GREEN HOUSE MANAGEMENT SYSTEM USING IoT

A

Mini Project Report

Submitted

by

Mr. Gaurav Jagtap	**2127071**
Mr. Shreyas Kulkarni	**2127072**
Ms. Muskan Pathan	**2127074**
Mr. Rushikesh Shinde	**2127077**

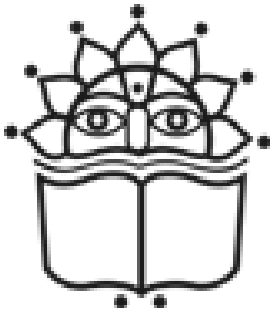
In partial fulfillment for the requirement of Project Based Learning-II

of

Bachelor of Artificial Intelligence and Data Science

Under the guidance of

Rajkumar V. Panchal



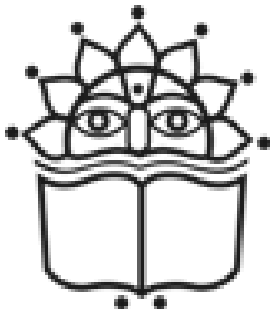
Department of Artificial Intelligence and Data Science

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology

Bhigwan Road, Vidyanagari

Baramati-413133

2021-2022



Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
Department of Artificial Intelligence and Data Science

Certificate

This is to certify that following students

Mr. Gaurav Jagtap	**2127071**
Mr. Shreyas Kulkarni	**2127072**
Ms. Muskan Pathan	**2127074**
Mr. Rushikesh Shinde	**2127077**

have successfully completed their project work on

GREEN HOUSE MANAGEMENT USING IoT

during the academic year **2021-2022** in the partial fulfillment towards the completion of **Project Based Learning-II** in **Artificial Intelligence and Data Science**

Project Guide
(Prof. Rajkumar Panchal)

Head, Deptt. of AI & DS
(Digambar Padulkar)

Principal
(**Dr. R. S. Bichkar**)

Internal Examiner

External Examiner

Contents

1 Synopsis **1**

1.1 Title . . . 1

1.2 Technical keywords . . . 1

1.2.1 **IOT** . . . 1

1.2.2 **AUTOMATION** . . . 1

1.2.3 **ARDUINO** . . . 1

1.2.4 **GREENHOUSE** . . . 1

1.2.5 **FIREBASE** . . . 2

1.3 Problem Statement . . . 2

1.4 Abstract . . . 2

1.5 Goals and objectives . . . 2

2 TECHNICAL KEYWORDS **4**

2.1 Area of project . . . 4

2.2 Technical keywords . . . 5

2.2.1 **IOT** . . . 5

2.2.2 **AUTOMATION** . . . 5

2.2.3 **ARDUINO** . . . 5

2.2.4 **GREENHOUSE** . . . 5

2.2.5 **FIREBASE** . . . 5

3 INTRODUCTION **6**

3.1 Motivation of the project . . . 6

3.2 Literature survey . . . 7

3.2.1 Existing System . . . 7

3.2.2 Proposed system . . . 7

4 PROJECT DEFINITION AND SCOPE **8**

4.1 Problem statement . . . 8

4.2 Goals and objectives . . . 8

4.3 Statements of scope . . . 9

4.4 Methodology . . . 9

4.5 Outcomes . . . 9

4.6 Applications . . . 9
4.7 Constraints . . . 9
4.8 Software hardware resources . . . 10
4.8.1 Software requirements . . . 10
4.8.2 Hardware Requirements . . . 10

5 PROJECT PLAN 11
5.1 Project Estimate . . . 11
5.1.1 Requirements gathering: . . . 11
5.1.2 Design and requirement: . . . 11
5.1.3 Construction/Iteration: . . . 11
5.1.4 Testing: . . . 11
5.1.5 Deployment: . . . 12
5.1.6 Feedback: . . . 12
5.2 Project Resources . . . 12
5.2.1 People: . . . 12
5.2.2 Software Requirement: . . . 12
5.2.3 Hardware Requirement: . . . 12
5.3 Risk Management . . . 12
5.3.1 Risk Identification . . . 12
5.3.2 Risk Analysis . . . 13
5.4 Project Schedule . . . 13
5.4.1 Project Task Set . . . 13
5.4.2 Timeline chart . . . 14
5.5 Team Organization . . . 14
5.5.1 Team Structure . . . 14
5.5.2 Management reporting and communications . . . 14

