and Smart city concept. The concept of Smart city aims to making a better use of resources, increasing services quality offered to the citizens, and reducing costs of the public administrations [10]. Another application is home automation which is the main focus of this project.

1.7 Home Automation

Fig 1.2 Home Automation [7]

Home Automation is the process which all the household appliances can be controlled, monitored and maintained automatically by the intelligence of device far from home regardless is typically called home automation which makes home smart. It connects everything in the network through internet. The idea of house being totally mechanized used to be numerous. Presently, it is a reality. Shrewd homes and penetrating home items are prominent in light of the fact that they offer more accommodation and security for family. User can check the update status of a device time to time. These gadgets can convey, track and send data, and react according to user command. In this technology we can control household appliances like lighting, AC, fan, washing machine, TV, Fridge, security system etc. By using artificial intelligence, it can also be self-controlled and monitored by itself. These frameworks additionally help increment home's vitality effectiveness, which can lessen vitality bill.

1.8 Objective

- To design an IoT based home appliance monitoring system
- To control home appliance load through internet
- To monitor & control using mobile application.
- To design face recognition door lock system.
- To monitor unauthorized movement inside house using motion sensor

1.9 Motivation

During the past few years, internet was known as a big mass that we can acquire data from. Embedding mobile transceivers to everyday items and gadgets enabled new forms of bi-directional communication between people with other people, and people with things. That paradigm, known as Internet of Things, that was first introduced in 1998by Kevin Ashton, has received recently more attention in the academia and industry [8], and this would add a new dimension to the world of Information and communication technology.

While that paradigm is growing and have high positive impact on many aspects of our lives, challenging issues arise, that should be considered and addressed. The central issues are guaranteeing security and privacy of users and their data. Another issue is fully achieving smartness of interconnected devices by enabling their interaction. Exchanging data and autonomous behavior is the key to achieving the latter [4].

IoT has different definitions from different perspectives, however, they all revolve around" things" generally, collecting, exchanging and communicating data with each other's and with people through the" internet". IoT helps in decision making and automating almost everything around us. The smarter life IoT vision promises in the near future through various applications, made smart Home Automation actually possible, starting from basically monitoring different parts of home, to actually controlling them. Integration of IoT and Home Automation, made it possible to monitor and control homes from different parts of the world. Some examples of applications to this are: controlling and setting the desired temperature of the house before arriving home, turning on/off the lights of a room and setting its intensity, running washing machine while the person is at work, leakage or smoke detection and notification, monitoring home through surveillance camera or car

inside the house while the person is away, or remote central locking, and many other applications.

As the field of Home Automation through IoT is a wide application in a very wide and challenging field due to the reasons mentioned in the previous paragraphs, I chose to work on that field as part of this thesis, specifically in maintaining and ensuring security and safety inside home.

1.10 Thesis Outline

The thesis is organized as follows:

- Chapter 1 includes introduction, Objective, motivation and outline.
- Chapter 2 includes Literature Review.
- Chapter 3 describes the methodology of the proposed model including the specific components and their description.
- Chapter 4 includes Result and Discussion.
- Chapter 5 describes the conclusion and future work of the project

Chapter 2

LITERATURE REVIEW

2.1. Literature Review

Fitriyah et al. (2016) designed a remote control based on a button which is outfitted with LCD screen. The LCD screen reduced the quantity of buttons as choices might be displayed in it. In addition, The LCD screen would return visual feedback of observability for users.

Kumar and Pati (2016) proposed a low-priced and flexible solution to the smart home. Home devices can be controlled by different technologies like GUIs and the internet. The house owner can monitor his family and the home devices from anywhere and at any time he wants. It improves home safety where the owner became alerted in case of any emergency to take the necessary action at appropriate time. The system minimizes frequent supervision and management of home devices as well as proper handling of guests in case if the owner is not around. The system also helps in saving electrical energy by proper scheduling and monitoring of devices.

Gandhi et al. (2016) developed smart industrial system where by all machineries and electronic devices in a company or industry can be controlled via an android application, a message is sent when a sensor is active or inactive.

Li et al. (2016) developed smartphone applications for an energy-efficient to control smart phone applications. Two versions of the application was developed; the first is iSHome1 which can interact with power plugs, and the second version is iSHome2 which communicate with the home management server. Both 2 versions uses Bluetooth as means of communication.

Zhang et al. (2016) developed a smart home control system using speech signals, the system takes a voice command as an input, then translates speech signal to text message. A robot will then use the text command and use it to perform a task. This system help old-aged people or people with disabilities in performing different tasks.

Khaled et al. (2016) designed a system for controlling and monitoring of submersible pumps using SMS with GSM modem. The system allows a user to control and monitor the pump remotely from anywhere, in which information about the state of the pump can be accessed or altered. This system works very fast and required minimal resources compared to other systems.

ROY and WILLIAMS. (2016) proposed a wireless control system for greenhouse which depends on Zigbee to minimize human hard work, the system was designed using Visual Basic then hosted to a Web server for easy communication with devices. A mobile phone was synchronized with the software using (TEAM VIEWER) to keep the devices in synchronization with the server, also a wireless camera was attached to monitor the real time activities. This system is mainly used for monitoring the three basic parameters for plant growth; humidity, temperature and light intensity. The results were truly consistent and accurate. The system successfully overcome several weaknesses of the current systems by decreasing the power loss, support and complexity, at the same time implementing a flexible and specific form of saving the environment.

Ransing and Rajput. (2015) developed a Wireless Sensor Network smart home system to help elderly people to work easier and faster. The Wireless Sensor Network (WSN) has many sensor nodes attached for sensing different environmental parameters, like temperature, LPG and gas leakage detector, it also have the capability to detect which door is opened/closed. In case of emergencies, a notification message will be sent via SMS, and also trigger an alarm system for quick notification.

