

# **AI Based Multifunctional Robot**

## **A Project Report**

Submitted in partial fulfilment of the  
Requirement for the award of degree of the  
**MASTER OF SCIENCE (INFORMATION TECHNOLOGY)**

By  
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Under the esteemed guidance of  
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**2022-2023**

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**CERTIFICATE**

This is to certify that the project entitled, " **AI Based Multifunctional Robot** ", is bonafied work of **Ms. Ankita Mukund Panpatil** bearing Seat.No: **3269943** submitted in partial fulfilment of their requirements for the award of degree of **MASTER OF SCIENCE IN INFORMATION TECHNOLOGY** from **University of Mumbai**.

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**External Examiner**

**Date:**

**College Seal**

## **ABSTRACT**

In this Project, we will learn how to do programming in Arduino. How to take digital, analog, and serial inputs and where to store them? All questions will answer in this project. Where can we write comments? We can write comments in starting, ending, or in between programming. Comments starts with // or /\* and \*/. They do not affect code.

**Operators :** An operator is a symbol that tells the compiler to perform specific mathematical or logical functions. Every operator is explained in a project.

**Variables :** A variable is a place to store a piece of data. It has a name, a value, and a type. There are three types of variables: Boolean, Integer, Character. How to define them? Watch the project to learn how to declare variables in Arduino.

After declaring, see how you can assign variables in Boolean, integer, and character variable. Where you are declaring variables is very important. Now, what is Setup? The setup() function is called when a sketch starts. Use it to initialize variables, pin modes, start using libraries, etc. The setup() function will only run once, after each power-up or reset of the Arduino board. See in the video how you can do every operation stated above, like how to pull up and pull down resistors, etc. In programming, the 'IFs statement' is mostly used. We can use the Variation of 'Ifs' like conditional ifs, action ifs, and 'else'. When you want repetition in a program, loops are used. A void loop is an example of loops where the bulk of your Arduino sketch is executed. The program starts directly after the opening curly bracket ( { ), runs until it sees the closing curly bracket ( } ), and jumps back up to the first line in loop(), and starts all over.

You can also use 'for loop' for repetition. It is often used in combination with arrays to operate on collections of data/pins. After that, 'while loop' also performs a repetitive task in Arduino. A "While" Loop is used to repeat a specific block of code an unknown number of times until a condition is met. So using all statements and loops, you can do programming in Arduino.

## **ACKNOWLEDGEMENT**

It gives me great pleasure to present this project report on "**AI Based Multifunctional Robot**". It's a great pleasure and moment of immense satisfaction for me to express my profound gratitude to my Project Guide, **Ms. Darshana Wajekar** whose constant encouragement enabled me to work enthusiastically. Her perpetual motivation, patience and excellent expertise in discussion during progress of the project report work have benefited me to an extent, which is beyond expression. I am highly indebted to his invaluable guidance and ever-ready support in the successful completion of this project report in time. Working under his guidance has been a fruitful and unforgettable experience.

I would like to thank all people who contributed to the successful completion of the project. I would like to thank our principal **Dr. Lata Menon** & Department Coordinator **Ms. Ashwini Khillari** for their support.

I would also like to thank entire Information Technology department of **Pillai H.O.C College of Arts, Science & Commerce** and all Library staffs for their corporation, which helped me to complete this project report.

Last but not the least I would also wish to thank all teaching and non-teaching staff and my friends; it is really impossible to repay the debt of all people who have directly or indirectly helped me for performing the project.

**Ankita Mukund Panpatil**

## PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

PRN No : .....

Seat No. : .....

1. Name of the Student

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4. Teaching experience of the Guide .....

5. Is this your first submission? Yes ☐ No ☐

1 .....

.....

Signature of the Student

Signature of the Guide

Date: .....

Date: .....

Signature of the Coordinator

Date: .....

# **DECLARATION**

I hereby declare that the project entitled, “**AI Based Multifunctional Robot**” done at **Pillai HOC College of Arts, Science & Commerce**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfilment of the requirements for the award of degree of **MASTER OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

**Ankita Mukund Panpatil**

**Your Name and Signature**

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# **Chapter 1**

## **INTRODUCTION**

Robotics is a branch of engineering that deals with the design, construction, operation, and application of robots. Robotics can be found in many different fields of study including manufacturing, electronics and computer science. The word robot comes from the Czech word robota meaning servitude or drudgery. The first use of the term "robot" was in Karel Čapek's play R.U.R., which introduced the word to the world in 1920.

Robots can be classified as either general-purpose or specialized. A general-purpose robot may perform a wide variety of tasks while a specialized robot may perform only one type of task. A robot may be constructed to take on human form in order to interact with humans, and these are called humanoid robots. The word robotics was coined in 1954 by science fiction author Isaac Asimov and comes from the word "robot," which was introduced to the public by Czech writer Karel Čapek in his play "R.U.R." (Rossum's Universal Robots).

Robotics is a fast-growing field with many applications in various industries. Robots can be classified into three main categories: industrial robots, service robots, and personal robots. Industrial robots are typically large machines that perform heavy duty tasks like welding or painting. Service robots are designed to perform tasks like delivering packages or providing customer service. Personal robots are designed for personal use and usually have some form of artificial intelligence (AI). Industrial Robots: Industrial Robots are machines built to do specific tasks on an assembly line or in a warehouse environment such as picking up objects from one location and placing them at another location.

### **1. What is a robot?**

A robot is an automatically guided machine capable of making decisions required to do a task, by monitoring, navigating through and manipulating its environment.

### **2. History of Robotics**

The word Robot is derived from a Czech word Robota' which means 'forced labor or a slave'.

### **3. Asimov's Laws**

#### **Asimov's Three Laws of Robotics:**

- A robot may not injure a human being or through inaction, allow a human being to come to harm.
- A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law.

- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

### 4. Algorithm

Algorithm is a list of instructions that can be encoded in a given programming language.

### 1.1 Background

Robots are becoming more and more sophisticated in their functions. The earliest robots were created in the early 1950s by George C. Devol, an inventor from Louisville, Kentucky. The first robot was a 10-inch tall machine with a TV camera, a video monitor and some wheels. It was able to move around on the floor and avoid obstacles while scanning its environment. The first industrial robot was installed on the General Motor assembly line in 1961 to lift hot pieces of metal from a die casting machine, which had previously been done by hand.