6 SOFTWARE REQUIREMENT AND SPECIFICATIONS 15
6.1 Introduction . . . 15
6.1.1 Purpose and scope of document . . . 15
6.2 Usage Scenarios . . . 15
6.2.1 Use case view . . . 15

1

Synopsis

1.1 Title

TITLE GREENHOUSE MANAGEMENT SYSTEM USING IOT

1.2 Technical keywords

1.2.1 IOT

The Internet Of Things describes physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the internet or other communication networks.

1.2.2 AUTOMATION

Automation describes a wide range of technologies that reduce human interventions in processes.Human interventions is reduced by predetermining decision criteria,subprocesses relationships and related actions – and embodying those predeterminations in machines.

1.2.3 ARDUINO

Arduino is a single-board microcontroller used for building digital devices and interactive objects that can sense and control the objects in both physical and digital words

1.2.4 GREENHOUSE

A greenhouse can be defined as a closed structure that is used to protect the plants from external factors such as climatic conditions, pollution, etc. Basic factors affecting plant growth are sunlight, the water content in the soil, temperature, humidity, etc. Manual irrigation using buckets, and watering cans, flood irrigation, drip irrigation, sprinkler irrigation is still being used today. The previous system has several limitations; leaching off

soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result in water scarcity in drought areas and production of unhealthy crops.

1.2.5 FIREBASE

Google Firebase is a Google-backed application development software that enables developers to develop iOS, Android. Firebase provides tools for tracking analytics, reporting and fixing app crashes, creating marketing and product experiment.

1.3 Problem Statement

Recent climate change scenario and their effect on the environment have motivated farmers to install greenhouses in their fields. But maintaining a greenhouse and its plantation is very labor-intensive and the majority of them perform vital operations intuitively. Also, agricultural researchers face a shortage of good quality data, which is crucial for crop development. Thus we have developed such a cost-effective system using Internet of Things (IoT) technology which is focused on solving these particular problems, our system automates the greenhouse maintenance operations and monitor the growth conditions inside the greenhouse closely.

1.4 Abstract

Very often farmer or Agriculturists rely upon their gut to figure out the vital operations which can have an adverse effect on their production, here sensor data in the fields or in the greenhouse can help farmers plan an optimum time to carry out the harvesting would then ensure that the crop is ready and the value generated is maximized. Thus agriculture is one of the largest use cases of IoT, besides this selective Irrigation, LIVE monitoring, remote equipment operation and monitoring, predictive analytics for crops and livestock, etc. are other use-cases where IoT is most helpful. Thus we have developed such a cost effective system using Internet of Things (IoT) technology which is focused on solving these particular problems, our system automates the greenhouse maintenance operations and monitor the growth conditions inside the greenhouse closely

1.5 Goals and objectives

The GOAL of greenhouse management system is to simplify the complexity of managing greenhouse's environment, such as temperature, moisture, humidity, sunlight, water irrigation using sensors, network and cloud technologies. Also, it collects data to represent graph by which user can take essential decision and control multiple aspect of system.

The aim of the project is to manage and control the greenhouse system that will remotely control greenhouse environment, using a microcontroller, sensors, cloud-based application which will collect the data like temperature, moisture, humidity, lux from greenhouse. The objective of this project is to implement a low cost, reliable and scalable greenhouse management system that can help to manage factors that affect crop growth. This project work is complete based on electronic sensors which are connected to cloud services and automatically control the components of greenhouse and also collect data and stream data to cloud on user's dashboard.