Adriansyah and Dani. (2014) created a small smart home control web based system using by using Arduino which depends on WLAN connectivity. The system is able to control different home devices like turning on/off lights, temperature control and alarms and etc. The system is built up with HTML5 where the status of objects that are connected to the system can be monitored and controlled via a website. Lights switches can be turned on/off, sockets can be activated or deactivated.

Das et al. (2014) also developed a home appliances monitoring system using GSM phones, where one can easily send an SMS command to control and receive the operation status of each device.

Zeebaree and Yasin. (2014) implemented an electrical devices control system in which home used electronic are remotely being controlled and monitored using a microcontroller via a GSM network. A message command can be sent to the system via a mobile phone from anywhere without internet connection. This system is very flexible in which electronic devices can be added or removed to the system.

Kumar and Lee. (2014) developed a low-cost Smart Living System that can be controlled with android mobile application by using Bluetooth or internet connection. The system has an integrated home security and alert systems for switching of lights, sensing of temperatures and motion detection and alarms to prove its effectiveness and feasibility.

Kumar. (2014) designed a smart home monitoring system which is flexible and standalone. This system depends on the micro-web server hosted via Arduino microcontroller. This system make use of Google speech recognition to translate voice commands into text commands. It has many functionalities which includes light switching, temperature/humidity sensing, sirens alert in case of smoke/fire accidents.

Bingol et al. (2014) built a web-based system for smart home automation using C# programming and PLC device for information storage. The system can be controlled via PC and operator terminal called DOP-AS35THTD. This system detects and controls home security treats like; smoke, gas, movement, door opening/closing as well as lightening or climate change.

Chapter 3

METHODOLOGY

3.1 Introduction

The Proposed model of the system is as follows. Figure 3.1 shows how the whole system will work. The device will be set up to take the data and there will be a base standard value shown in the Blynk App. The sensors will collect data and based on the set values it will show the output. The following Fig.3.1 shows the proposed model system.

Fig. 3.1 How IoT Works [8]

3.2 Block Diagram of Proposed System

The block diagram of the proposed system is as follows. Figure 3.2 shows how the whole system will work. Here Power Supply, The device will be set up to take the data and there will be a base standard value shown in the Blynk App. The sensors will collect data and based on the set values it will show the output. The following Fig.3.2 shows the block diagram of the proposed system.