#### Features:

- Using Serial Communication
- Interfacing obstacle sensor
- Wall Following Robot
- Interfacing Light Sensor
- Hand Following Robot
- Internet Controlled Robot
- Email talking Robot
- Facebook connected Robot

### 1.2 Objective

Robots have been a part of our lives for a while now. They are now evolving and becoming more capable than ever before. They can do things that humans can't, like working in hazardous environments or handling delicate objects.

Robots eliminate dangerous jobs for humans because they are capable of working in hazardous environments. They can handle life-threatening situations, like the ones at Fukushima nuclear plant after the 2011 tsunami. Robots also render jobs such as welding, painting, and handling radioactive material safer for humans by performing these tasks remotely or in isolation chambers.

## **1.3 Scope, Purpose and Applicability**

### **1.3.1 Scope:**

Programmers work in a virtual world, while machinery works in the physical world. Now to combine both of these worlds, the microcontroller comes in to picture. A microcontroller is a kind of chip in which we upload program. It is a small-scale computer with generalized inputs & outputs. You can say a microcontroller is one type of CPU. In this, microprocessor, RAM, and program memory exist. In the program, memory code is stored, and in RAM, inputs are stored. All these components combined in a system, which is known as 'Embedded System.' So, in an embedded system, the software is loaded into a hardware device.

Types of Arduino are classified based on the number of pins, size, processor it has. Like: Leonardo, micro, mega, uno, etc., let's talk about Arduino UNO. It is the first Arduino. Its detailed explanation is available in the video. You can see how many different pins come with it. Every pin's work is described in the video.

### **1.3.2 Purpose:**

Robots have changed the way we do things. They can do tasks that humans cannot or would find too dangerous to do such as working in hazardous environments like nuclear power plants. They can also work for hours on end without a break which is not something humans can do. The goal of introducing robots into your home is to free up your time, by delegating unpleasant tasks to someone, or some-bot, that can do it for you. Some of the most popular, and successful, examples are iRobot's Roomba, which vacuum your floors, and Amazon's Echo, which can perform simple tasks like turning on the light or listening to music. If you've ever considered installing one of these products in your home, you've probably wondered how much it would cost to keep one of these robots running. This article will explore the costs associated with running Roomba, and other popular robot vacuum models.

### **1.3.3 Applicability:**

The first step in the manufacturing process is the initial shaping of the material. This is commonly referred to as mechanical editing or milling. The material is cut, ground, deburred and polished to get the material into the shape required for the final product. This process is used for all materials, including plastics and metals, and allows for complex geometries that would be impossible to achieve with other methods.

Today, machine shops are faced with a challenge. They need to ensure that every part they produce meets or exceeds their high quality standards and that their customers receive their parts on time. One way to ensure that your machine shop continues to meet your high standards is to invest in mechanical cutting, grinding, deburring and polishing equipment. This

equipment can be used to remove excess material from a part and provide a smooth finish on both small and large parts.

### 1.4 Organization of Project Report

The report is composed of the following sections:

#### Chapter 1: Introduction

This chapter gives a short summary and outlines the objectives of the project.

#### Chapter 2: Survey of Technologies

This chapter explains the comparison between the technologies used in this project.

#### Chapter 3: Requirements and Analysis

This chapter contains the details about what are the basic requirements for the project implementation.

#### Chapter 4: System Design

This chapter presents different UML diagrams of an implemented system like Data flow Diagram, Use case Diagram, Sequence Diagram, Class diagram, Activity Diagram and Entity Relationship Diagram.

#### Chapter 5: Conclusion

This chapter presents the actual implementation of the project.

### 1.5 Conclusion

In this chapter we have studied about what this project is, in short. Introduction to this project that is what is the purpose, scope, applicability and introduction to the project is given.

Robots are machines that perform tasks without human supervision. They are becoming more common in factories, warehouses, and laboratories. They are used to perform tasks that are difficult or dangerous for humans, such as cleaning, packaging, or moving objects. They are also used in entertainment, such as playing music or dancing. Today, robots are used for a variety of purposes. Some are used in industries, such as factories and warehouses. Others are used in laboratories, such as to help scientists study cells. Most robots work for people, performing jobs such as delivering packages or cleaning.

## Chapter 2

# SURVEY OF TECHNOLOGIES

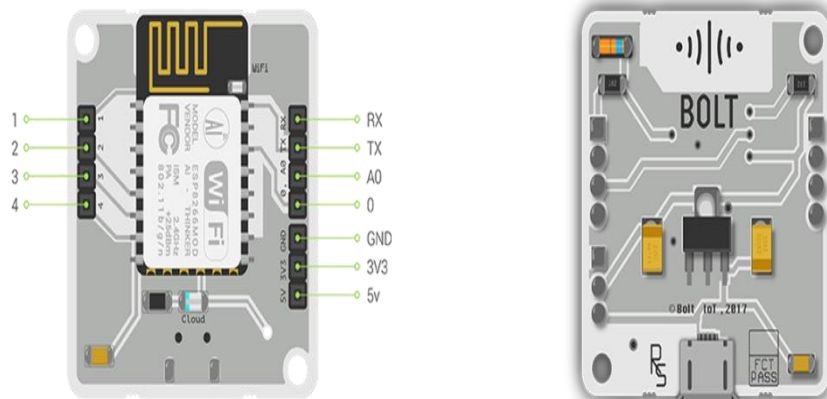
## 2.1 Description of comparative study of different technologies

### Bolt IoT Bolt WiFi Module

Application of Internet of Things is an emerging domain, which makes common objects to connected objects. In recent few years Internet of Things is making its way into industry applications. In this project Bolt IoT kit based system is planned to real time control the basic appliances in Industry. This system provides real time access of basic industry appliances such as Fans, Tube Lights etc .

Bolt IoT kit has in built microcontroller having input and output ports. The output port is connected to the relay which further gets connected to targeted appliances . Bolt IoT kit connected to internet via Inbuilt WiFi module. With the help of Bolt Cloud Service the webpage is created in Python language and accordingly the current status of appliances is shown there. With the help of Graphical User Interface one can change the ON/OFF condition ,which will trigger the relay and device connected to that relay.

- Our IoT Platform Bolt, enables enterprise and makers to easily and quickly build IoT products. Bolt comes with a WiFi /GSM Chip and a cloud platform which helps the enterprise connect their products to the Internet.
- The chip connects to the cloud out of the box. The Bolt cloud helps users control and monitor the products over the internet, create personalized dashboards to visualise the data, monitor the device health etc.
- With Bolt the companies can build scalable IoT prototypes in just a days time. Bolt Platform takes care of analytics, visualisation, network connectivity, storage, security and scalability, so that the developers can focus on the end application.