2

TECHNICAL KEYWORDS

2.1 Area of project

IOT and Arduino based Greenhouse Environment Monitoring and controlling project use four sensors to detect the Temperature, Light, Humidity and Soil moisture in the Greenhouse.Temperature Sensor is used to detect the temperature inside the greenhouse. Reading from the sensor is sent to the microcontroller. The microcontroller is connected to different relays. One of the relays is connected to a blower. If the temperature is above or below the threshold value, the microcontroller would send signals to turn ON the Fan. Light Sensor is used to detect the amount of sunlight inside the greenhouse. Reading from the sensor is sent to the microcontroller. If the Sunlight is above the threshold value, the microcontroller would send signals to turn ON the relay which would, in real-time, be a 'shade' that would reduce the amount of Sunlight. For demo purposes, we have connected a DC motor to replicate a Shade. Similarly, the Humidity sensor is used to detect the humidity value and the Soil moisture sensor (two probes dug in the soil) is used to detect the soil moisture. If the humidity value detected by the sensor is above the threshold value OR if the soil moisture reduces, the microcontroller would turn on the blower to decrease the humidity and will open the water outlet to increase the moisture in the soil. For demo purposes, we have connected a DC motor in place of blower and water outlet.

Our Lifestyle wants everything around us to be operated without any manual interaction. And without any manual interaction for that simply we can say automation. For the automation, Internet of Things (IoT) is the best technology. The IoT is nothing but creating connection of different intelligent and the self-configuring nodes. That all nodes are connected to each other in a network. IoT is a network of devices that are connected to each other, and then they communicate to perform given tasks. And all those tasks are done without any manual inaction i.e., without any human to human or human to computer disturbance.

2.2 Technical keywords

2.2.1 IOT

The Internet Of Things describes physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the internet or other communication networks.

2.2.2 AUTOMATION

Automation describes a wide range of technologies that reduce human interventions in processes.Human interventions is reduced by predetermining decision criteria,subprocesses relationships and related actions – and embodying those predeterminations in machines.

2.2.3 ARDUINO

Arduino is a single board microcontroller used for building digital devices and interactive objects that can sense and control the objects in both physical and digital word.

2.2.4 GREENHOUSE

A greenhouse can be defined as a closed structure that is used to protect the plants from external factors such as climatic conditions, pollution, etc. Basic factors affecting plant growth are sunlight, the water content in the soil, temperature, humidity, etc. Manual irrigation using buckets, and watering cans, flood irrigation, drip irrigation, sprinkler irrigation is still being used today. The previous system has several limitations; leaching off soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result in water scarcity in drought areas and production of unhealthy crops.

2.2.5 FIREBASE

Google Firebase is a Google-backed application development software that enables developers to develop iOS, Android. Firebase provides tools for tracking analytics, reporting and fixing app crashes, creating marketing and product experiment.

3

INTRODUCTION

3.1 Motivation of the project

India is a developing country whose more than 40 percent of peoples do farming. The main source of income for India is agriculture. So, India is an agriculture-based country. And for agriculture water is very important aspect. On earth, there is only 0.5 percent of water is useful for farming. As per the reports, there is lots of water wastage in the earth and it is a very dangerous problem so we have to find solution for smart and efficient way of irrigation. In the fast-moving world, the human requires that everything is done very quick and fast without manual inaction.

A greenhouse can be defined as a closed structure that is used to protect the plants from external factors such as climatic conditions, pollution, etc. Basic factors affecting plant growth are sunlight, the water content in the soil, temperature, humidity, etc. Manual irrigation using buckets, and watering cans, flood irrigation, drip irrigation, sprinkler irrigation is still being used today. The previous system has several limitations; leaching off soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result in water scarcity in drought areas and production of unhealthy crops.

There are some devices are in the market which waters the soil from time to time. They do not sense the moisture inside. This problem can be rectified if we use Monitoring, and Controlling System using the Arduino Platform in which the irrigation, monitoring and controlling will be automated.

As we are aware that India is a developing country and the Agriculture sector contributes to the majority of the economy it is necessary to implement newer technologies in the field of agriculture. Hardship faced by the farmers of this nation Green house management using IoT helps to innovate traditional ways of agriculture. Farmers work endlessly in there fields to produce the desired product even at night they have to leave precious sleep and go in to the field to work our project makes it easy for them to remotely control and monitor there fields.