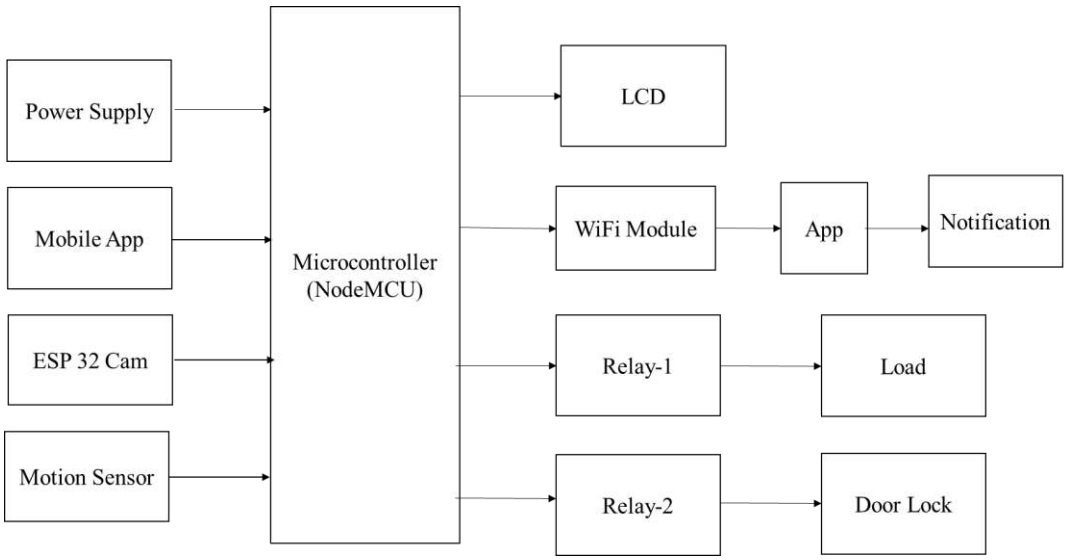


Fig. 3.2 Block Diagram of Our Proposed System

3.3 Flow Chart of Proposed System

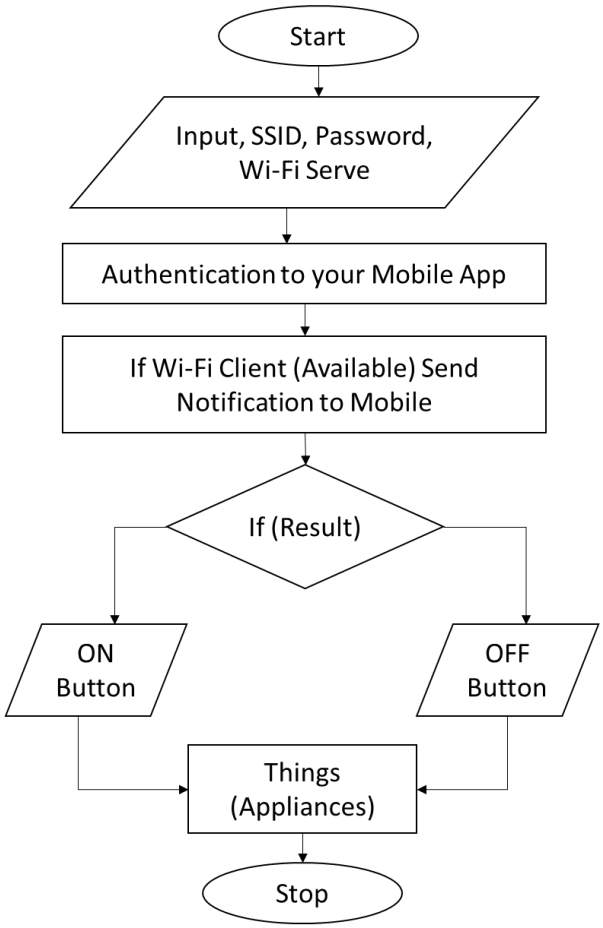


Fig 3.3 Flow Chart for proposed model of the system

3.4 Circuit Diagram of proposed mode

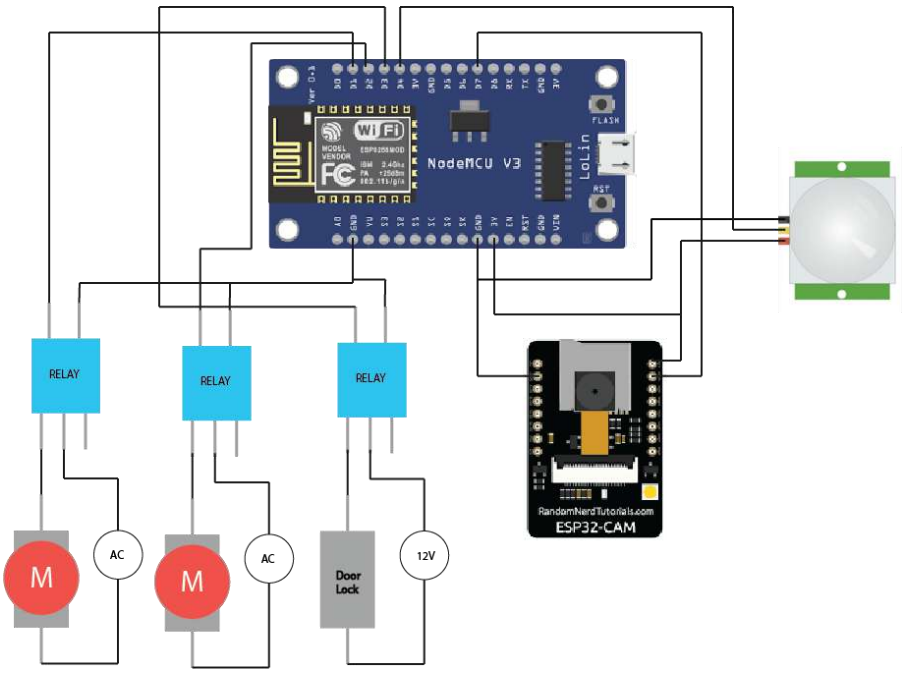


Fig 3.4 Circuit diagram of the Propose model

3.5 Proposed Model in Real Life

The Fig. 3.4. shows the Proposed Model in Real Life.

Fig 3.5 Proposed Model in Real Life

3.6 Components of the Project:

The project is built with various sensors and they take data by sensing from the environment for plant monitoring. The sensors take analog data from the

environment which later is converted into digital with the help of Node MCU and then sent to the server where all the data are stored.
This device is consisting of the following components:

- Arduino UNO
- ESP 8266 Wi-Fi Module
- Relay
- Display
- AC Load
- Raspberry Pi 3
- ESP 32 Cam
- PIR Motion Sensor
- 12V Electronic Door Lock
- Motion sensor
- Power Supply

3.6.1 Arduino Uno

Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller.

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. Arduino Uno can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

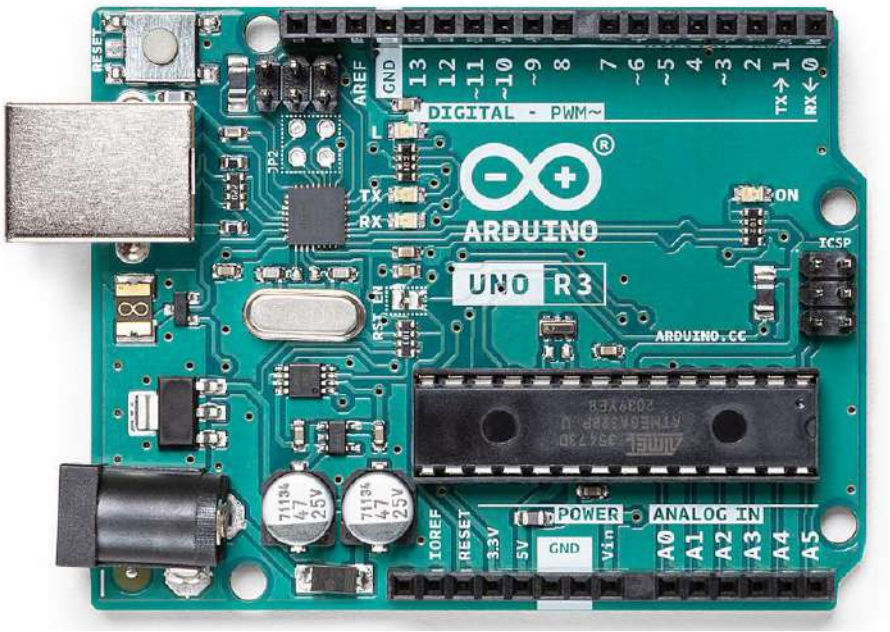


Fig 3.6 Arduino Uno [8]