**Figure : Bolt IoT Bolt WiFi Module**

### USB-A to Mini-USB Cable

The term USB stands for "Universal Serial Bus". USB cable assemblies are some of the most popular cable types available, used mostly to connect computers to peripheral devices such as cameras, camcorders, printers, scanners, and more.

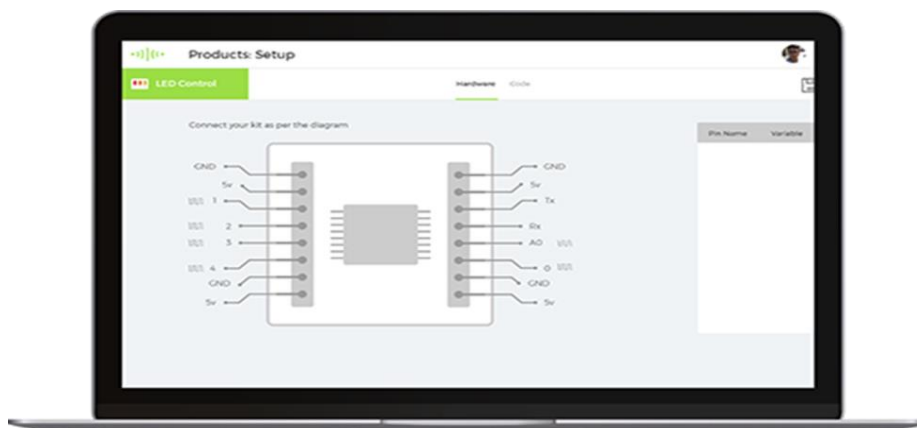
- USB cables are "Hot Pluggable", in other words you can connect and disconnect the cables while the computer is running without fear of freezing the computer.
- USB cables are fast, transferring up to 480Mbps. Compare that to serial communication which transfers data at about 20Kbps.
- USB cables carry power as well as signals. This allows for "USB powered" gadgets as well as recharging batteries in cameras and other USB peripherals.
- USB cables are designed with several distinct connector types, making it easy to identify which plug goes into the computer and which plug goes into the peripheral device.



**Figure : USB-A to Mini-USB Cable**

### IoT cloud

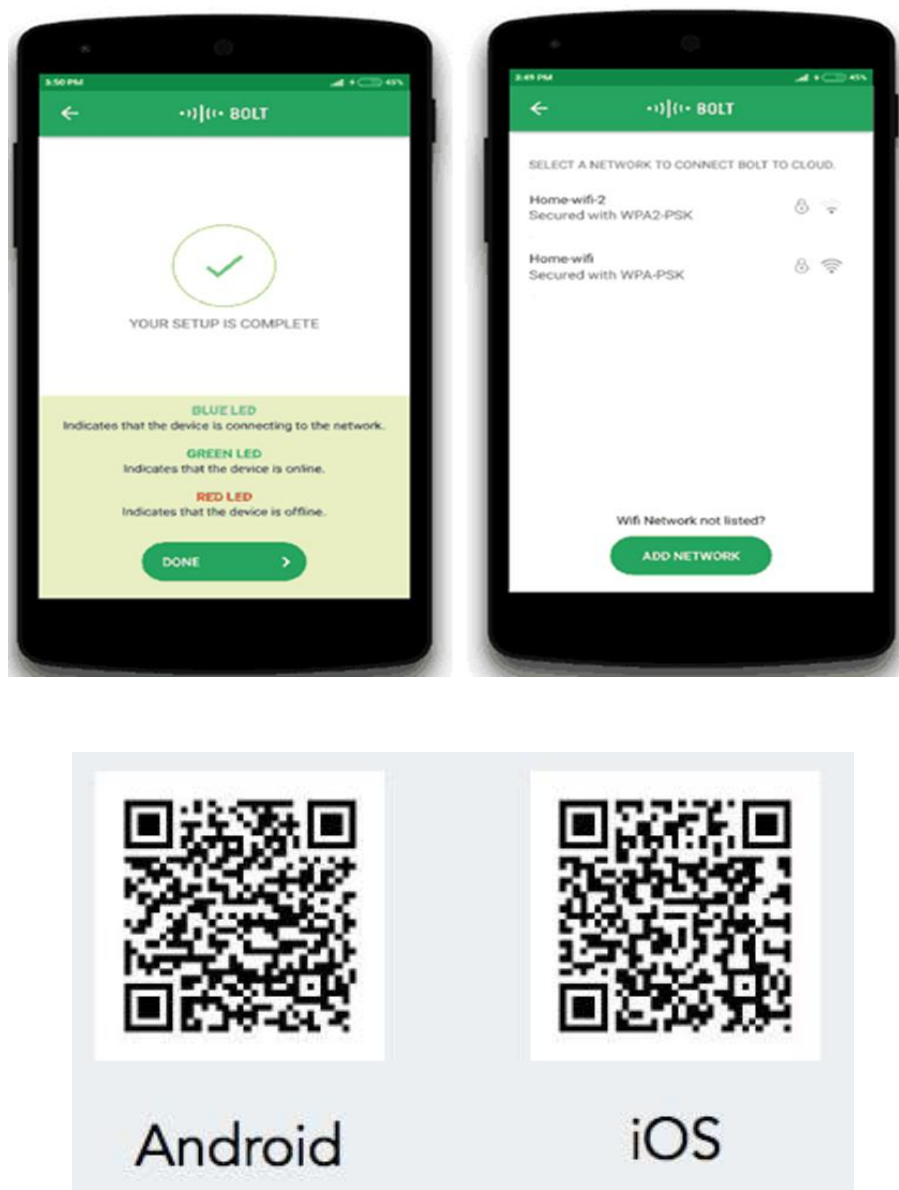
An IoT system requires a hardware as well as a cloud. Bolt cloud is a server which lets you communicate with your Bolt WiFi module over the internet. It offers features like receiving and storing the data collected by Bolt Modules, Storing the data, Analysing it via Data visualisation and Machine Learning as well as it lets your program your Bolt modules.