3.2 Literature survey

3.2.1 Existing System

This system is made up of Arduino microcontrollers. Arduino can receive input from various sensors and it can control motors, lights and other actuators devices. Some sensors, DHT11 sensor, LDR sensor, Soil moisture sensor, and pH sensor is used in this project. The soil moisture sensor is used to measures the water content inside the soil. pH sensor measures the pH of the soil. LDR sensor is used to measure light intensity.

Devices like a DHT11 sensor, LDR sensor, Soil moisture sensor, water pump, artificial light, and servo motor are also connected to the Arduino which help to maintain the to the mobile user, and the mobile user turns on the water pump by sending input. When the temperature comes to the normal range, the mobile user turns off the roofs by sending another input. When humidity exceeds a defined level, the system sends input to the mobile user, and the mobile user turns on the exhaust fan by sending another input. When the humidity comes to the normal range, the mobile user turns off the exhaust fan by sending another input.

When pH of the soil exceeds a defined level, the system sends input to the mobile user, and the mobile user turns on the motor pump which sprays acidic or alkaline solution by sending another input. Similarly, when light intensity is lower than a defined level, the system sends SMS to the mobile user, and the mobile user turns on the artificial lights by sending another input. Finally, when the soil moisture sensor does not sense moisture in the soil than the system sends input to the mobile user, and the mobile user turns on the water pump by sending another input.

To eliminate input charges, all environmental parameters are sending to the server through Ethernet and stored in the database. It has disadvantage that the water pump is going to be operated using Wi-Fi module through mobile, so controlling water pump user should carry his mobile phone, or any other device with internet connectivity.

3.2.2 Proposed system

The proposed system supports water management by sensing soil moisture and controlling the environment inside a greenhouse by measuring the parameters like temperature and humidity. The system continuously monitors the soil moisture and provides an accurate amount of water required to the crop by adding nutrients inside water automatically.

The system can also control the environment inside a greenhouse by sensing the humidity and temperature inside a greenhouse. The system works without any interrupt. It is a Low-cost system and effective with less power consumption and without any manual interaction. Users can monitor the system from a remote location through the website or mobile application. Cameras used to capture live videos of the greenhouse. By using these videos, the user able to see the real condition of the greenhouse and control the greenhouse remotely from any part of the world.

4

PROJECT DEFINITION AND SCOPE

4.1 Problem statement

Recent climate change scenario and their effect on the environment have motivated farmers to install greenhouses in their fields. But maintaining a greenhouse and its plantation is very labor-intensive and the majority of them perform vital operations intuitively. Also, agricultural researchers face a shortage of good quality data, which is crucial for crop development. Thus we have developed such a cost-effective system using Internet of Things (IoT) technology which is focused on solving these particular problems, our system automates the greenhouse maintenance operations and monitor the growth conditions inside the greenhouse closely.

4.2 Goals and objectives

The GOAL of greenhouse management system is to simplify the complexity of managing greenhouse's environment, such as temperature, moisture, humidity, sunlight, water irrigation using sensors, network and cloud technologies. Also, it collects data to represent graph by which user can take essential decision and control multiple aspect of system.

The aim of the project is to manage and control the greenhouse system that will remotely control greenhouse environment, using a microcontroller, sensors, cloud-based application which will collect the data like temperature, moisture, humidity, lux from greenhouse. The objective of this project is to implement a low cost, reliable and scalable greenhouse management system that can help to manage factors that affect crop growth. This project work is complete based on electronic sensors which are connected to cloud services and automatically control the components of greenhouse and also collect data and stream data to cloud on user's dashboard.

4.3 Statements of scope

The proposed system supports water management by sensing soil moisture and controlling the environment inside a greenhouse by measuring the parameters like temperature and humidity. The system continuously monitors the soil moisture and provides an accurate amount of water required to the crop by adding nutrients inside water automatically.

The system can also control the environment inside a greenhouse by sensing the humidity and temperature inside a greenhouse. The system works without any interrupt. It is a Low-cost system and effective with less power consumption and without any manual interaction. Users can monitor the system from a remote location through the website or mobile application. Cameras used to capture live videos of the greenhouse. By using these videos, the user able to see the real condition of the greenhouse and control the greenhouse remotely from any part of the world.