Arduino Uno Technical Specifications & Features

Microcontroller : ATmega328P – 8 bit AVR family microcontroller

Operating Voltage : 5 V

Input Voltage : 7-12 V

Digital I/O Pins : 14 (Out of which 6 provide PWM output)

Analog Input Pins : 6 (A0 – A5)

Flash Memory : 32 KB (0.5 KB is used for Bootloader)

SRAM : 2 KB

EEPROM : 1 KB

Clock Speed : 16 MHz

Arduino Uno Pinout:

Pin Category	Pin Name	Details

Power	Vin, 3.3V, 5V, GND	**Vin:** Input voltage to Arduino when using an external power source. **5V:** Regulated power supply used to power microcontroller and other components on the board. **3.3V:** 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. **GND:** ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

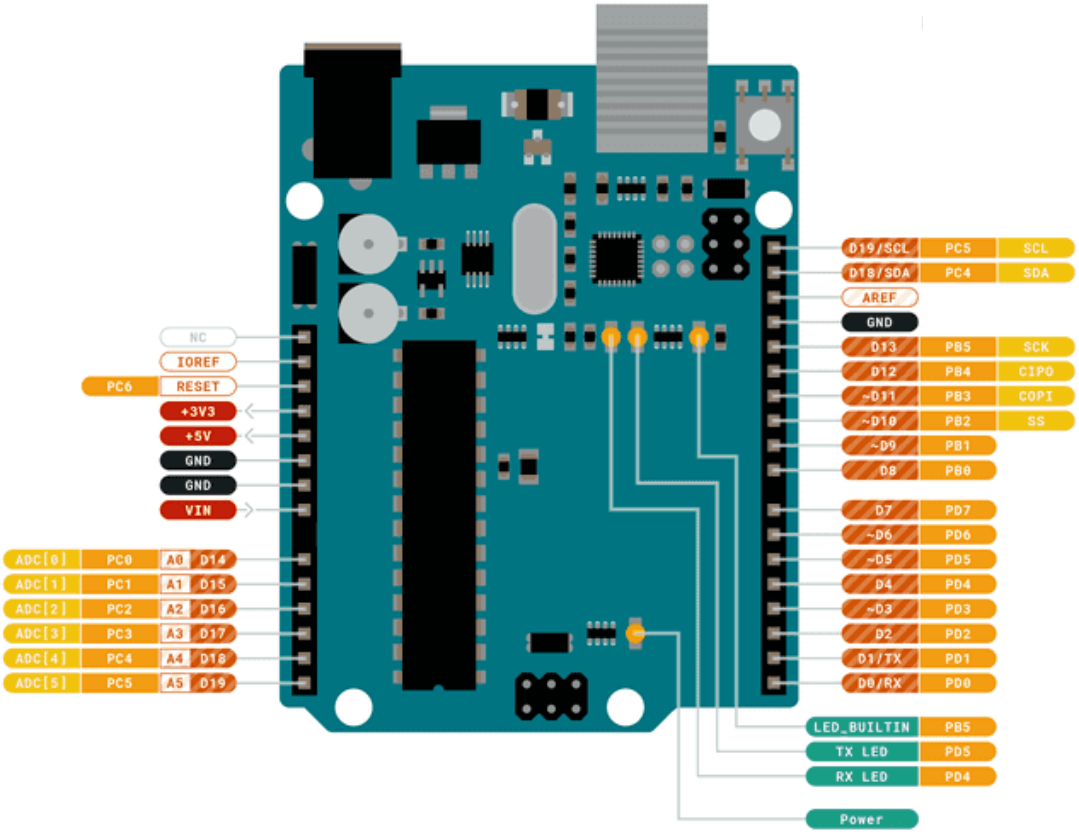


Fig 3.7 Arduino Uno Pinout [9]

3.6.2 ESP 8266 Wi-Fi Module

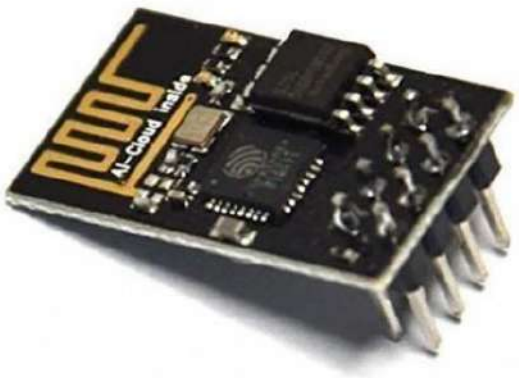


Fig 3.8 ESP 8266 Wi-Fi Module [10]

The ESP8266 is a very user friendly and low cost device to provide internet connectivity to your projects. The module can work both as an Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making Internet of Things as easy as possible. It can also fetch data from internet using API's hence your project could access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly.

ESP8266 Features

Power Supply: +3.3V only

Current Consumption: 100mA

I/O Voltage: 3.6V (max)

I/O source current: 12mA (max)

Processor: 32-bit MCU @ 80MHz

Flash Memory: 512kB

ESP8266 Pin Configuration

Pin No	Pin Name	Used for
1	**Ground**	Connected to the ground of the circuit
2	**TX**	Connected to Rx pin of programmer/uC to upload program
3	**GPIO-2**	General purpose Input/output pin
4	**CH_EN**	Chip Enable – Active high
5	**GPIO - 0**	General purpose Input/output pin
6	**Reset**	Resets the module
7	**RX**	General purpose Input/output pin
8	**Vcc**	Connect to +3.3V only

3.6.3 Raspberry Pi 3

RASPBERRY PI 3 is a development board in PI series. It can be considered as a single board computer that works on LINUX operating system. The board not only has tons of features it also has terrific processing speed making it suitable for advanced

applications. PI board is specifically designed for hobbyist and engineers who are interested in LINUX systems and IoT (Internet of Things).