**Figure : IoT cloud**

### Bolt IoT Mobile App

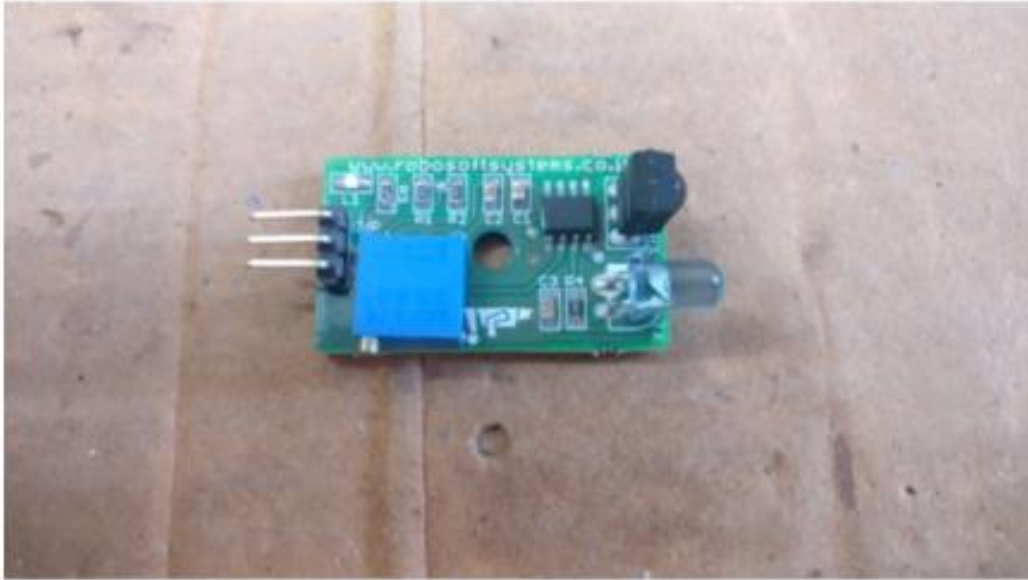
For connecting the Bolt to your cloud account, the Bolt IoT Mobile App is available for download on the Android Play store and iOS App Store. It is not available for other mobile OS such as Windows since the number of users of these Mobile OS is very low. Search for "Bolt IoT" on the App Store. Once you have downloaded the app, use the same username and password that you used for creating your Bolt Cloud account to log in to the app. There aren't any physical On or Off button on the Bolt WiFi Module. To power it on, just plug in the Micro USB Power Adaptor and Blue LED will start blinking showing that it is on. Once you power on the Bolt WiFi Module, it will start its local WiFi Hotspot. You need NOT know the password of this Hotspot. Just open the Bolt IoT mobile app and follow the instructions in the App to set it up.



**Figure : Bolt IoT Mobile App**

**Obstacle sensor**

The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces in the conductor a current of one ampere, the conductor not being the seat of any electromotive force.



**Figure : Obstacle sensor**

**3 pin female to female berge pin connector**

The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces in the conductor a current of one ampere, the conductor not being the seat of any electromotive force.



**Figure : 3 pin female to female berge pin connector**



### **DC power supply**

The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces in the conductor a current of one ampere, the conductor not being the seat of any electromotive force.



**Figure : DC power supply**

### **Double sided tape**

The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces in the conductor a current of one ampere, the conductor not being the seat of any electromotive force.



**Figure : Double sided tape**

### Mechanical components box to place the robot on

The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces in the conductor a current of one ampere, the conductor not being the seat of any electromotive force.



**Figure : Mechanical components box to place the robot on**

### JavaScript

JavaScript is a text-based programming language used both on the client-side and server-side that allows you to make web pages interactive. Where HTML and CSS are languages that give structure and style to web pages, JavaScript gives web pages interactive elements that engage a user.

JavaScript is a programming language commonly used in web development. It was originally developed by Netscape as a means to add dynamic and interactive elements to websites. Like server-side scripting languages, such as PHP and ASP, JavaScript code can be inserted anywhere within the HTML of a webpage.

### IFTTT

Unlike the Bolt Cloud, where you have an API key and you can build API links to control or read from the Bolt WiFi module, different services have different methods to allow you to access their API. The word IFTTT is short for "If this then that", and the service that IFTTT provides can be explained with just that phrase. What IFTTT does for you, is that it provides a standard way to collect data from one service, and then send conditional data to another service. These standard methods are called "recipes" by IFTTT. To provide these recipes for collecting and pushing data to different devices, the engineers at IFTTT have gone through the API of several hundreds of online services, and integrated those APIs with their service, which provide a simple connection to those services to you.

## **2.2 Conclusion**

In this chapter comparison between the technology used in this project and other technologies are shown.

A network is the most critical component of any ICT infrastructure which is live 24x7 and to monitor it through physical human intervention is not feasible when the scale is large. Therefore, the IoT applications for monitoring temperature, motion, fire, uplink status, security can be of great utility for detecting any issue and raising alerts through SMS and email thereby coming to know quickly about the problem occurring on a remote site without delay and then act according to the need. This can also lead to saving in Power by switching off the device remotely when not in use, by Power ON/OFF application.

## Chapter 3

# REQUIREMENT ANALYSIS

### 3.1 Problem Statement

PWM stands for Pulse Width Modulation. Using a digital signal that pretends to be analog is called PWM. Remember, the resulting output will always digital, even when it is PWM. See video for how to define PWM in coding, which pins are for analog output, etc. Learn, duty cycle with a graph and how you can generate delay in a microsecond. You can use PWM in creating an application like a dimmer, speed-controlled motors, etc.

### 3.2 Requirement Specification

Today, we are increasingly talking about creating ‘Smart Homes’. Smart homes can mean different things to different people. A builder might say that he is offering a ‘Smart Home’ to a prospective buyer if the IP video door phone that he is installing can also be viewed over a smart phone. For an architect, a ‘Smart Home’ could be one, where lighting controls that can be activated manually, on a time clock, remotely or from a house- for one room or for the entire house. A system integrator, selling AV systems could say that he has designed a smart home, where the home owner can view any media content stored in the cloud or locally in the home from anywhere in the home.

So who is right? Or rather, what is the correct meaning of a smart home? For me, there is no right or wrong. A Smart home can be one or all of these things. All of the above could comprise what we call Smart Home technology. One thing however should be common. Whatever technology is used to make a smart home should enhance the user and the home owner experience, making life more convenient and enjoyable!