4.4 Methodology

Thus we have developed such a cost effective system using Internet of Things (IoT) technology which is focused on solving these particular problems, our system automates the greenhouse maintenance operations and monitor the growth conditions inside the greenhouse closely.

4.5 Outcomes

- Live to monitoring of fields.
- Detecting the percentage of Greenhouse gases like NH3 (azane), NOx(nitric oxide), alcohol, benzene, smoke, and CO2(carbon dioxide) in the closed environment.
- Water supply is provided by the submersible water pump when required and vice-versa
- Consequently, the greenhouse environment is established in the field.

4.6 Applications

- Farmers can remotely control their fields.
- Real time monitoring of soil moisture, temperature, humidity, light density, Co2 levels in the fields

4.7 Constraints

- A stable internet connection is required

- Electricity is required for the project to function properly.

4.8 Software hardware resources

4.8.1 Software requirements

1. Arduino IDE
2. Browser

4.8.2 Hardware Requirements

1. MKR 1010 WIFI (Micro-controller)
2. DHT 11 (Temperature and humidity sensor)
3. MQ 135 (Air quality sensor)
4. LDR (Light Density Resistor)
5. Soil Moisture Sensor Module
6. Battery
7. DC Motor

5

PROJECT PLAN

5.1 Project Estimate

The meaning of Agile is swift or versatile."Agile process model" refers to a software development approach based on iterative development. Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning. The project scope and requirements are laid down at the beginning of the development process. Plans regarding the number of iterations, the duration and the scope of each iteration are clearly defined in advance.

5.1.1 Requirements gathering:

In this phase, you must define the requirements. You should explain business opportunities and plan the time and effort needed to build the project. Based on this information, you can evaluate technical and economic feasibility.

5.1.2 Design and requirement:

When you have identified the project, work with stakeholders to define requirements. You can use the user flow diagram or the high-level UML diagram to show the work of new features and show how it will apply to your existing system.

5.1.3 Construction/Iteration:

When the team defines the requirements, the work begins. Designers and developers start working on their project, which aims to deploy a working product. The product will undergo various stages of improvement, so it includes simple, minimal functionality.

5.1.4 Testing:

In this phase, the Quality Assurance team examines the product's performance and looks for the bug.

5.1.5 Deployment:

In this phase, the team issues a product for the user's work environment.

5.1.6 Feedback:

After releasing the product, the last step is feedback. In this, the team receives feedback about the product and works through the feedback.

5.2 Project Resources

5.2.1 People:

There are total four people in group.We have divided project work among us.

5.2.2 Software Requirement:

1. Arduino IDE
2. Browser

5.2.3 Hardware Requirement:

1. MKR 1010 WIFI (Micro-controller)
2. DHT 11 (Temperature and humidity sensor)
3. MQ 135 (Air quality sensor)
4. LDR (Light Density Resistor)
5. Soil Moisture Sensor Module
6. Battery
7. DC Motor

5.3 Risk Management

5.3.1 Risk Identification

Risk identification involves brainstorming activities. it also involves the preparation of a risk list. Brainstorming is a group discussion technique where all the stakeholders meet together. this technique produces new ideas and promotes creative thinking.Preparation of risk list involves identification of risks that are occurring continuously in previous software projects.

5.3.2 Risk Analysis

It is a process that consists of the following steps:

1. Identifying the problems causing risk in projects
2. Identifying the probability of occurrence of problem
3. Identifying the impact of problem
4. Assigning values to step 2 and step 3 in the range of 1 to 10
5. Calculate the risk exposure factor which is the product of values of step 2 and step 3
6. Prepare a table consisting of all the values and order risk on the basis of risk exposure factor

Risk Analysis table for our project:

Sr.No	Problem	Probability	Impact	Risk exposure	Priority
1	Issue of internet connection	4	2	4	9
2	Electricity Blackout	2	1	4	10

Table 5.1: Risk Analysis For Green House Management using IoT

5.4 Project Schedule

5.4.1 Project Task Set

Major Tasks in the Project stages are:

- Task1:Topic Sleection
- Task2:Requirement Ghathering
- Task3:Analysis
- Task4:Design and Modeling
- Task5:Coding
- Task6:Testing and Analyzing Project quality
- Task7:Maintences

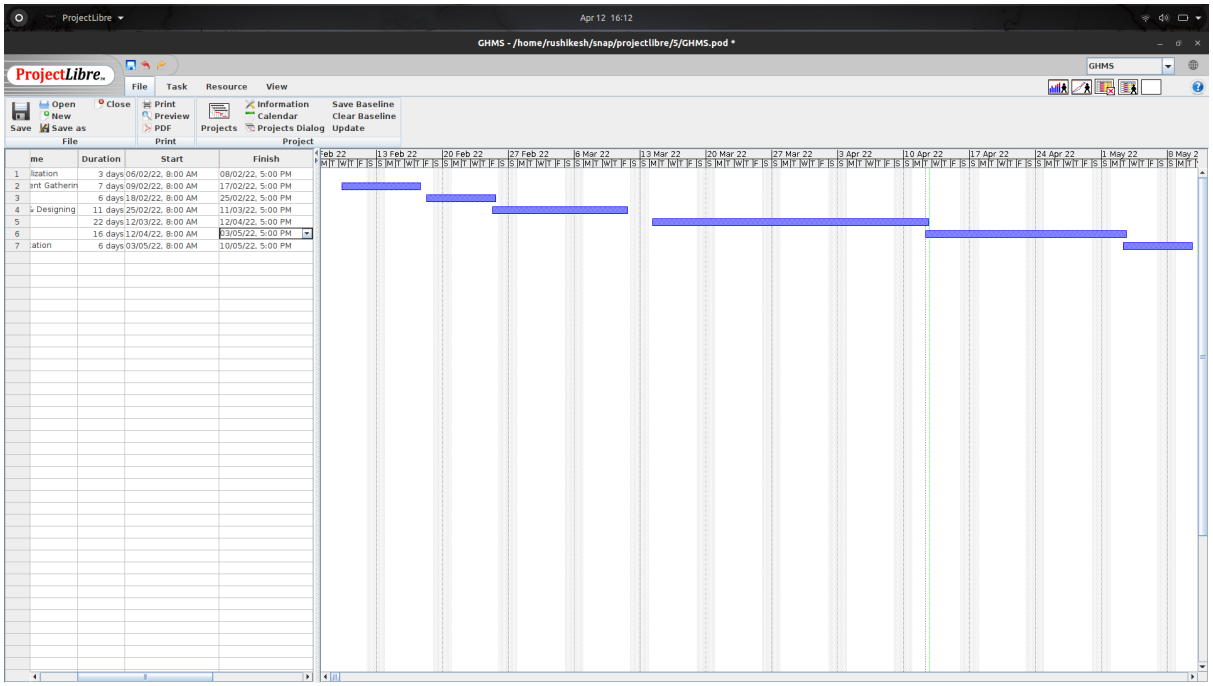


Figure 5.1: PROJECT PLAN.

Sr.No	Name	Task
1	Mr. R. V. Panchal	Project Guide
2	Gaurav Jagtap	Project Design and Management
3	Shreyash Kulkarni	Project Implementation and Monitoring
4	Muskan Pathan	Analyzer And Requirement Gathering
5	Rushikesh Shinde	Project Implementation and Co-ordination

Table 5.2: Team Structure

5.4.2 Timeline chart

5.5 Team Organization

5.5.1 Team Structure

5.5.2 Management reporting and communications

- We used various social media for communications.
- We used Github for all type of resources sharing and for collaborative work amongst for coding and documentation sharing purposes.
- We also used G-Mail for data exchange purpose.
- We maintained communication between by timely updates to each one and timely meetings to know about the progress of our project

6

SOFTWARE REQUIREMENT AND SPECIFICATIONS

6.1 Introduction

A software requirements specification (SRS) is a document that captures complete description about how the system is expected to perform. It is usually signed off at the end of requirements engineering phase.

6.1.1 Purpose and scope of document

The proposed system supports water management by sensing soil moisture and controlling the environment inside a greenhouse by measuring the parameters like temperature and humidity. The system continuously monitors the soil moisture and provides an accurate amount of water required to the crop by adding nutrients inside water automatically.

The system can also control the environment inside a greenhouse by sensing the humidity and temperature inside a greenhouse. The system works without any interrupt. It is a Low-cost system and effective with less power consumption and without any manual interaction. Users can monitor the system from a remote location through the website or mobile application. Cameras used to capture live videos of the greenhouse. By using these videos, the user able to see the real condition of the greenhouse and control the greenhouse remotely from any part of the world.

6.2 Usage Scenarios

6.2.1 Use case view

Use case diagram of the whole system.

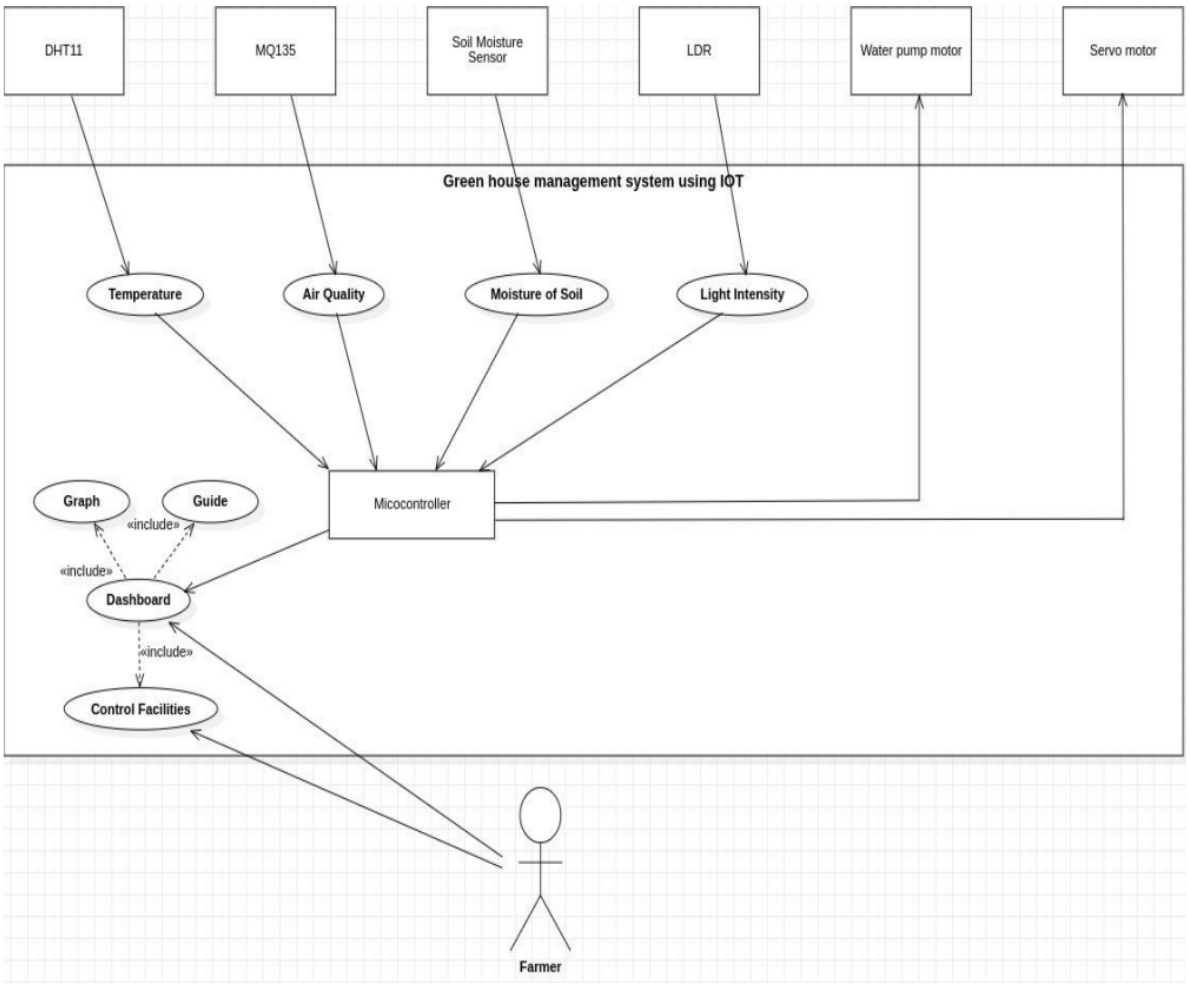


Figure 6.1: USE CASE DIAGRAM-1.

Use case diagram of Guide.

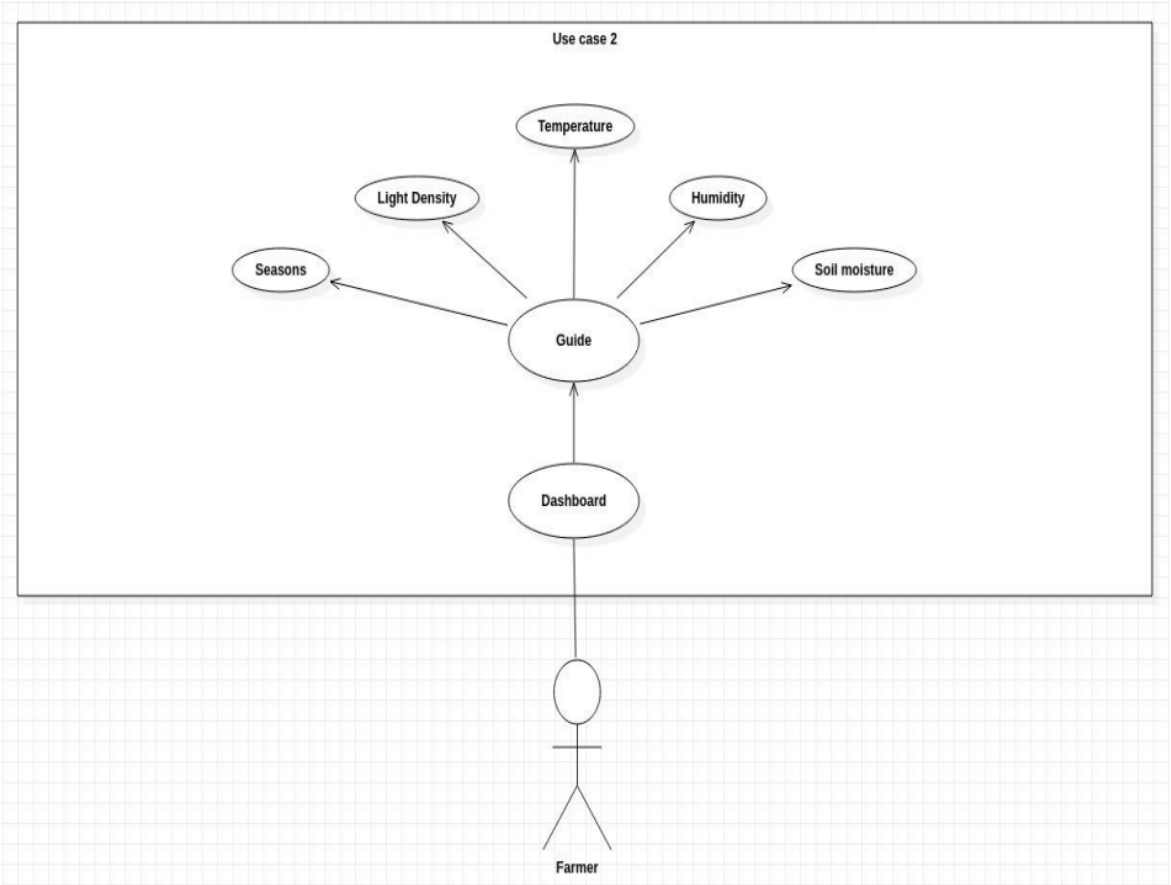


Figure 6.2: USE CASE DIAGRAM-2.