Fig 3.9 Raspberry Pi 3 [11]

RASPBERRY PI platform is most used after ADRUINO. Although overall applications of PI are less it is most preferred when developing advanced applications. Also the RASPBERRY PI is an open source platform where one can get a lot of related information so you can customize the system depending on the need.

Technical Specifications

Microprocessor:	Broadcom BCM2837 64bit Quad Core Processor

Operating Voltage:	3.3V
Raw Voltage input:	5V, 2A power source
Flash Memory:	16Gbytes SSD memory card
Internal RAM:	1Gbytes DDR2
Clock Frequency:	1.2GHz
Ethernet:	10/100 Ethernet
Operating Temperature:	-40ºC to +85ºC

Raspberry Pi-3 Pin Configuration

PIN GROUP	PIN NAME	DESCRIPTION
POWER SOURCE	+5V, +3.3V, GND and Vin	+5V -power output +3.3V -power output GND – GROUND pin
COMMUNICATION INTERFACE	UART Interface(RXD, TXD) [(GPIO15,GPIO14)]	UART (Universal Asynchronous Receiver Transmitter) used for interfacing sensors and other devices.
SPI Interface(MOSI, MISO, CLK,CE) x 2	SPI (Serial Peripheral Interface) used for communicating with other boards or peripherals.	
TWI Interface(SDA, SCL) x 2	TWI (Two Wire Interface) Interface can be used to connect peripherals.	
INPUT OUTPUT PINS	26 I/O	Although these some pins have multiple functionsthey can be considered as I/O pins.

PWM	Hardware PWM available on GPIO12, GPIO13, GPIO18, GPIO19	These 4 channels can provide PWM (Pulse Width Modulation) outputs.
EXTERNAL INTERRUPTS	All I/O	In the board all I/O pins can be used as Interrupts.

3.6.4 ESP 32 Cam Module

Fig 3.10 ESP 32 Camera Module [12]

ESP32-CAM has integrated with Wi-Fi, Bluetooth and can be used with OV2640 or OV7670 cameras. The ESP32 IC has high-resolution ADCs, SPI, I2C, and UART protocols for information communication. The module has an inbuilt Hall sensor, temperature sensor, and touch sensors, and watchdog timers. RTC can be operated in different modes. The module has a maximum clock frequency of 160 MHz that means the computing power up to 600 DMPIS. Furthermore, it is quite durable and reliable when it comes to internet connectivity.

3.6.5 Relay Module

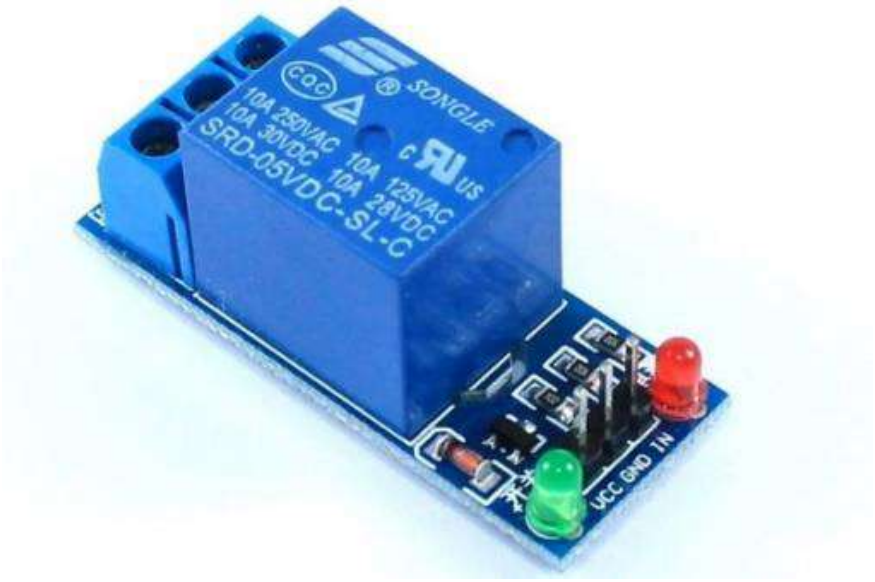


Fig 3.11 Relay Module [13]

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as controlling any other output as we'll see later on. This relay module has two channels (those blue cubes). There are other models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use with an Arduino. There are other relay modules that are powered using 3.3V, which is ideal for ESP32, ESP8266, and other microcontrollers.

3.6.6 16×2 LCD Display

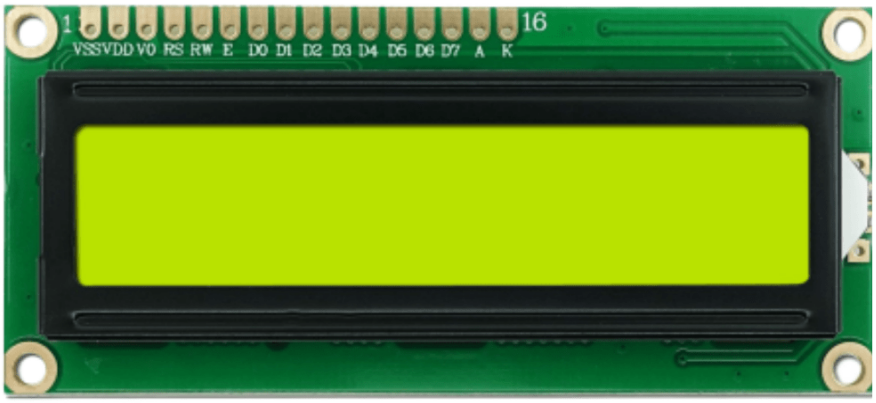


Fig. 3.12 16x2 LCD Display [14]

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for

consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight.

3.6.7 PIR Motion Sensor

Fig. 3.13 PIR Motion Sensor [15]

The PIR sensor stands for Passive Infrared sensor. It is a low cost sensor which can detect the presence of Human beings or animals. This HC-SR501 PIR sensor module has three output pins Vcc, Output and Ground. Since the output pin is 3.3V TTL logic it can be used with any platforms like Arduino, Raspberry, PIC, ARM, 8051 etc. PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

3.6.8 12V Electronic Door Lock

12 V automatic electric door lock can be used as cabinet lock, locker locks, file cabinet locks, luggage locks, electric locks, door locks, solenoid locks, drawer, newspaper boxes lock, sauna lock, locker electromagnetic locks, electric locks, newspaper boxes, sauna electronics lock.

Fig. 3.14 12V Electronic Door Lock [16]

Ultra-thin design, compact and delicate, easy installation. Safety and stability, the lock body is made of metal material, hard and stable. Working way: electrify to unlock, shut the door to lock, easy to use. Low power consumption: voltage 12v, current is only about 0.65A, power instant trigger unlocks. Long life: aging test: 100 thousand times, durable. Directional: left and right symmetrical design, light processing, no matter positive and negative, general installation of left and right! Convenient. Installation methods: mounted, hidden, embedded arbitrary installation, 360 degrees from all angles applicable. Security: anti-vibration, prying-resistant, anti-drilling, anti-technology open design! Suitable for all kinds of container products. Widely used in school, mines, factories, banks, troops, prisons, courts, hotel, farm, bath center and other places.

3.6.9 ThingSpeak

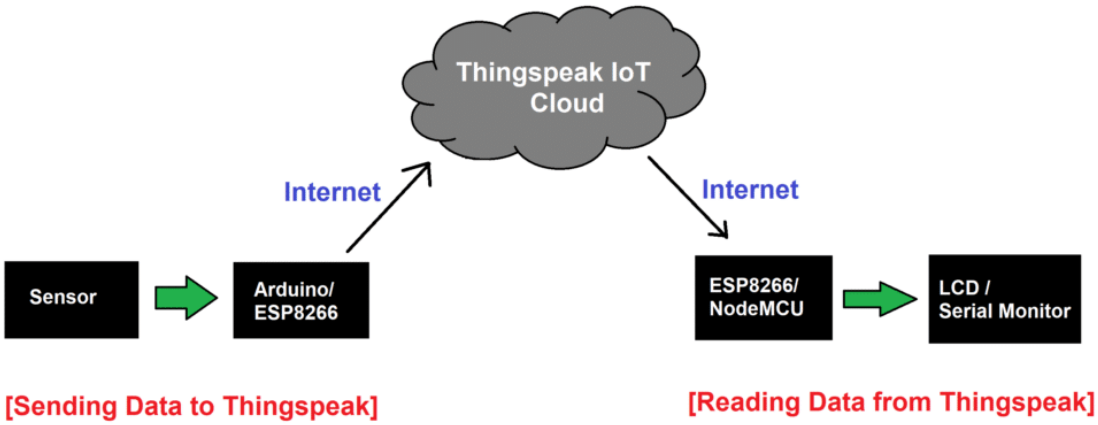


Fig. 3.15 Thingspeak Architecture [17]

ThingSpeak is an IoT analytics platform service that allow to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by our devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak we can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics. Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights.

3.6.10 Blynk App

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

Fig. 3.16 Blynk App [18]

3.11 Software Requirements

1. Aurdino IDE 1.8.8
2. Thingspeak website
3. Blynk App

Chapter 4

RESULT AND DATA ANALYSIS

4.1 Introduction

This chapter is all about our devices experiment and its results. We put our device in different situations to get data as much as possible.

4.2 Displaying data of output result

Fig. 4.1 shows the output of real life project view.

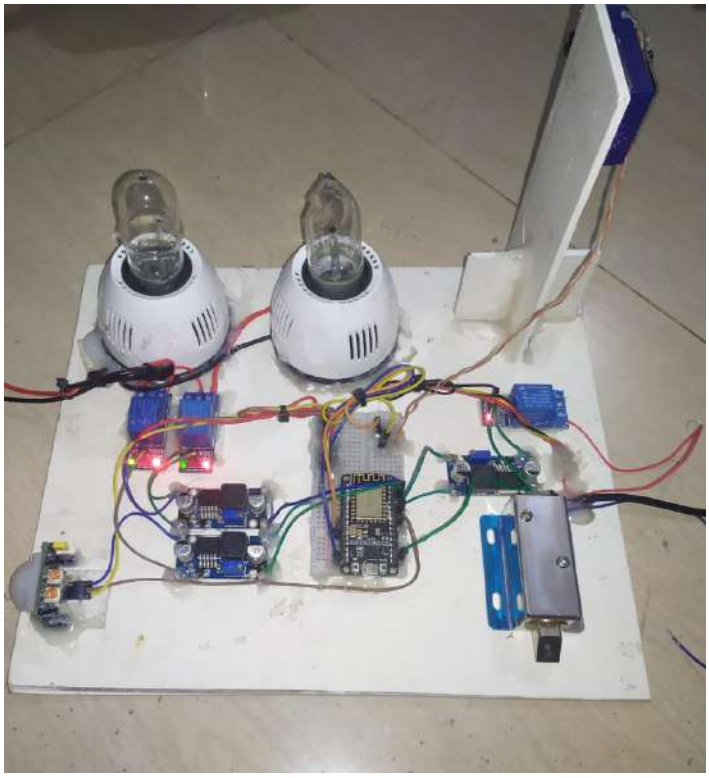
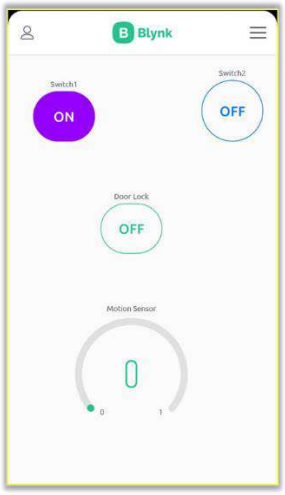


Fig. 4.1. Project View (real scenario)

4.3. Monitoring and controlling data to the cloud platform

The esp8266 establishes connection between microcontroller and Blynk App cloud platform to send data.

Fig. 4.2 shows the Mobile Application view of the system.



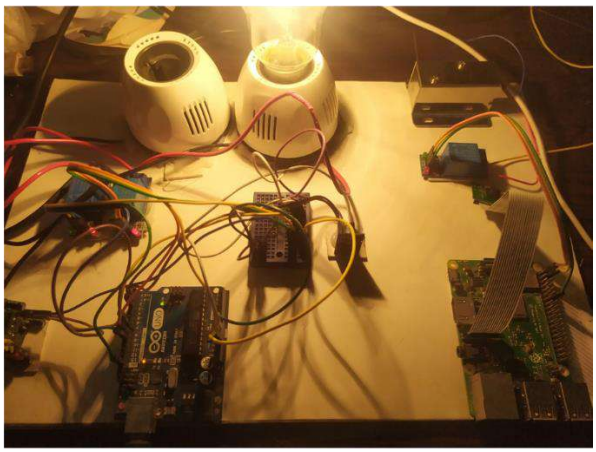
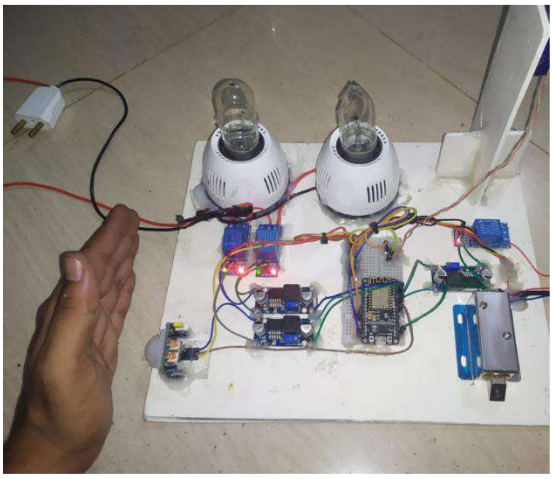


Fig. 4.2 Load Control using Mobile App



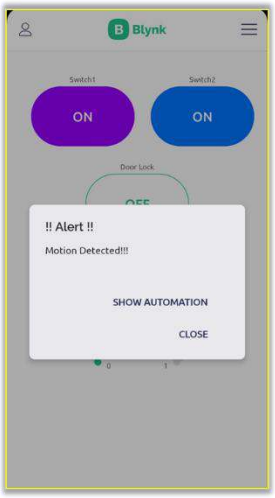


Fig. 4.3 Motion Alert On Mobile App

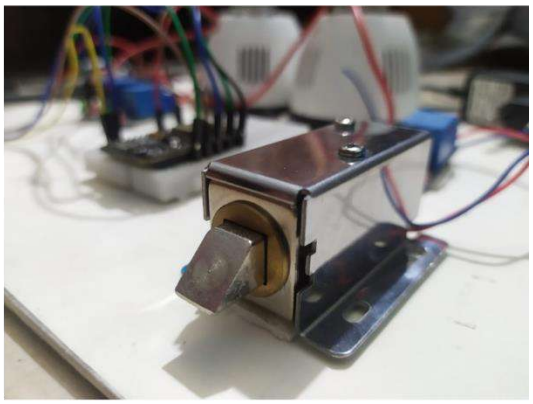


Fig. 4.4 Face Detection On Mobile App

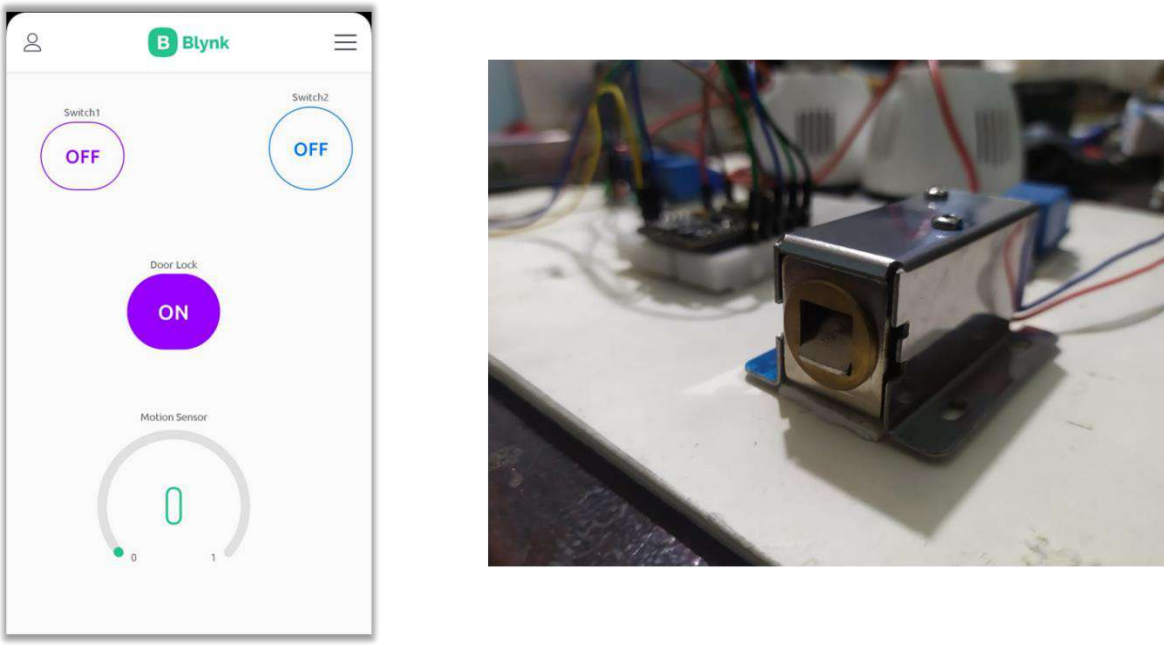


Fig. 4.5 Door Lock Control using Mobile App

4.4. Result

In this system, we can monitor the load from anywhere. Even when we are in out of the home and forgot about switching off the load, in the meantime the app remaindering us and we can emergency load off by app. All home power appliances are networked together and able to operate without human involvement. The main advantage of this app is easy access. Also, security became an essential component in day to day life. Information theft, lack of security and violation of privacy etc. are the essential components which are needed to be protected. Using smart secure systems for door lock and unlocking became popular nowadays. This is system is being adapted by many countries and first grade countries such as USA, Japan etc. already makes use of this system. This system provides a facial recognition security feature to unlock the door.

4.5. Cost Analysis

Table 4.1 shows the cost analysis of the project. We have chosen ESP 32 Cam in spite of Raspberry Pi Cam to minimize cost of the project.

TABLE: 4.1 COST ANALYSIS OF THE PROJECT.

Equipment	Quantity	Price (Taka)
Arduino Uno	1	1200
ESP 8266 WiFi Module	1	200
ESP 32 CAM	1	800
LCD Display	1	300
Relay	1	50
AC Load	2	200
12 V DC Door Lock	1	850
PCB circuit	1	100
Total		**3700 Taka**

Chapter 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

In this Thesis, we have introduced the event of a home management and security system exploitation using Raspberry pi cam and Internet of Things technology. The system is suitable for real-time home safety monitoring and for remotely controlling the home appliances and protection from fire accidents with immediate solutions. The system may be employed in any places like banks, hospitals, and labs etc. that dramatically cut back the hazard of unauthorized entry. Proof may be given to the safety department if any theft issue happens.

5.2 Limitation

We have tried to make a Door lock security system with ESP 32 Cam for low costing. But we have faced some complexity with it as it has less efficiency in face recognition. Hence we have used Raspberry Pi Cam Instead of ESP 32 Cam.

5.3 Future work

The various future applications may be used by controlling various household devices of house with internet, Industrial automation and management through internet, machine-driven fireplace exit systems and improvement of security problems in extremely restricted areas.

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APPENDIX

Microcontroller Code of the proposed model

```
#define BLYNK_TEMPLATE_ID "TMPLjZMZzgju"
#define BLYNK_DEVICE_NAME "Home Sicurity"
#define BLYNK_AUTH_TOKEN "mhCHQkooQiJOJXsr0uiM4SX5VuM_JDYY"

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "RedmiNote7";  // type your wifi name
char pass[] = "245025245025";  // type your wifi password

#define RelayPin1 5  //D1
#define RelayPin2 4  //D2
#define doorLock 2   //D4
#define pirPin 14    //D5
#define VPIN_BUTTON_1    V1
#define VPIN_BUTTON_2    V2
#define VPIN_BUTTON_3    V3
#define VPIN_BUTTON_4    V4

BlynkTimer timer;

BLYNK_CONNECTED() {
  // Request the latest state from the server
  Blynk.syncVirtual(VPIN_BUTTON_1);
  Blynk.syncVirtual(VPIN_BUTTON_2);
  Blynk.syncVirtual(VPIN_BUTTON_4);
}

BLYNK_WRITE(VPIN_BUTTON_1) {
  int State = param.asInt();
  digitalWrite(RelayPin1,State);
```

```
}

BLYNK_WRITE(VPIN_BUTTON_2) {
  int State = param.asInt();
  digitalWrite(RelayPin2,State);
}

BLYNK_WRITE(VPIN_BUTTON_4) {
  int State = param.asInt();
  digitalWrite(doorLock,State);
}

void sendSensor(){
int value=digitalRead(pirPin);
Blynk.virtualWrite(VPIN_BUTTON_3,value);
}

void setup(){
  Serial.begin(115200);
  pinMode(RelayPin1, OUTPUT);
  pinMode(RelayPin2, OUTPUT);
  pinMode(doorLock, OUTPUT);
  pinMode(pirPin,INPUT);
  digitalWrite(RelayPin1, HIGH);
  digitalWrite(RelayPin2, HIGH);
  digitalWrite(doorLock, HIGH);
  Blynk.begin(auth, ssid, pass);
  Blynk.virtualWrite(VPIN_BUTTON_1, LOW);
  Blynk.virtualWrite(VPIN_BUTTON_2, LOW);
  Blynk.virtualWrite(VPIN_BUTTON_3, LOW);
  Blynk.virtualWrite(VPIN_BUTTON_4, LOW);
  timer.setInterval(2000L, sendSensor);
}

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