### 3.3 Hardware Requirement

Bolt WiFi Module	3.3V
Obstacle sensor	Check if an obstacle is present
USB Cable	5V
DC power supply	Connect to electricity board
3 pin female to female merge pin connector	Connect to circuit
Double sided tape	stick it to the lower side of the sensor
Mechanical components box	To place the robot on

### **3.4 Software Requirement**

OPERATING SYSTEM	Windows 7 Or Above
TECHNOLOGY	Javascript
BROWSERS	Google Chrome
EDITOR	Cloud.Boltiot.Com , Arduino Sketch
CONTROLLING SOFTWARE	IFTTT Applet

### **3.5 Conclusion**

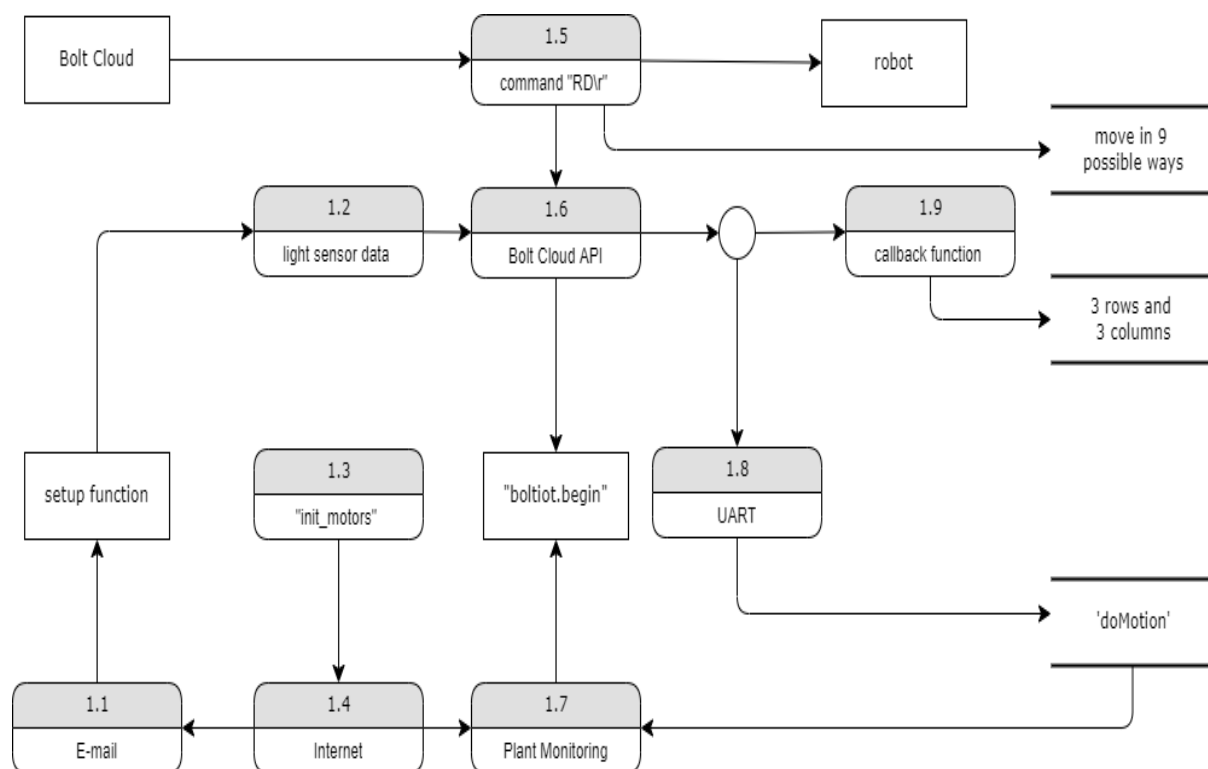
In conclusion, this chapter states the various hardware and software requirements along with the requirement specifications.

## Chapter 4

# SYSTEM DESIGN

### 4.1 Data Flow Diagram:

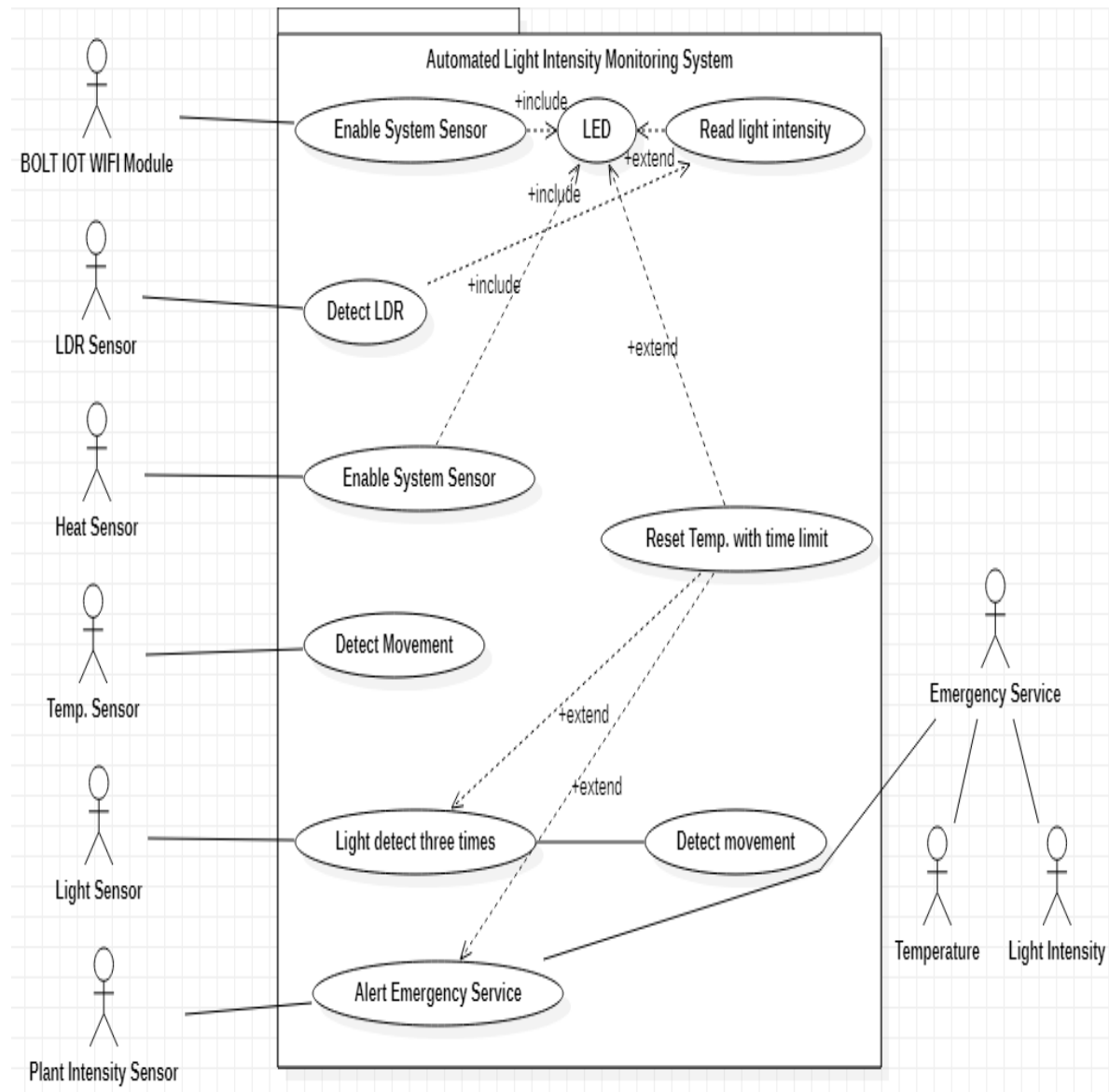
A **Data Flow Diagram (DFD)** is a graphical representation of the "flow" of data through an information system. DFDs can also be used for the visualization of data processing (structured design). Often they are a preliminary step used to create an overview of the system which can later be elaborated. A DFD shows what kinds of information will be input to and output from the system, where the data will come from and go to, and where the data will be stored.



**Figure 4.1 Data Flow Diagram**

## 4.2 Use Case Diagram:

A **Use Case Diagram** in the Unified Modelling Language (UML) is a type of behavioural diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors.

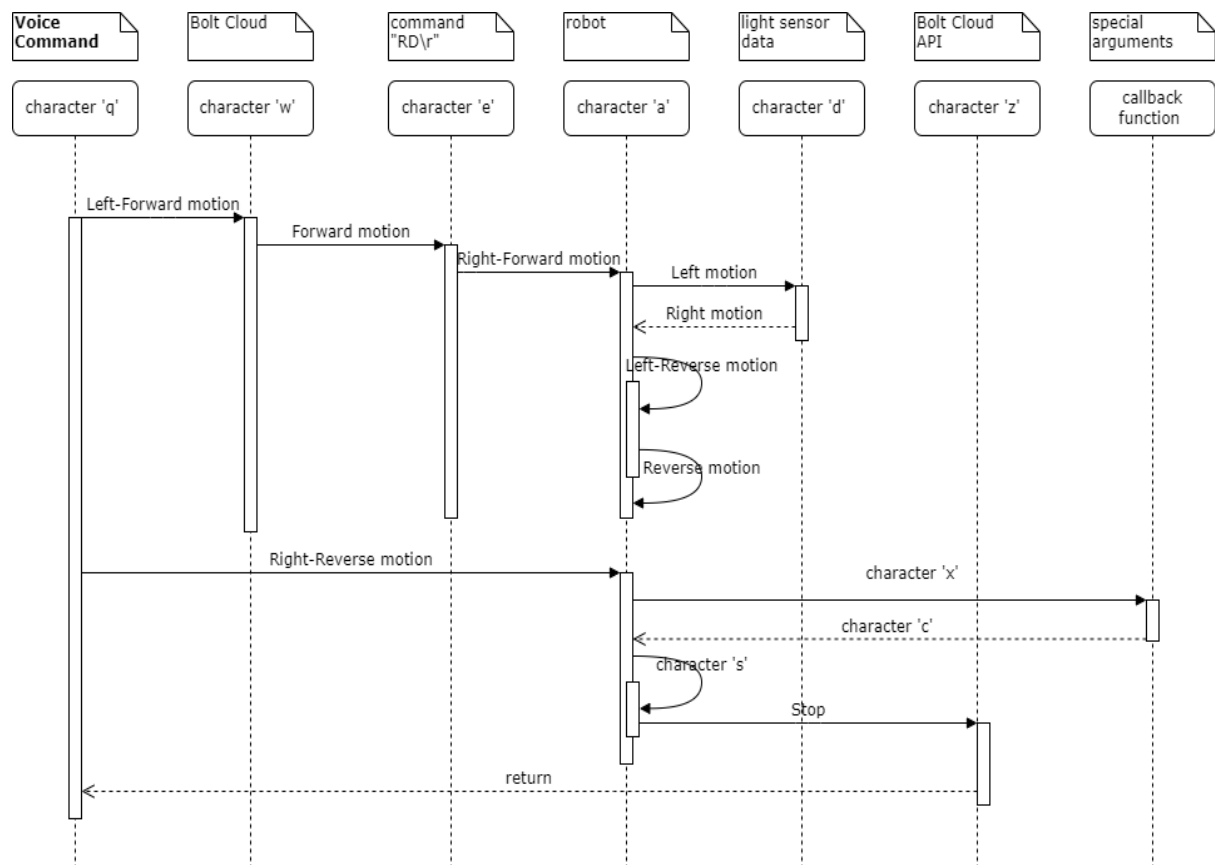


**Figure 4.2 Use Case Diagram**

### 4.3 Sequence Diagram:

A **Sequence Diagram** shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios.

A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

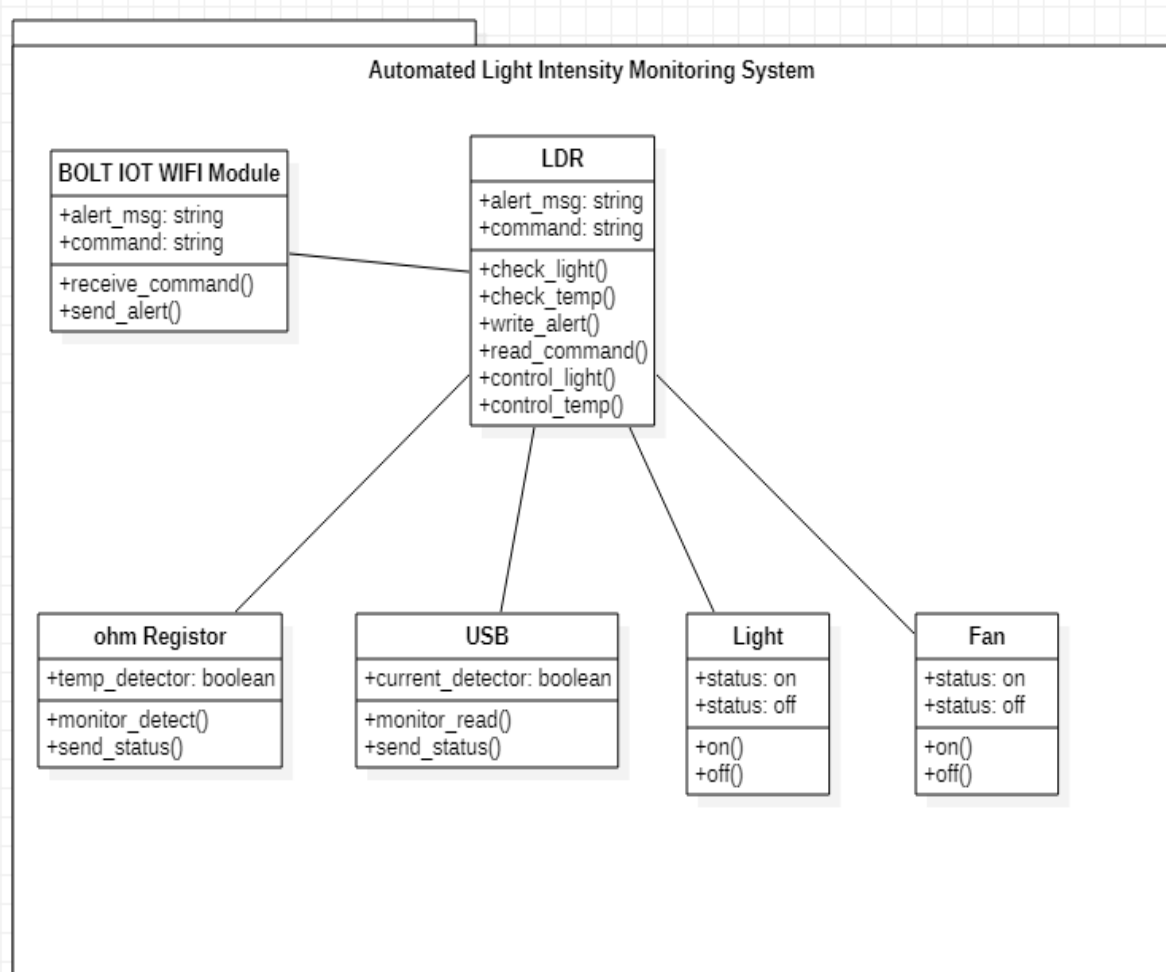


**Figure 4.3 Sequence Diagram**



## 4.4 Class Diagram:

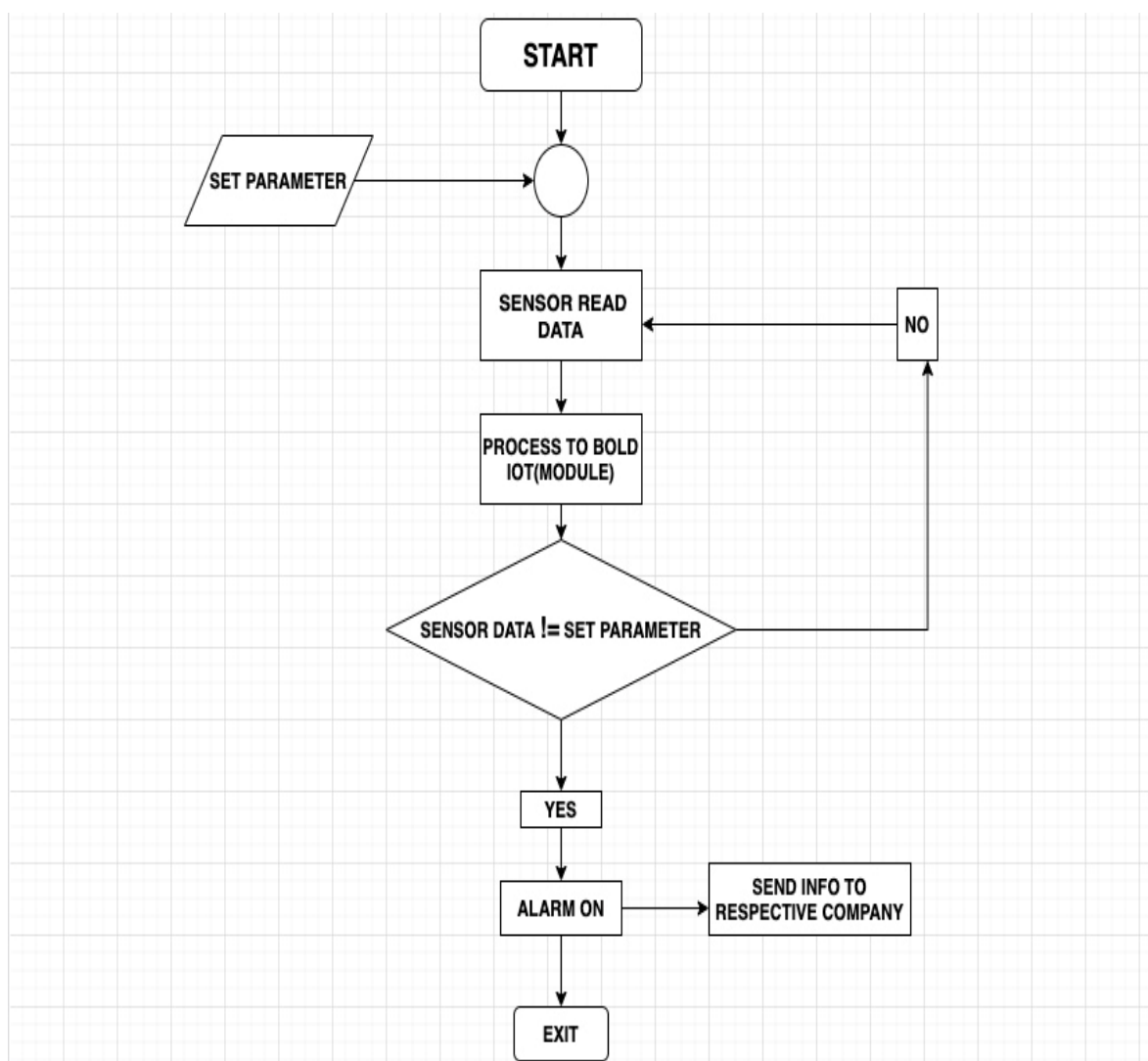
A **Class Diagram** in the Unified Modelling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, and the relationships between the classes. The class diagram is the main building block of object oriented modelling. It is used both for general conceptual modelling of the systematic of the application, and for detailed modelling translating the models into programming code.



**Figure 4.4 Class Diagram**

## 4.5 Activity Diagram:

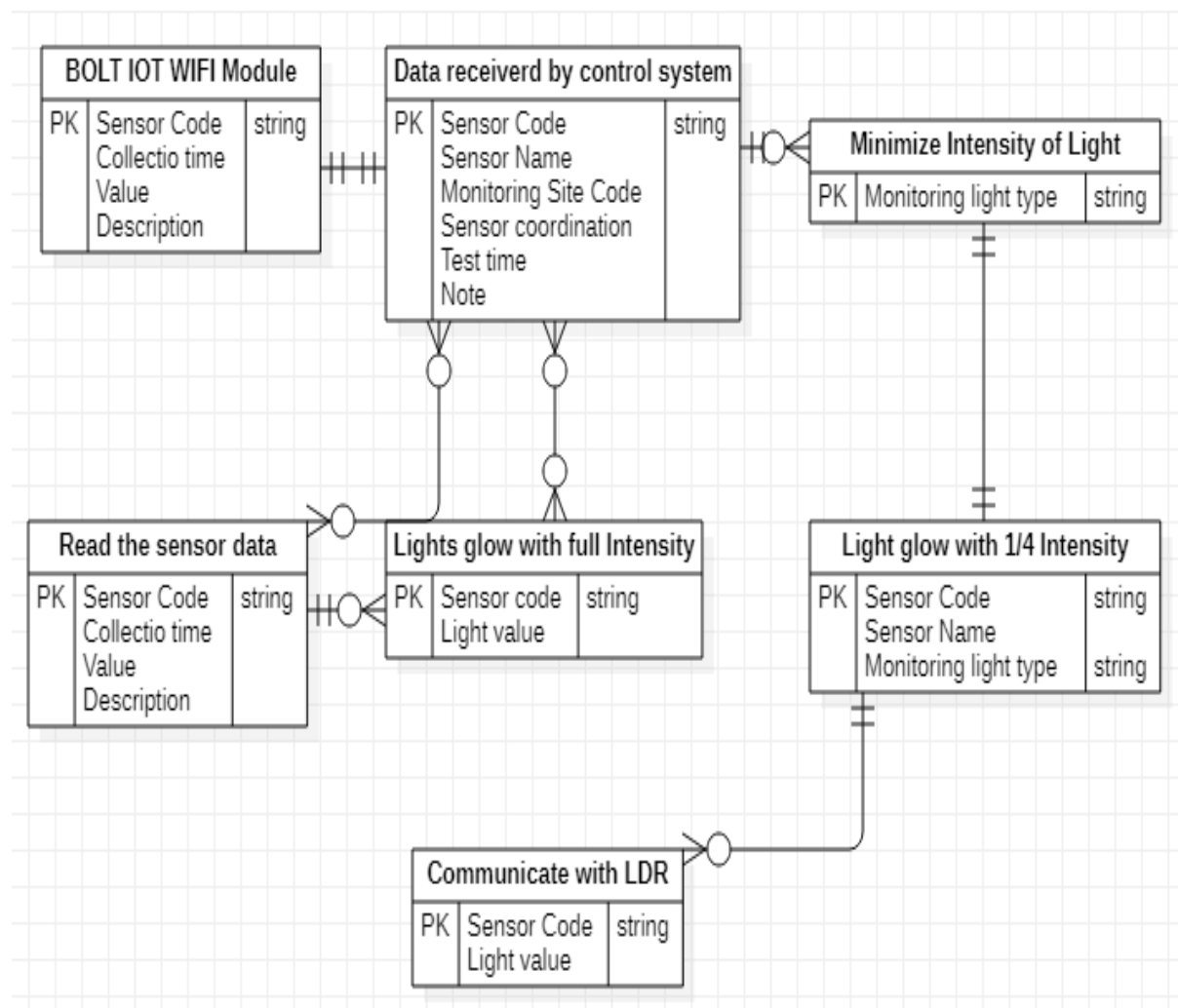
**Activity Diagram** is another important diagram in UML to describe the dynamic aspects of the system. Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent. Activity diagrams deal with all type of flow control by using different elements such as fork, join, etc.



**Figure 4.5 Activity Diagram**

## 4.6 Entity Relationship Diagram:

An **Entity-Relationship Diagram (ERD)** is a data modelling technique that graphically illustrates an information system's entities and the relationships between those entities. An ERD is a conceptual and representational model of data used to represent the entity framework infrastructure. The elements of an ERD are Entities, Relationships and Attributes.



**Figure 4.6 Entity-Relationship (ER) Diagram**

## 4.7 Conclusion

This chapter concludes all the diagrams that defines the process of this project and shows diagrammatical representation of the overall project.

## Chapter 5

# CONCLUSION

### 5.1 Summary of Project

This project is based on the principle that whenever the light falling on the sensor changes, the resistance of sensor changes which is then converted into a change in voltage. The ADC pin on Bolt WiFi Module converted this analog voltage level into digital values which are shown on the graphs.

We will talk about the third type of output that is serial communication or serial output. Serial communication is used for communication between the Arduino board and a computer or other devices. All Arduino boards have at least one serial port (also known as a UART or USART), and some have several ports.

Arduino dedicates pin 0 for receiving information and pin 1 for transferring information. What is the baud rate in communication? The baud rate is the rate at which data is transmitted in a communication channel. In the serial port context, "9600 baud" means that the serial port can transfer a maximum of 9600 bits per second.

This digital data is then sent to the cloud where it is plotted for visual representation.

### 5.2 Learning Experience

It was a great experience to design and implement the **AI Base Multifunctional Robot** by using Javascript and to work on its documentation. While working on this project, I have learned many things especially how to apply to concepts of Javascript into real life problems. It helped me learning working in different environments and increased my interest in this very field.

### 5.3 Future Enhancement

We all know that plants require sunlight for their healthy growth. However, at times we may not be able to keep a track of it or maybe we are not sure if our plants are getting enough sunlight.

In this project, we will build a system so that we could monitor the light our plants get and send the data to Bolt Cloud.

At the end of the project, we will be able to collect the values indicating intensity the of the light and plot them over a line graph.

## Web References

- <https://docs.bolttiot.com/docs/setting-up-the-bolt-wifi-module>
- [https://hackster.imgix.net/uploads/attachments/525577/unbox\\_bXyv68384x.gif?auto=compress&w=680&h=510&fit=max&fm=mp4](https://hackster.imgix.net/uploads/attachments/525577/unbox_bXyv68384x.gif?auto=compress&w=680&h=510&fit=max&fm=mp4)
- <https://youtu.be/7ztf21CNWqE>
- <https://docs.bolttiot.com/docs/so-what-is-bolt-iot>
- <https://www.geeksforgeeks.org/artificial-intelligence-in-robotics/>
- <https://create.arduino.cc/projecthub/Muhammad-sheraz/artificial-intelligence-ai-based-line-following-robot-b20235>
- [https://www.tutorialspoint.com/artificial\\_intelligence/artificial\\_intelligence\\_robotics.htm](https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm)