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GREENHOUSE SENSING SATION

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Greenhouse Sensing Station

by

Sharvinessh Ravi

Dissertation submitted in partial fulfilment of

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CERTIFICATION OF APPROVAL

Greenhouse Sensing Station

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A project dissertation submitted to the
Information Technology Programme
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Approved by,

_____

(Saipunidzam Bin Mahamad)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
September 2021

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

SHARVINESSH RAVI

ABSTRACT

Web of Things is one of the main advances of the 21st century. Green house detecting station is fundamentally a framework in which different sensors are utilized for checking different boundaries inside a nursery like temperature, pressure, moistness, soil dampness, pH sensors and so on Green house is fundamentally a spot, or we can call it as a climate where plants like vegetables and blossoms are developed and they are generally covered with glass or "clear plastic rooftops". The reason for this venture is to plan a simple to utilize, simple to introduce and easy to use nursery detecting station to screen and follow the upsides of boundaries like temperature, stickiness, normal daylight, and burning gases which are constantly observed with an expect to enhance them for getting most extreme conceivable plant increment and yield. NodeMCU has been used which has an entirely amazing little microcontroller ready with a built in WIFI module to obtain readings from the sensors. The results can be seen on an Internet website and a built- in app in smart phones. In addition, the owner can also receive notifications through text message or email if any unsuitable environment detected in the greenhouse for the plants. A nursery detecting station is carried out effectively utilizing the idea of Internet of Things which would be so valuable for horticulture area.

ACKNOWLEDGEMENT

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ABBREVIATIONS

1. IOT Internet of Things
2. IDE Integrated Development Environment
3. RAD Rapid Application Development
4. NodeMCU Node MicroController unit
5. GSM Global System for Mobile
6. LDR Light Dependent Resistor

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Greenhouse is a connected thing to a structure or where little plants and vegetables are developed. Furthermore, the region under green house is covered with glass or clear plastic rooftops. Furthermore, this assumes a significant part for the vegetation in colder areas since it is still freezing to take them to an external climate. Furthermore, presently pushing ahead to examine about the nursery impact. Nursery impact is just a cycle in which different ozone harming substances entangles the infrared beams from the daylight subsequently prompting increment of level of carbon dioxide which further aides in expanding the measure of chlorophyll and hence prompting noteworthy plant development and yield.

In the context of global computerization and digitization, traditional agriculture is gradually changing to digital agriculture. Greenhouse cultivation is the main vegetable cultivation method in many areas of our country. Although some modern greenhouses are emerging, traditional greenhouses account for most of the greenhouses used in China. China Since most greenhouses have poor backroom equipment and poor management, farmers must connect all day and work hard in the greenhouse. Wireless sensor network technology is mainly used for environmental monitoring. This work uses a vegetable greenhouse structure to achieve scientific planting and reduce management costs in environmental monitoring. Greenhouse environment analysis is a practical and inexpensive greenhouse monitoring system based on wireless sensor network technology, designed to monitor important environmental parameters such as temperature, humidity, and soil moisture.

Wireless sensor networks are a current technological know-how which integrates the expertise of sensors, automation control, digital community transmission, records storage, and statistics processing. Currently wi-fi sensor community science has been often utilized to environmental monitoring. In this paper, a vegetable greenhouse structure is proposed to gain scientific cultivation and decrease administration charges in the thing of environmental monitoring. According to the evaluation of the elements of greenhouse environment, a sensible and affordable greenhouse monitoring machine is designed primarily based on wireless sensor community science to reveal key environmental parameters such as the temperature, humidity, and soil moisture.

1.2 Problem Statements

In today's greenhouses, many parameter measurements are required to monitor and control for the good quality and productivity of plants which come into play like temperature, light etc. And sometimes what happen, due to the lack of knowledge among farmers, they are not able to perform their activities with accuracy. They usually perform such activities based on their own observation from the past and with their gut feeling which may lead to unexpected results most of the times. Thus, this system is created to perform such activities that is to monitor the system from a particular place which would take care of weather inside the greenhouse.

The system also has the capacity to monitor the condition of greenhouse remotely from cayenne app by using wireless module. All these readings will be transmitted to the NodeMCU, and it will send it to the IOT Cloud. These data can be seen vividly in Cayenne Web and App through online. We could set the triggers in the app to alert the owner if any unsuitable environment detected by the sensors inside greenhouse.

1.3 Objectives

There are several objectives for this project which are:

1. To design a smart greenhouse sensing station with the aid of IOT with a safe environment for plants by collecting data of temperature, humidity, light intensity and detect the combustion gases.
2. To provide monitoring features the plants and notify mishaps in the greenhouse constantly for greater growth of plants.

1.4 Scopes of Study

This project focuses on the development of greenhouse sensing station among the farmers with easy implementation. The venture is to assume a significant part in fate of farming framework and ideally it would be going to help in supporting the effectiveness of development and creation of agribusiness industry. Aside from that a portion of the significant benefits of the proposed framework are it is not difficult to utilize and can acquire more precise outcomes on significant boundaries. Besides, this system will naturally increase the production of plants by escalating its fertility. The concept of this project is monitoring the temperature and humidity by using DHT11 sensor and LDR sensor to monitor the light intensity in the greenhouse. MQ2 is also used to detect combustion gases among the plants in greenhouse. These measurements will be seen in an Internet website and a mobile app through smart phones. In addition, also the venture has an incredible application in agribusiness area and can be utilized in nurseries, professional flowerbeds, and horticulture ranches. Temperature observing activity can be utilized in home or different lobbies like gathering room, workshop lobby to control the temperature of room. With little adjustment, this task can be utilized in Mechanical organizations to quantify different boundaries of working machines like temperature and light.

1.5 Importance of Study

One of the significances of study is to learn in designing a circuit and making PCB circuit using Easy EDA online software. The schematic circuit is created before it converted to PCB layout for the actual circuit developed. Besides, each component used in the circuit can increase understanding of its functions and working principles. For examples, the polarities, input, output, and type of components are learnt during the project. Moreover, this study helps to explore about coding skills using Arduino IDE software. This IDE have produced the user the liberty to program a microcontroller using C language. It connects to the NodeMCU ESP8266 WIFI Module and hardware to upload programs and communicate with them. After that, to create Cayenne Apps to store data collected on the NodeMCU. These data can be further used on websites, mobile applications and anywhere can access the Internet. Another importance is monitoring the sensor data through Cayenne App. This app takes the sensor data from Cayenne Web and send notifications to users in smartphones. Finally, the main importance of this project is to create a safe environment for plants in the sense of temperature, humidity, light intensity, and smoke free to maximize the plant growth and yield.

CHAPTER 2

LITERATURE REVIEW

2.1 Greenhouse

Greenhouse is a structure made of glass that offers adjustable surroundings to develop vegetation productively. In greenhouse gadget, the sun radiation from the solar is absorbed with the aid of using vegetation, soil, and different matters internal the greenhouse, because the glass is lucid [1]. Planning in greenhouse surroundings is a technique in which perfect surroundings is furnished for plants to develop sturdy that during turns improves the best of the plants and complements the overall performance of the farmers [2]. A kingdom of the artwork low fee greenhouse gadget that offer most advantageous environmental situations should lead to first-rate farming productiveness in nations in which there are unfavourable weather situations, infertile land, or some outside hazard of pests. A green and powerful greenhouse tracking and controlling gadget can boom productiveness, can lessen hazard of production, and may offer meals all year spherical with the aid of using preserving the depth of light, the extent of humidity, the extent of temperature and the moisture degree of soil [3].

In today's population, the demand for land and food is huge. People use active farmland to build homes and install household items. The country is shrinking due to the growing demand for food from more and more people. Considering all the worrisome situations, greenhouses can be an alternative solution for growing plants under natural environmental conditions. Some environmental factors are directly related to proper plant growth. Among the various factors, factors such as light, temperature, humidity, and soil moisture are the most important for successful plant nutrition [4].

2.2 Sensor

The sensor framework is a significant component of shrewd farming. In nursery development, particularly in the research centre climate, any worth in an analysis can be critical. Greater part of the current nursery arrangements uses sensors in various phases of cultivating for data gathering, viable observing and dynamic. The fundamental disadvantage of these nursery arrangements is the absence of tangible broadening. In present day logical greenhouse research explores, countless various sensors should be utilized to diminish the chance of deficient exploration results. The huge number of sensors is utilized to decrease the impact factors on various nursery areas and to recognize diverse impact factors in the plant development. Because of the idea of any logical turn of events, it is critical to keep the costs inside as far as possible. Subsequently, trying different things with costly and convoluted sensors might be uneconomical in such tasks. Also, it very well may be trying to apply such a climate to creation offices.

Practically all-natural factors (temperature, mugginess, measure of light in like manner and individual unearthly areas, barometrical pressing factor, and air quality) in the nursery framework can be utilized as detected information. Because of the necessities of the nursery analyse, various kinds of ecological factors should be observed, and subsequently various upsides of sensors should be measured [6].

2.3 Cloud IOT Based Greenhouse Monitoring System

Authors has clarified GSM (Global System for Mobile), distributed computing and Internet of things (IOT) based electronic framework, its plan and execution for detecting the climatic boundaries in the nursery. The framework meets the real farming creation prerequisites and screens an assortment of natural boundaries in nursery adequately. For exhibiting the proposed framework gadgets like temperature sensor, light sensor, relative stickiness sensor and soil dampness sensor are coordinated. The boundaries gathered by an organization of sensors are being logged and put away web based utilizing distributed computing and Internet of Things (IOT) together called as Cloud IOT. Regardless of the proprietor's essence on location, the system gives the proprietor the subtleties on the web. [7]

In current farming nursery development addresses a vital job. A totally modernized nursery control systems close by additional created noticing structure gives clear benefits, for instance, work saving, but verifiably more basically, it enables chipped away at nature of creation and information gathering that will make contrast between getting an advantage and encountering huge adversities. As of late undertakings are on an ascent even in metropolitan regions in special structures. Mechanical advancement causes the farming area to develop high, which here the Cloud IOT makes. The data put away with regards to us and the way we carry on with our regular routines will11 be significantly changed by IOT. As the PC identifies with the Internet this distributed computing is allowed to utilize whenever and anyplace to give the updates this observing framework statutes various boundaries inside the nursery utilizing sensors, GSM, and cloud. [7]

2.4 Microcontroller Based Greenhouse Control Device

Authors has determined in their paper about the Microcontroller based Green House control gadget utilized in the programmed control and checking of Equipment and amounts like screening establishments, warming, cooling, lighting, temperature, soil Moisture level and different amounts/conditions in a Green House, with their powerful observing, subsequently the need of human observing is killed. With a successful component it incorporates and mechanizes the gadgets by turning them ON or OFF in the house additionally it gives suggestions to amendment when the prerequisite happens. The MCU innovation is behind it that can be handily adjusted and once again altered without any problem. The caution circuit is utilized to alarm the Supervisor. This review focuses on deciding the reason and usefulness of nursery control gadget. Inserted nursery observing and control is expected to give an exceptionally itemized miniature environment information for plants inside a nursery climate with another technique for developing moderate harvests in a tropical climate utilizing microclimatic conditions. [8]

The ordinary wired sensors which are in the green house give readings of the air temperature, light force, and supplement arrangement temperature in the blending tank. The expected framework is an installed framework which screens and controls the microclimatic boundaries of a nursery consistently round the12 clock for development of yields or explicit plant species which could augment their creation over the entire harvest development season and to kill the hardships associated with the framework by decreasing human cooperation to the most ideal degree utilizing sensors, Analog to Digital Converter, microcontroller and actuators .When any of the previously mentioned climatic boundaries pass a wellbeing boundary which must be kept up with to secure the harvests, the sensors sense the change and the microcontroller peruses this from the information at its feedback ports in the wake of being changed over to an advanced structure by the ADC. The microcontroller then plays out the required activities by utilizing transfers until the wandered-out boundary has been taken back to its ideal level. Since a microcontroller is utilized as the core of the framework, it makes the set-up minimal expense and powerful, by and by. As the framework likewise utilizes an LCD show for consistently cautioning the client about

the condition inside the nursery, the whole set-up becomes easy to understand. Subsequently, this framework wipes out the downsides of the current set-ups and is planned as a simple to keep up with, adaptable and minimal expense arrangement.

This venture included the carrying out of a nursery control gadget to control, screen and keep up with the ideal temperature in the green house by turning ON the Heater/cooling framework as when due likewise concentrate on the dirt dampness content (when water is required) by turning the water valve ON or OFF. The framework has effectively defeated many inadequacies of the current frameworks by diminishing the power utilization, upkeep, and intricacy, at a decreased expense and simultaneously giving an adaptable and exact type of keeping up with the climate.[8]

2.5 Comparison of Existing Approaches

There are some of the past research studies have been compiled and will be used as reference to recognize the shortcomings that can be improvised in this project.

Table 2.1 Comparison of Existing Approaches

No	Author (s)	Title	Findings	Shortcomings
1	J. Xiao, B. Jiang, and K. J. Ming	An Automated Greenhouse Monitoring and Controlling System using Sensors and Solar Power	• Automated greenhouse • Temperature, humidity,light,soil sensor • Monitor via SMS facility	The Arduino Mega board provides numerous analogue inputs and processes them based on the threshold values specified in the software, causing the relevant components to operate together. All of this is powered by solar energy.

2	Verónica Saiz-Rubio	Smart Farming towards Agriculture 5.0	• Data driven agriculture with robotic solution • Crop data management	One of the most important features of these applications is that they aid in the early detection of weather-related risks, allowing farmers, policymakers, and aid organisations to reduce their risk exposure.
3	Keerthi.v, Dr.G.N.Kodandaramaiah	Cloud IOT Based Greenhouse Monitoring System	• GSM, IOT, Cloud computing for sensing parameter • Temperature, relative humidity, soil and light sensor	They make it possible to increase quality. It is the quality of production and information collecting that will determine whether you make a profit or lose a lot of money.
4	Alausa Dele W.S, KeshinroKazeem Kolawole	Microcontroller Based Green House Control Device	• Microcontroller device • ON/OFF monitor system • Alarm circuit	They provide access to the greenhouse crop for essential pollinators. Ventilation may be performed by the use of recirculation fans and vents,

				which are frequently regulated automatically.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The Rapid Application Development (RAD) primarily based methodology has been chosen as the most appropriate methodology for the Greenhouse Sensing Station project due to the fact it is a small-to-medium scale venture and solely quick period of improvement has been given which is about four months.

Rapid Application Development (RAD) is a technique that gives a faster improvement and better nice gadget compared to the traditional existence cycle This methodology was once chosen due to the fact it is designed in such a way that it may want to take advantage of the effective improvement software program for occasion CASE tools, prototyping equipment and the code generator to pace up the analysis, graph and implementation phases in order to get positive element of the Greenhouse Sensing Station developed swiftly and into the palms of the customers for comparison and feedback.

The remarks from the customers will then reanalyse, redesign, and re-implement a second model of prototype that corrects deficiencies and add greater features. This methodology is very beneficial when the Greenhouse Sensing Station customers have difficulty in expressing their necessities for the gadget due to the fact it ought to rapidly provide a machine for customers to consider and reassures customers that development is being made.

Therefore, prototype-based RAD is the most suitable methodology for the system requirements that are uncertain as it can provide users with collaboration in the early stage of development and a short period of time for Android application development. The Android app is designed to be easy to use for users who want to compare the prices of various domestic courier services and in the meantime might opt for low-cost peer-to-peer and peer-to-peer delivery.

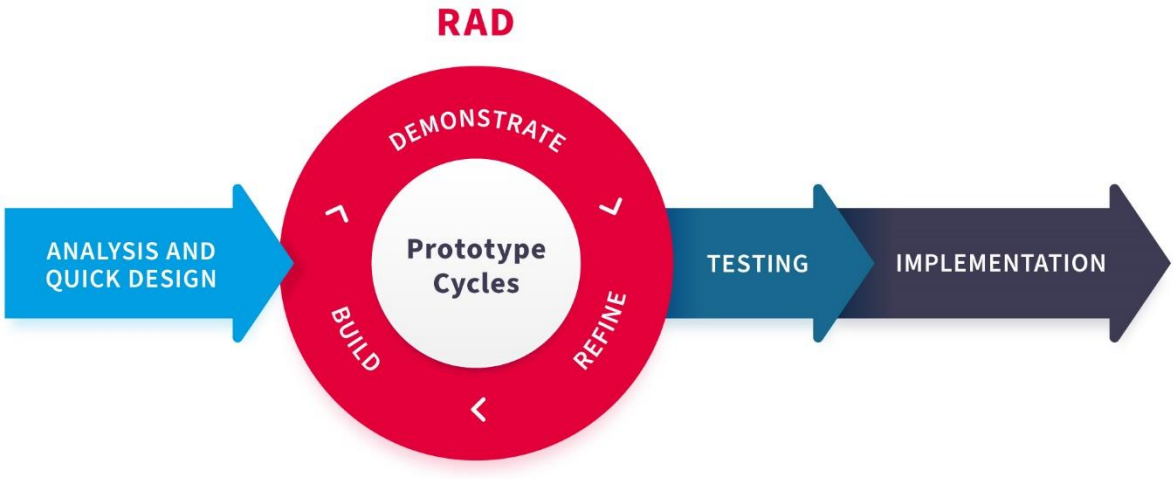

FIGURE 3.1 shows Prototyping- RAD

3.2 Project Phases

3.2.1 Phase 1: Initiation & Planning

The planning phase is the basic process of understanding why the application is built and defining the research problem. The project found a problem: improvisation and implementation measures are needed to provide a monitoring and control system for the greenhouse climate from a specific location; in addition, with the help of the Internet of Things, by collecting temperature, humidity, light intensity, and smoke detection data, design an Intelligent greenhouse testing station in a safe environment. Plants continue to report failures in the greenhouse to promote plant growth.

The project is carried out in two phases: the first phase is data collection and research, which takes 11 weeks, and the second phase is system development, a total 14 weeks. The total number of weeks required for the project must be 25 weeks. About this project, please refer to Appendix A for the Gantt chart and milestones.

3.2.2 Phase 2: Analysis

At this stage, a critical analysis of the literature is carried out to better understand the problems faced by farmers. They cannot carry out activities accurately. They usually carry out these activities based on their own observations of the past. Based on your intuition, this will produce unexpected results in most cases.

After completing the analysis strategy, the next step is to gather requirements. Collect user needs and other data and information through various data collection methods such as interviews, observations, and user tests.

3.2.3 Phase 3: Design

During this period, models and prototypes representing all processes, inputs, and outputs of the system are created; this is a continuous interactive process that enables users to understand, change, and finally verify the working system model that meets their needs. At this stage, develop high-level block diagrams, hardware block diagrams, software block diagrams, and high-level design block diagrams to simulate the system to meet user needs

3.2.4 Phase 4: Implementation

This stage focuses on coding and testing the project, which includes the actual development of the application program, turning the system specification into an executable system, and then testing the project against system requirements. Feedback During the testing phase, feedback is used to re-analyse, re-design and implement a second prototype with different functions, and finally provide it to the end user of the greenhouse inspection station system, and then complete the development cycle.

3.3 Hardware Components

3.3.1 Light Sensor

Figure 3.2 LDR (Light Dependent Resistor) is the light sensor which is normally utilized for the reason. Its fundamental capacity is to screen the power of light. It comes with 2 outputs, digital and analog. We can adjust the threshold (sensitivity) of digital output by tuning the on-board variable resistor (potentiometer).

FIGURE 3.2 Light Dependant Resistor

3.3.2 Temperature Sensor

As the name proposes, these are utilized for observing the temperature and used to check whether the temperature is high or low inside the nursery. A temperature sensor plays an important role in many applications. For example, maintaining a specific temperature is essential for equipment used to fabricate medical drugs, heat liquids, orclean other equipment. For applications like these, the responsiveness and accuracy of the detection circuit can be critical for quality control.

3.3.3 Humidity Sensor

Moistness Sensors are fundamentally utilized for estimating the relative stickiness, which is the proportion of fume air to the aggregate sum of fume that could be held noticeable all around for a given temperature.

3.3.4 DHT11 Sensor

Figure 3.3 DHT11 sensors has been used in this project. It is essentially a dampness and temperature sensors which helps in getting computerized yield. It is very dependable and has great security and simultaneously is practical. It includes three principal components a resistive sort of stickiness sensor, a NTC thermistor (for temperature estimation) and an eight-bit microcontroller which helps in changing over simple signs from the two sensors and helps in conveying computerized signal.

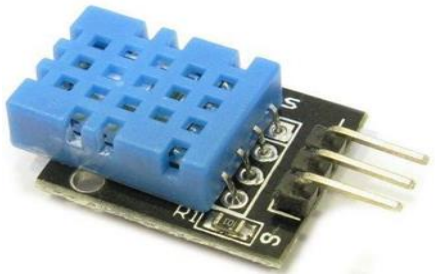

FIGURE 3.3 DHT11 Sensor

3.3.5 Smoke Sensor

Figure 3.4 MQ2 smoke sensor has been utilized in this venture which helps in identifying assuming there is a type of spillage of any gases in the harvest field or might be fire. When the gas is recognized, notice will be sent which helps in alarming individuals and make an important move and safety measure. It chips away at altered rationale. MQ2 smoke sensors has incredible affectability and has speedy reaction time and simultaneously is steady and has long lifetime.

FIGURE 3.3 MQ2 Sensor

3.3.6 Water Pump

Figure 3.5 R385 Water Pump powered by 12V DC power supply and combination between plastic and metal material. Use 90 mm x 40 mm x 35 mm pump size. It also has 1.5~2L / Min (approx) flow rate and it works quietly with the sound level under 30db.

FIGURE 3.4 R358 Water Pump

3.3.7 NodeMCU ESP8266 WIFI Module

Figure 3.6 NodeMCU is an open-source firmware and development kit that helps you to prototype or build IOT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. MCU stands for MicroController Unit - which really means it is a computer on a single chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. They are used to automate automobile engine control, implantable medical devices, remote controls, office machines, appliances, power tools, toys etc. Since NodeMCU is open-source platform, their hardware design is open for edit/modify/build. The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use.

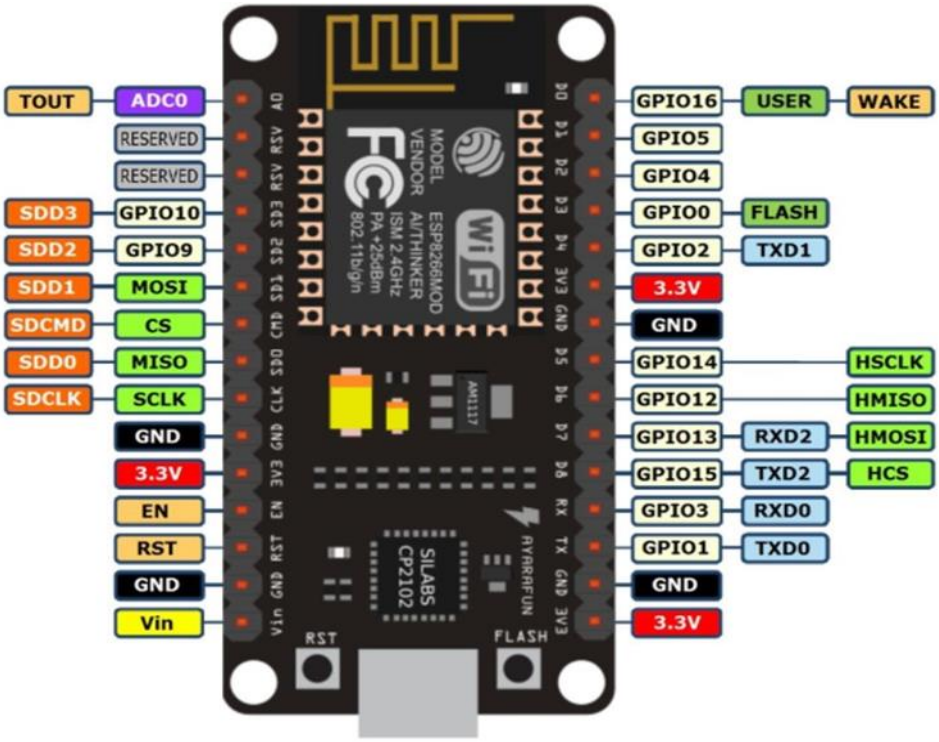

FIGURE 3.5 Node MCU

3.3.8 Relay

Figure 3.7 the relay is an electric switch. It consists of a set of input terminals for one or more control signals and a set of normally open contact terminals. Magnetic locking relays are very useful in applications where you do not want power interruptions to affect the circuits you control.

FIGURE 3.6 Relay

3.4 Software Components

3.4.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. Therefore, in this project Arduino is used to upload the code into the ROM of microcontroller.

FIGURE 3.8 Arduino IDE interface

3.4.3 Cayenne Web and App

Cayenne is an online IOT dashboard that takes most of the complication out of creating hardware-oriented programming. Cayenne is a drag-and-drop programming system for the IOT that really does make it much easier. Cayenne is one of the platforms to view or monitor the data. Although the design in the Cayenne is very creative, it can only view by one person who have their own id and password. Moreover, it allows only one login at one time only. Even though, it has a lot of disadvantages, the feature of notification makes the Cayenne more superior compared to other IOT platform. This is because the Cayenne helps to push the notification to everyone at the same time whenever there are threshold values. Furthermore, it can also set the threshold value at trigger setting without typing any code.

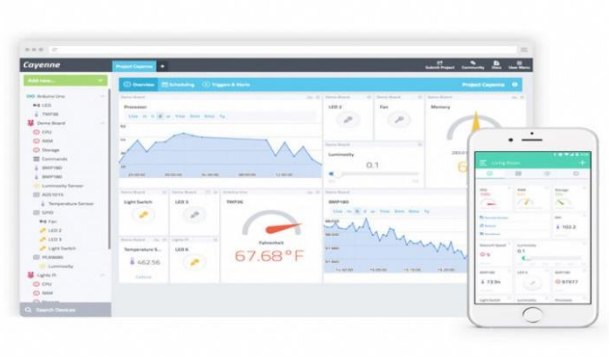

FIGURE 3.9 Cayenne Web and Apps

CHAPTER 4

RESULT AND DISCUSSION

4.1 Pilot Study

4.1.1 Study Setting

This part focuses on how stakeholders view the proposals and ideas behind the system and understand its requirements in detail. The survey results are also attached below, along with a brief description of each. Means to answer, such as WhatsApp, Facebook. The survey received a good response because it received nearly 33 responses.

To conduct the survey, Google Forms was used to construct the survey as it an open source. The survey initially provided a brief description of what the survey should be, and the survey was consistent so that the interviewee could understand the purpose of the survey.

The following is the results of the questionnaire that I have distributed randomly to collect requirements for this proposed project. The responses are made in chart and are attached below for a better view at the statistics that have been obtained:

4.1.2 Survey Outcome

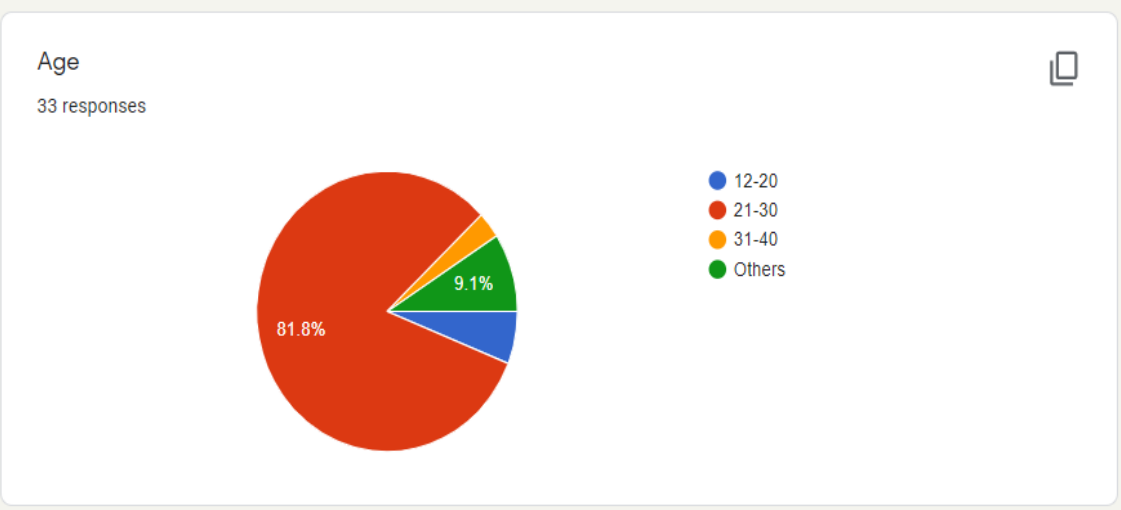

FIGURE 4.1 shows respondent's age

Other than asking for the respondent's name, the subsequent question figure 4.1 is to ask the age range of the respondents, since the respondents are one of the main users or to be affected by this system. From the survey, 81.8% are mostly the age range were between 21-30 which are most likely still studying and working as well. 9.1% can say as the second highest and indicates more to the age whoever more than 40 which can say as also housewives or retired people. The third will teenagers which age range between 12-20 and the least is the age range between 31- 40 who are busy with their working life and family commitments.

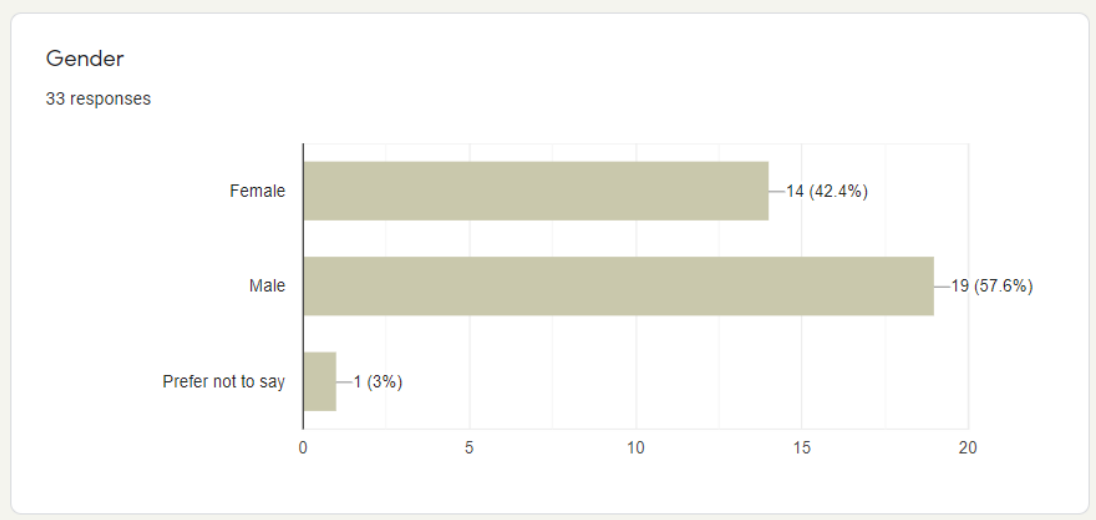

FIGURE 4.2 shows respondent's gender

The next question in figure 4.2 shows respondents gender is to ask a very common question to their gender which can know that males or females more interested to answer this survey. Out of 33 respondents, male represent the majority of 57.6% or 19 respondents to spend their time on answering the survey and more likely interested to see this project to be successful in the future as well. The second highest will be the female represent of 42.4% or 14 respondents to answer the survey and give their ideology for this project as well. Based on the survey for this question can conclude that males are more preferring to be interested in this project rather than female who are busy with their daily lifestyle.

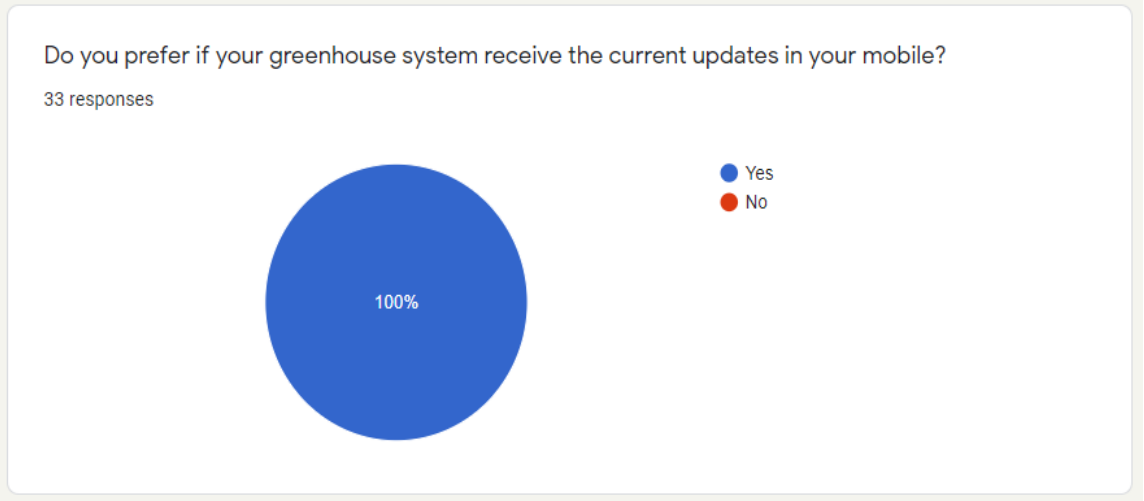

FIGURE 4.3 shows current updates in your mobile

The next question figure 4.3 is to ask if the respondents prefer their greenhouse system receive the current updates in their mobile phones. It is important to ask this question because today's world there are many of them still monitoring manually with their plants and vegetables. From 33 respondents of the survey, majority or can say as all of them have response for yes which they want to monitor their greenhouse through their mobile phones.

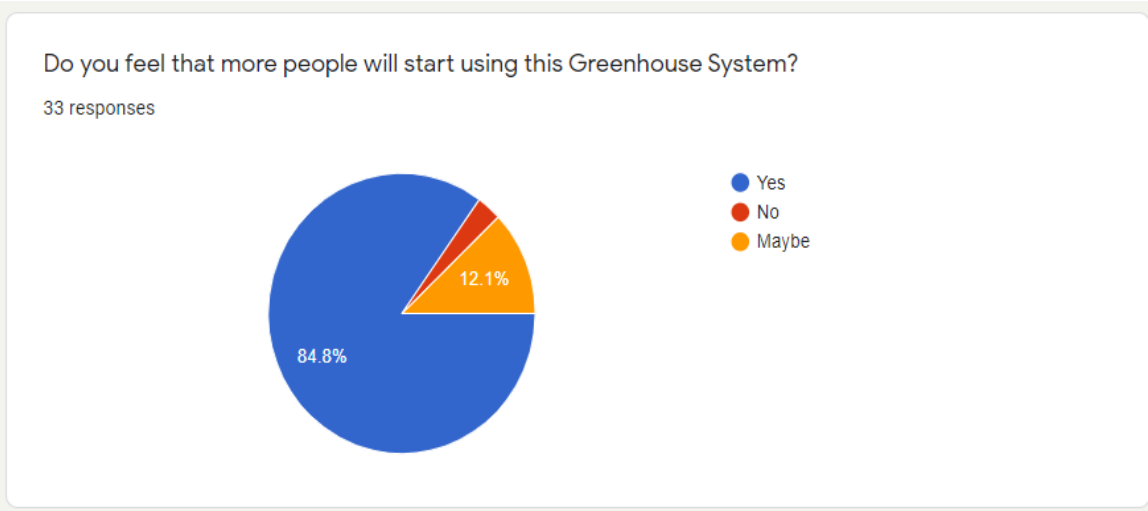

FIGURE 4.4 shows people start using this system

In this question, figure 4.4 the respondents are asked if they feel that more people will start using the Greenhouse System. Greenhouse System is necessary to make sure that the monitoring system will make the user easy and knows what happening to their greenhouse by just monitoring or view through the cayenne web. Based on the survey, 84.8% respondents need this Greenhouse System whereas 12.1% respondents are not confident because they are worried whether this system will be secure to their greenhouse.

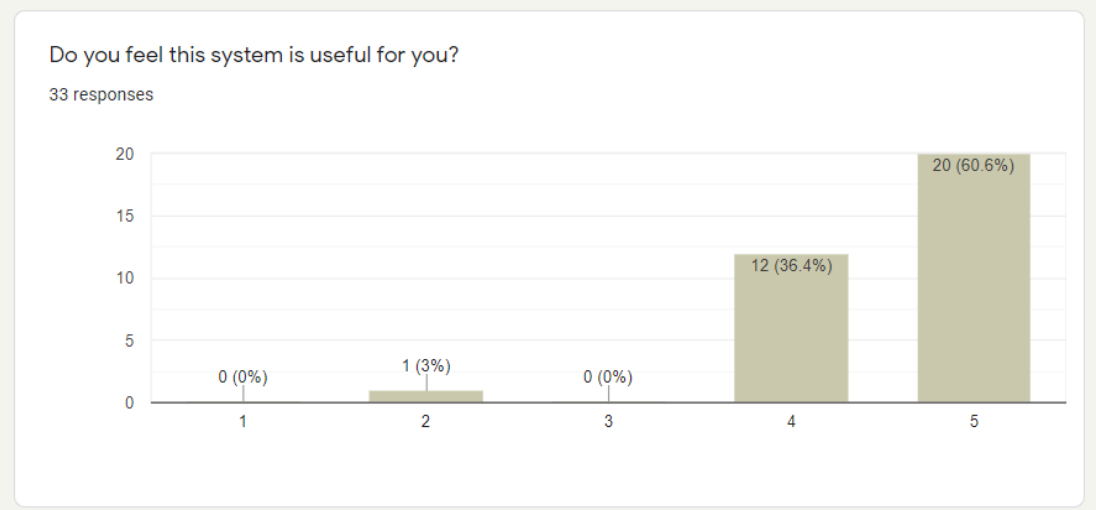

FIGURE 4.5 shows bar chart

The final question figure 4.5 shows bar chart was asked on the rating on their feel to use the system is useful for the user. The rating was set from 1 to 5 indicates a better rating as it increases. Out of the 33 respondents, 3% or 1 respondents have rated 2, 36.4% or 12 respondents have rated this project 4 and 60.6% or 20 respondents have

this project for the highest rating, which is 5, which explains the idea is accepted and can be even improved along the way on the system is useful for them of this project.

4.1.3 Project Survey Outcome

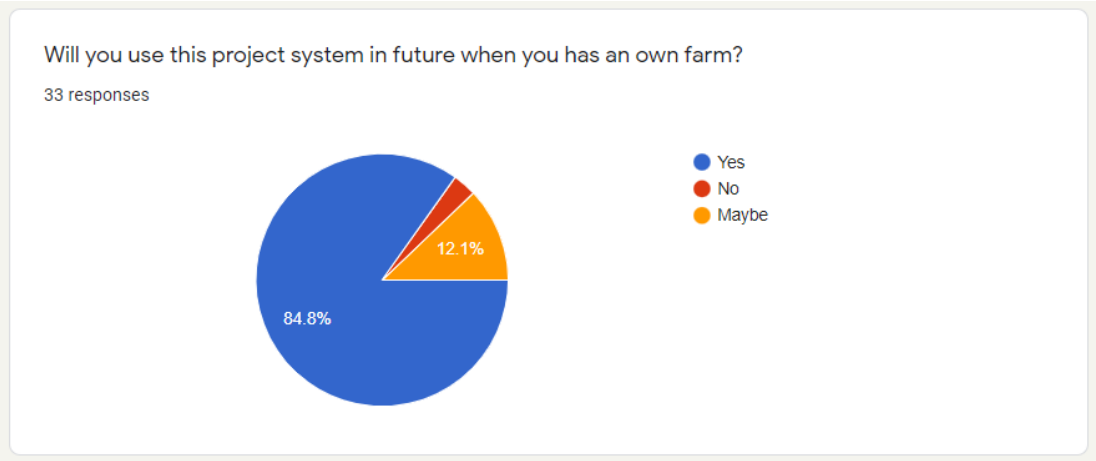

FIGURE 4.6 shows pie chart

This survey in figure 4.6 has been done after completing the project to get to know from the user whether will the user use this project system in future when they have an own farm. Majority of them has response yes to use the project system because in my point of view it is easy for the user to monitor their farm from a mobile phone and does not to worry much on their farm manually. Out of 33 respondents, 84.8% have agree to get to go in future use whereas 12.1% have response maybe because this makes them decides whether they want to use or not. A maybe answer can be in many ways because some respondents does not understand to the greenhouse thing, also some of them are still new to the greenhouse or more confident that they know the accuracy of them plantation. The rest respondents have response to no which means they does not want to get interest into it. Finally, the majority have agreed to this project system so that they will use this greenhouse in future or upcoming years.

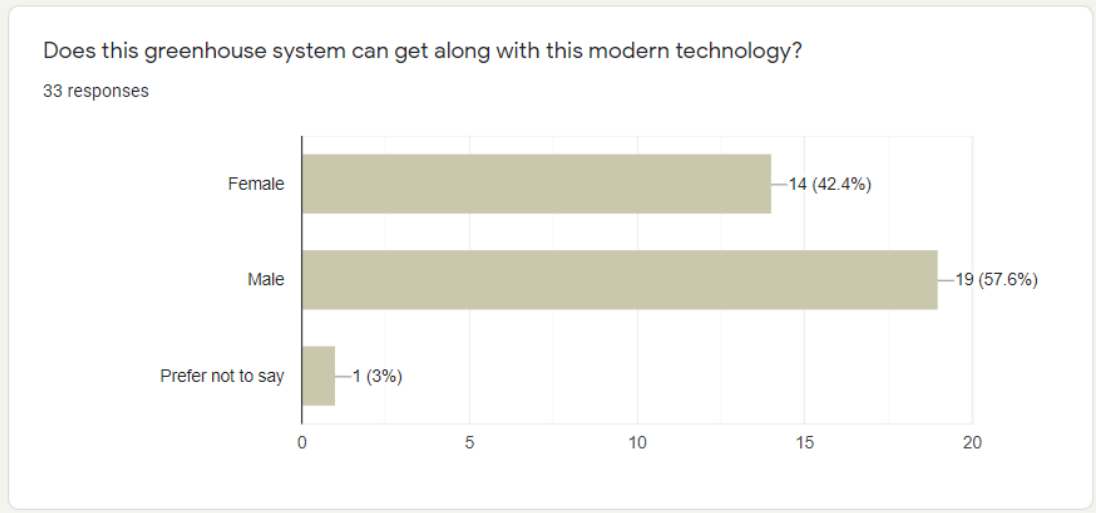

FIGURE 4.7 shows user get along with this modern technology

The survey in figure 4.7 have done once completing the whole project. This survey shows that this greenhouse system can get along with this modern technology. Out of 33 of respondent's, there are 19 of male's respondents that have been shown up that they will get along with this modern technology of the greenhouse system. These will happen once they are getting older by days then just for their time to pass, they will take it as a habit to monitor their plantation through mobile app or web as well. There are 42.4% which is 14 females' respondents have been shown that they will get along with this greenhouse in modern technology show they no need to worry much about it since they can monitor everything through the mobile app or web in their laptop or tab/iPad. These also will help the females to make easier their work since they the one will be busy with the housework's etc. The 3% have says prefer not to say just because maybe they are not interested in the plantation thing and any other personal problem with them.

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4.2 General Flowchart

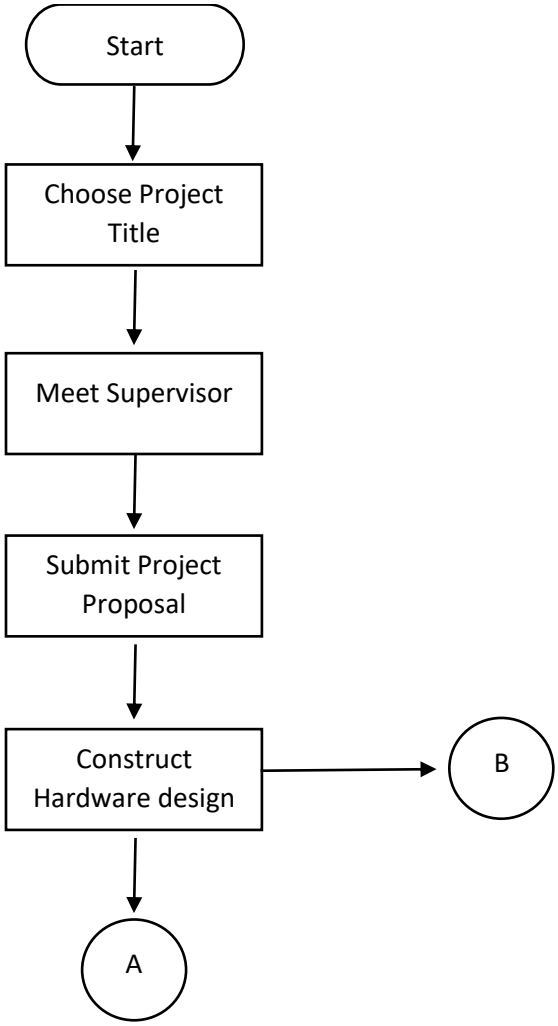


FIGURE 4.8 General flowchart

Figure 4.5 the flowcharts above explain the process of this project. First and foremost, had a brief from the coordinator to choose a project title then to meet supervisor for assistance of the project. Title has been selected or chosen and then submit project proposal to the supervisor to get approval for the proposed project. Then, setup a meeting with supervisor to obtain more information regarding the final year project and to get more idea from the supervisor. Even after the meeting, the submitted proposal can be corrected in the future or improve in upcoming steps. There will be several times of changes in constructing the hardware design must be aware of it and also get some knowledge about designing a hardware project.

4.3 Overall Project Flowchart

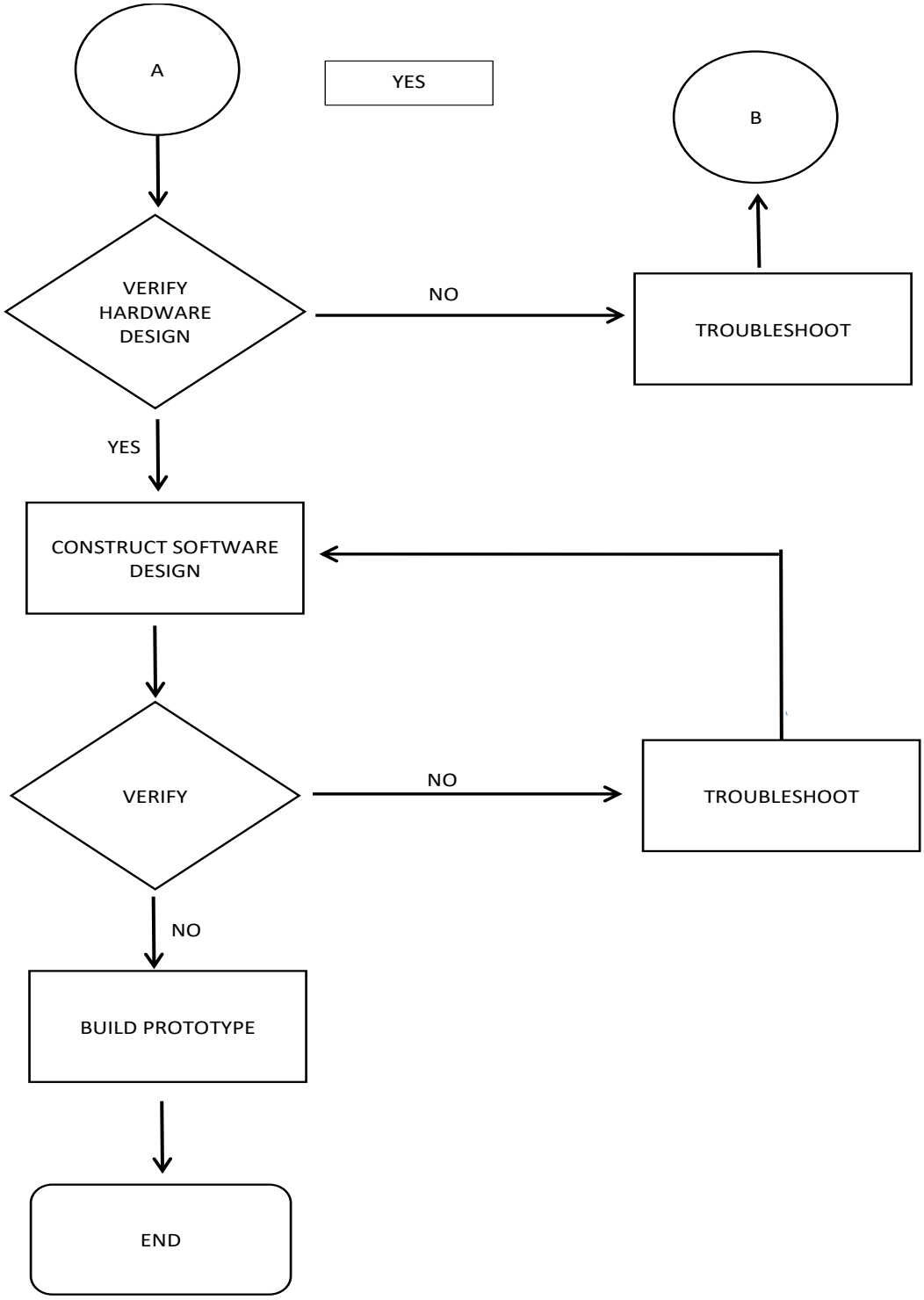


FIGURE 4.9 shows Overall Project Flowchart

Figure 4.6 shows an overall project flowchart, first starting on the project must study on what coding language to use or create in the proposed project so that won't be messed up in the future. Then, after the study code has been created using the Arduino IDE and complied it to ensure that the code had no errors. Subsequently, the circuit has been constructed using Easy EDA and simulate it. After the hardware and software design is completed, the prototype has been built. There will be a problem in building the prototype with some errors in it so with that the hardware and software should properly compiled and ready to go after finish doing the prototype. There will be a must in troubleshoot when started to use any programming language or coding with some unnecessary errors in it.

4.4 Block Diagram

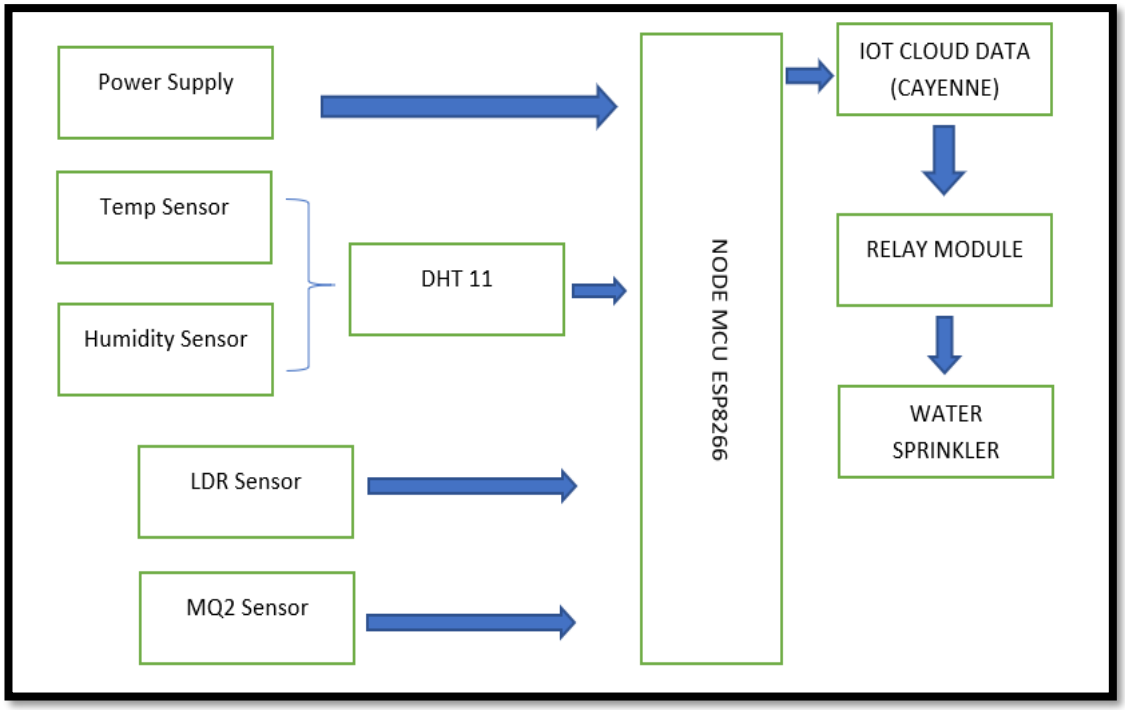


FIGURE 4.10 shows Block Diagram of Greenhouse Sensing Station

First and foremost, the figure 4.7 shows Block Diagram of Greenhouse Sensing Station, NodeMCU will connect to the local WIFI network after given power supply to the microcontroller. Once the connection is successful the NodeMCU will instruct all the sensors to sense their parameters respectively. For instance, DHT 11 will detect the temperature and humidity, LDR sensor will sense the light intensity in the greenhouse and MQ2 sensor will detect combustion gases. Then, all these readings

will be transmitted to the NodeMCU and it will send it to the IOT Cloud. These data can be seen vividly in Cayenne Web and App through online. We could set the triggers in the app to alert the owner if any unsuitable environment detected by the sensors inside greenhouse. For example, when the MQ2 sensor detects any combustion gases by fire accidents, the NodeMCU will trigger the relay to switch on the water sprinkler therefore, the fire will be easily put out without any manpower.

4.5 Hardware Design

4.5.1 Hardware Flowchart

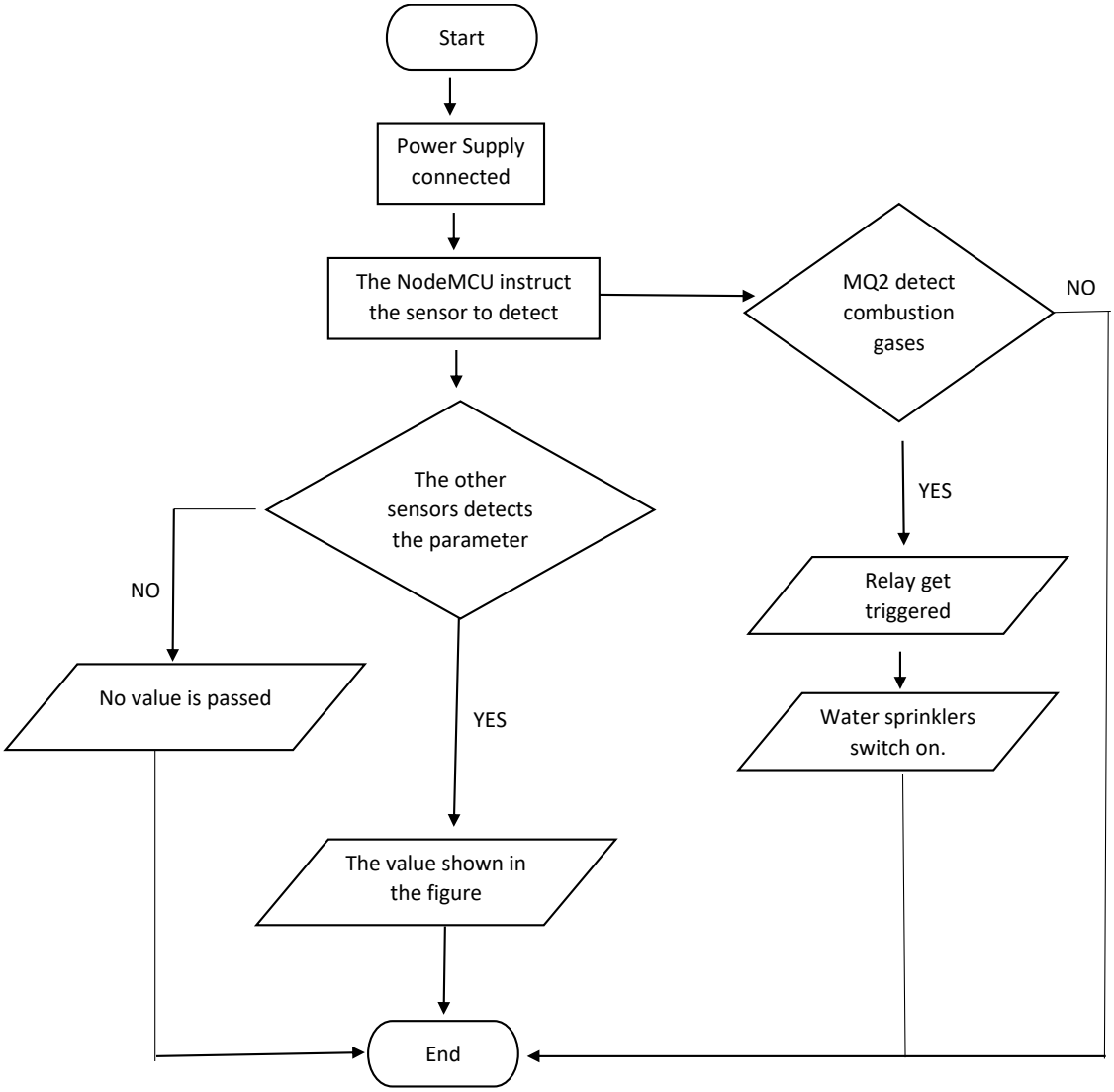
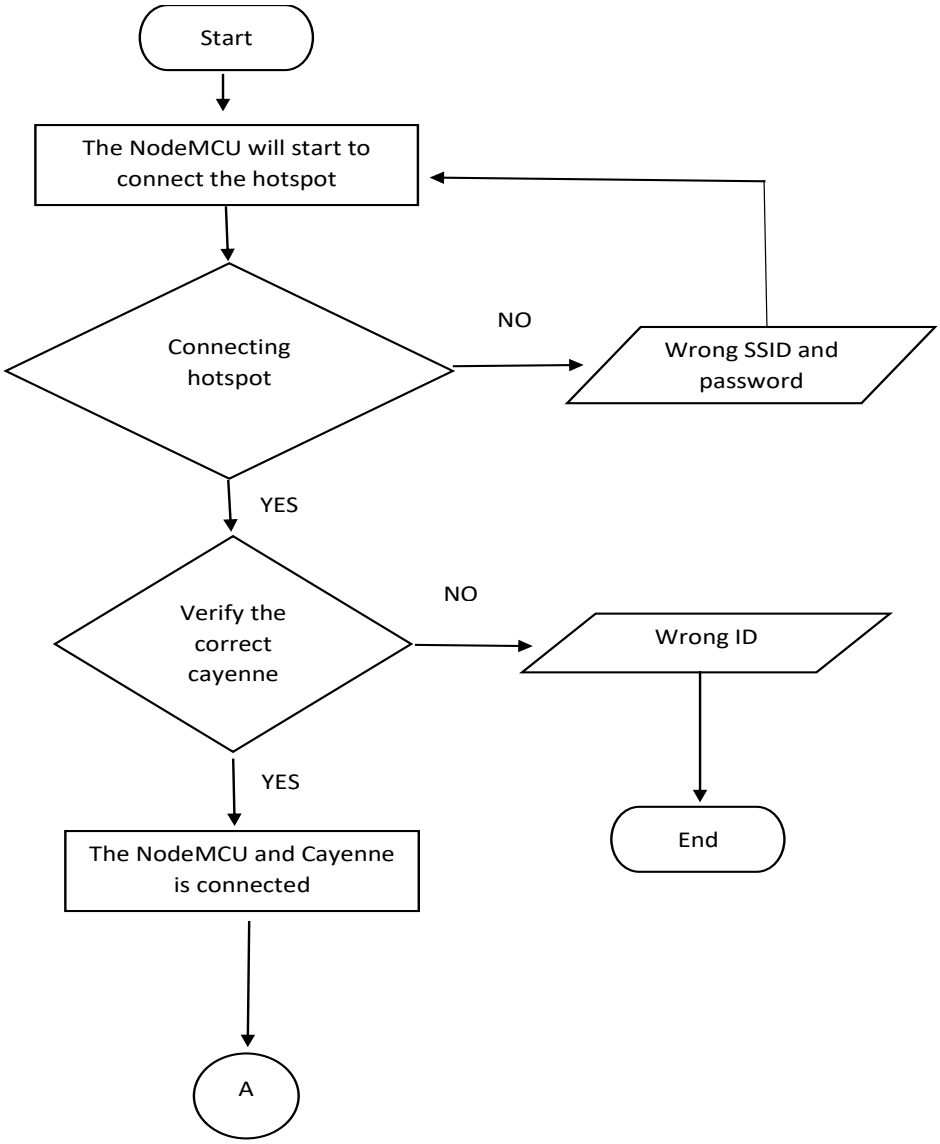


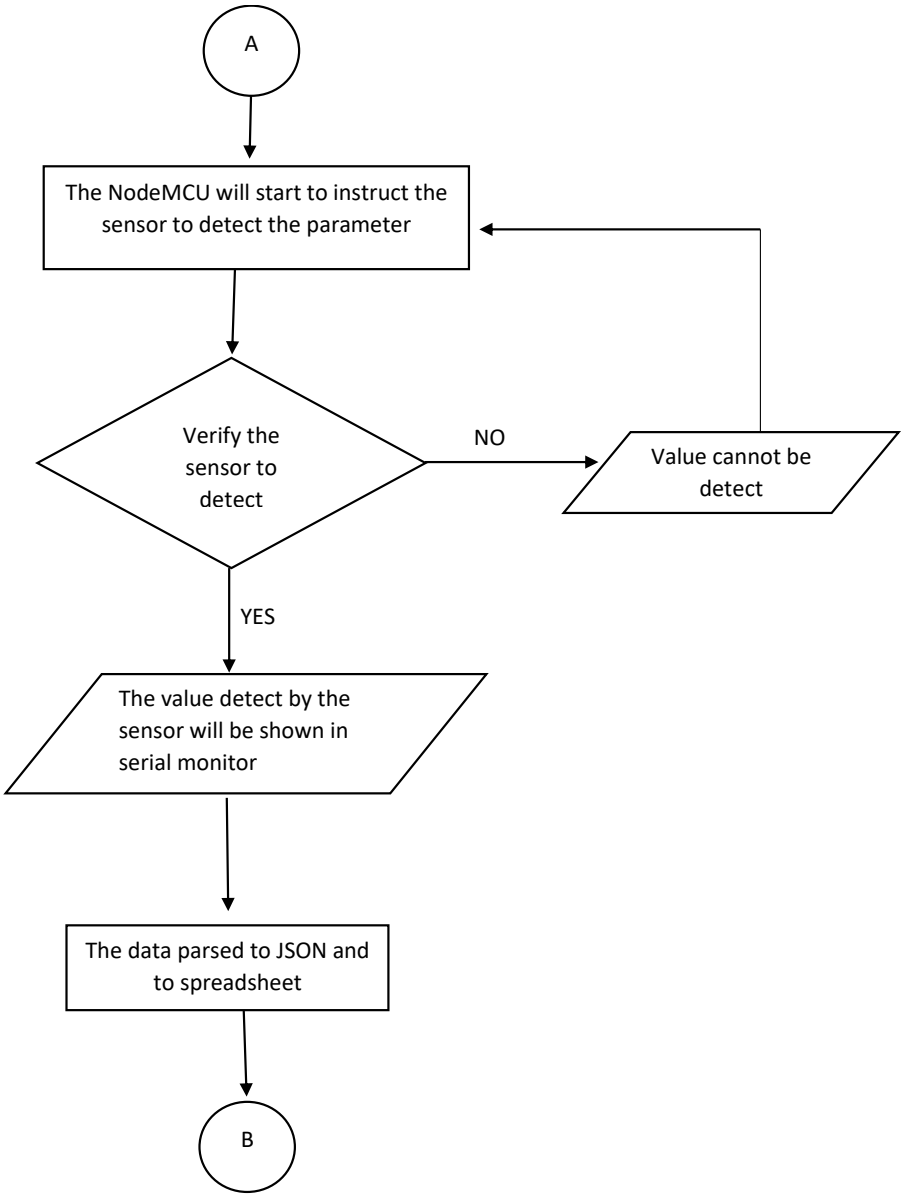
FIGURE 4.11 Flowchart of Hardware

The figure 4.8 flowchart shows how does the NodeMCU and sensor work without interfacing other software. Initially, the main purpose of this project is to monitor the parameter. So, there will be three inputs which are DHT11, LDR sensor and MQ2 sensor to detect temperature and humidity, light intensity, and combustion gases, respectively. These data will be transmitted to IOT cloud. When the MQ2 sensor detects any combustion gases, the NodeMCU will trigger the relay to switch on the water sprinkler. Once the power supply is connected the sensors will instruct to detect the MQ2 which is the smoke sensors to detect is there any combustion gases. If yes, then the relay will be triggered and automatically the water sprinklers will turn on when the there is any combustion gases around the greenhouse. If no, then the process will end there without any detection around of combustion gases. The other sensors detect the parameter then if yes, the value will be shown in the figure. If no, then no values are passed so the process will end there.

4.6 Software Design

4.6.1 Flowchart of Software Process




A
The NodeMCU will start to instruct the sensor to detect the parameter
Verify the sensor to detect
NO
Value cannot be detect
YES
The value detect by the sensor will be shown in serial monitor
The data parsed to JSON and to spreadsheet
B

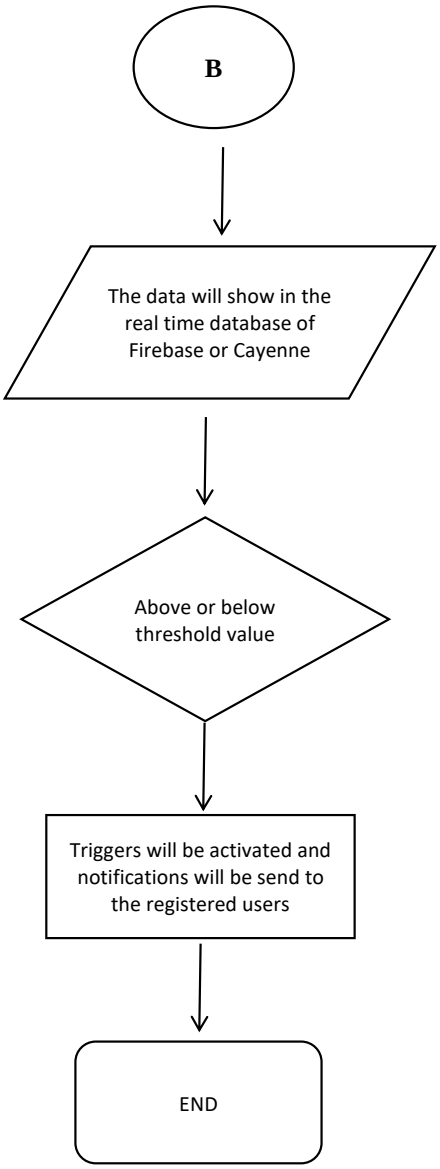


FIGURE 4.12 Software Flowchart

The figure 4.9 flowchart shows the whole process of the NodeMCU and Cayenne. NodeMCU is an open-source firmware and development kit that helps you to prototype or build IOT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and Cayenne is the app were one of the platforms to view or monitor the data. Firstly, the NodeMCU should be connect to the user hotspot or user Wi-Fi. If it is connected to the hotspot or Wi-Fi, then it will direct to Cayenne App to view or monitor the data. If the NodeMCU fail to connect the hotspot or Wi-Fi, then there is a problem occur with the wrong login ID and password. If the verification is not correct

to open the cayenne app, then the problem will be wrong login ID. The les in the NodeMCU will light up when power supply is connected. So, the NodeMCU will connect the hotspot then it will be connected to the Cayenne. After that, the sensors will start to detect the parameters and will upload to the Cayenne platform. From the Cayenne web, data will be transferred to Cayenne Web. If there are any threshold vales the Cayenne will help to push notification to the user mobile phone through SMS and email at the same time.

4.7 Circuit Operation

4.7.1 Operation of Circuit (Hardware)

In this project, cloud data is the output of this system which enables to monitor the parameter in live. First and foremost, the NodeMCU is connected to the 5V supply. Since the code is already uploaded, the sensors begin to detect the temperature, humidity, light intensity, and combustion gases respectively. Every time the sensors are detecting the parameter, a blue LED in NodeMCU will blink. By this, the users can know that all the sensors are working properly. Furthermore, the sensors will detect their parameter for every 2 or 3 second.

4.7.2 Operation of IOT

4.7.2.1 Cayenne Web and App

Cayenne is an online IOT dashboard that takes most of the complication out of creating hardware-oriented programming. Cayenne is a drag-and-drop programming system for the IOT that really does make it much easier. Cayenne is one of the platforms to view or monitor the data. Although the design in the Cayenne is very creative, it can only view by one person who have their own id and password. Moreover, it allows only one login at one time only. Even though, it has a lot of disadvantages, the feature of notification makes the Cayenne more superior compared to other IOT platform. This is because the Cayenne helps to push the notification to everyone at the same time whenever

there is threshold values. Furthermore, it can also set the threshold value at trigger setting without typing any code.

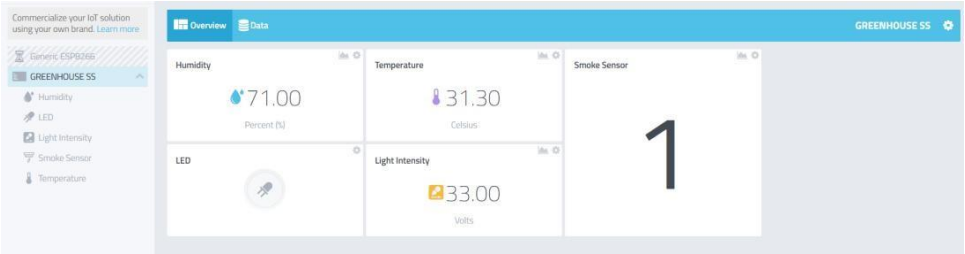


FIGURE 4.13 Sensor Data in Cayenne Web

FIGURE 4.14 Triggers in Cayenne Web

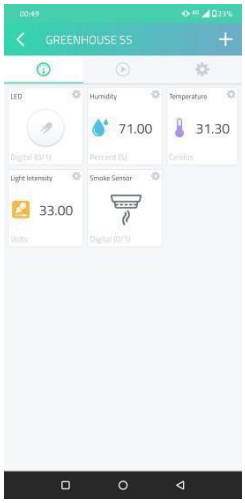


FIGURE 4.15 Sensor Data in Cayenne App

FIGURE 4.16 Cayenne App Notification

4.8 Prototype

A simple greenhouse sensing station has been designed to demonstrate the function of the sensors and output of the system in more detail. To design this prototype, a black cardboard was used as the base and wooden ice cream sticks to build the structure of house. Then, plastic covers were used to cover the greenhouse and some decorative ornaments to make the prototype more attractive. The DHT11 is placed on the left side of the house, LDR on the right side of the house and MQ2 on the top of the house. The NodeMCU and breadboard were fixed inside the greenhouse neatly. Before the circuit transfer to the prototype, the code has been uploaded to the NodeMCU and verified the system has worked. Finally, the sensors were placed to their respective places. The figures below show multiple views of the prototype.

FIGURE 4.17 Front View

FIGURE 4.18 Back View

FIGURE 4.19 Left View

FIGURE 4.20 Right View

4.9 Overall Discussion

The designed of this project system is based on Technology System Acceptance Modelling. The readings from the sensors are visualized in online webpage and application. The software is already working properly in appropriate manner with the purpose in the beginning, that is to get temperature, humidity, light intensity values and any combustion gases from greenhouse.

After development is finished, test for sensor's work is done and device is working properly. The testing that has done shows that readings of sensor are accurate in real-time database of Google Firebase and Cayenne platforms. If the sensor values get higher then threshold value, an instant notification will be popped out in the registered user's smartphones through Cayenne App. This system has successfully overcome on the drawbacks of the existing systems by reducing the power consumption, time required, maintenance and complexity. It also provides a flexible and precise form of maintaining the environment.

The complications throughout the journey of building this project were rectified successfully. Firstly, Android Studio was planned to be used to create an Android Application synced with Google Firebase however some coding errors could not make it happen and Cayenne App was implemented in the project as a replacement. Secondly, there was only one Analog input in NodeMCU whereas the project needed two analog inputs for LDR sensor and MQ2 sensor each. Nevertheless, MQ2 sensor was changed to a digital input to only show 0 or 1 as an alert to the users instead of showing the level of air quality inside greenhouse.

The proposed system is going to play an important role in future of agriculture system and hopefully it would be going to help in boosting the efficiency of growth and production of agriculture industry.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

In a nutshell, Greenhouse Sensing Station portrays about the different parts of nursery observing utilizing IOT. Cultivating exercises, even in metropolitan zones are on a climb lately, in momentous constructions. Imaginative development causes the agrarian region to foster high, which here is made by the IOT. The IOT will assume an incredible part in changing the everyday valuable experience. The surrounding in the greenhouse always monitored and notify the users any mishaps instantly and keep them updated about the safe environment of greenhouse. The undertaking could be useful as it will help in propelling the resources in the nursery. Furthermore, the present moment, we are utilizing set number of boundaries in our task yet with the further headway a more prominent number of boundaries could be added for supporting the creation. In future by developing a flexible application for IOT system makes more versatile to the social classes.

5.2 Future Work

In future research about greenhouse sensing station, more relays can be added into the system to control the environment inside the greenhouse than just monitoring it. Transfer is basically an electromagnetic switch which helps in opening and shutting of circuits electronically. It has four significant parts electromagnets, an armature, a spring and set of electrical contacts. In short it is an attraction gadget for remote or programmed the executives that is spurred by variety in states of an electrical circuit which works progressively elective gadgets (like switches) inside the equivalent or an exceptional circuit. For light intensity, the relays can switch on or off artificial lights in the greenhouse to maintain the brightness and fan to control the humidity and surrounding temperature. Besides, buzzer can be fixed to alert surrounding people

when any mishaps inside greenhouse. All these actions will be sent as a notification to the registered users.

Another recommendation will be about the pop-up notification in smartphones when any unsuitable environment detected inside greenhouse. The Cayenne platform can send notification to the users but by mentioning the number of channels instead of the parameter name. Cayenne system should be modified to notify the users by the parameter names so that the users can interpret the information from the notification easily.

Additionally, another recommendation will be The Smart Irrigation system that has wide degree to robotize the total water system framework. Here we are building a IoT based Irrigation System using ESP8266 NodeMCU Module and DHT11 Sensor. It will not just naturally flood the water dependent on the dampness level in the dirt yet in addition send the Data to ThingSpeak Server to monitor the land condition. The System will comprise a water siphon which will be utilized to sprinkle water on the land contingent on the land ecological condition like Moisture, Temperature and Humidity.

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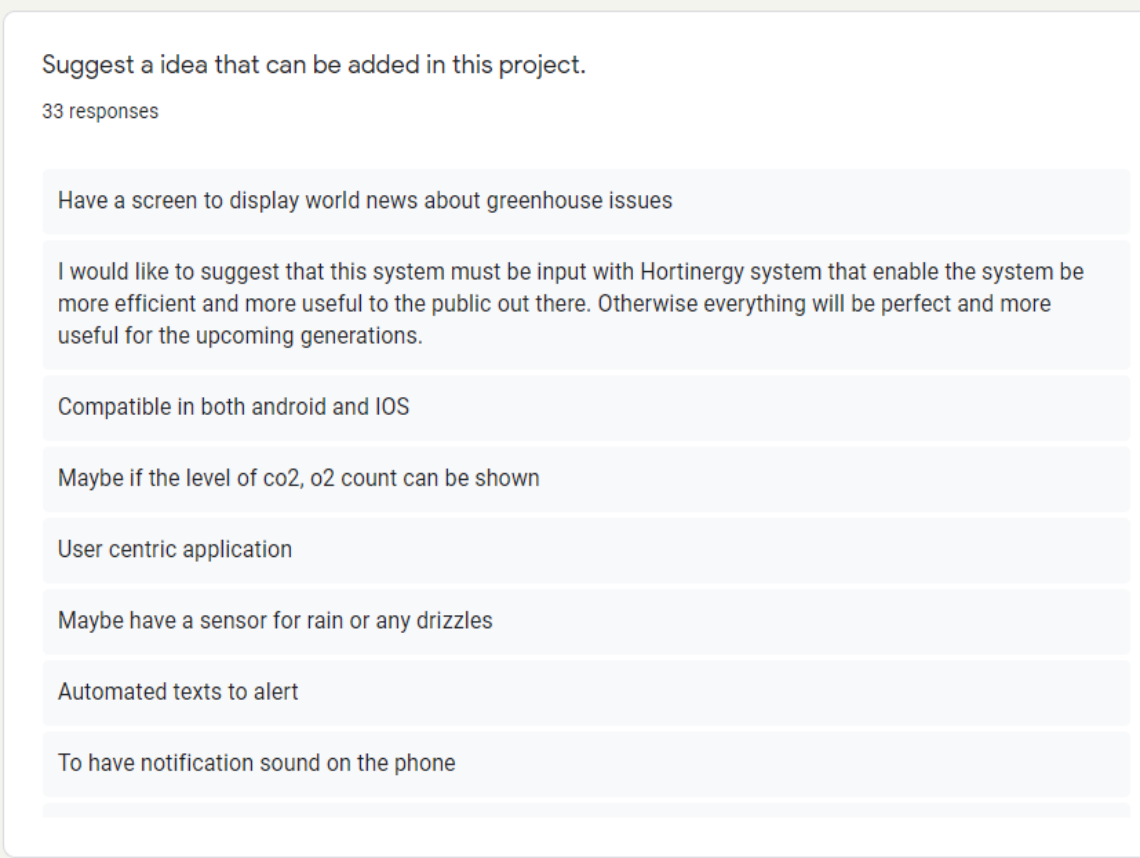
APPENDICES

Appendix A: Gantt Chart (FYP 1 & FYP 2)

Task/Week	FINAL YEAR PROJECT 1												FINAL YEAR PROJECT 2													
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
Planning Phase																											
Project title selection																											
Preliminary research work																											
Analysis Phase																											
Literature analysis																											
Submission of progress assessment 1																											
Data collection & analysis																											
Proposal Defense																											
Interim Report Draft Submission																											
Interim Report Submission																											
Design Phase																											
Coding analysis																											
Developer testing																											
System testing																											
Acceptance testing																											
Implementation Phase																											
Project dissertation																											
Presentation slides and prototype video submission																											
Viva presentation																											

Reference
Completed
Yet to be completed

Appendix B: Extended Questionnaire


Suggest a idea that can be added in this project.

33 responses

Have a screen to display world news about greenhouse issues

I would like to suggest that this system must be input with Hortinergy system that enable the system be more efficient and more useful to the public out there. Otherwise everything will be perfect and more useful for the upcoming generations.

Compatible in both android and IOS

Maybe if the level of co2, o2 count can be shown

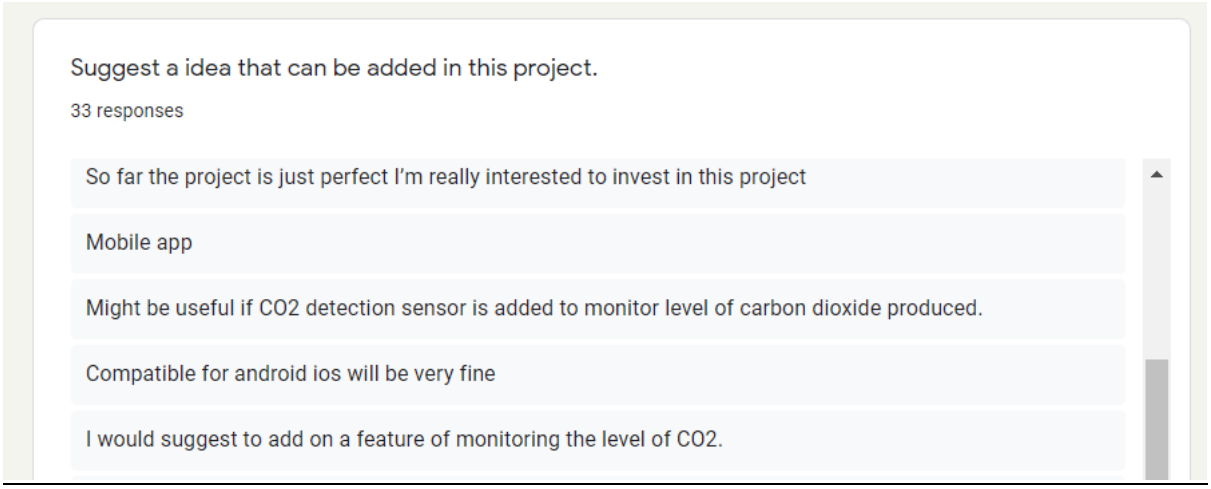
User centric application

Maybe have a sensor for rain or any drizzles

Automated texts to alert

To have notification sound on the phone

1


Suggest a idea that can be added in this project.

33 responses

So far the project is just perfect I'm really interested to invest in this project

Mobile app

Might be useful if CO2 detection sensor is added to monitor level of carbon dioxide produced.

Compatible for android ios will be very fine

I would suggest to add on a feature of monitoring the level of CO2.

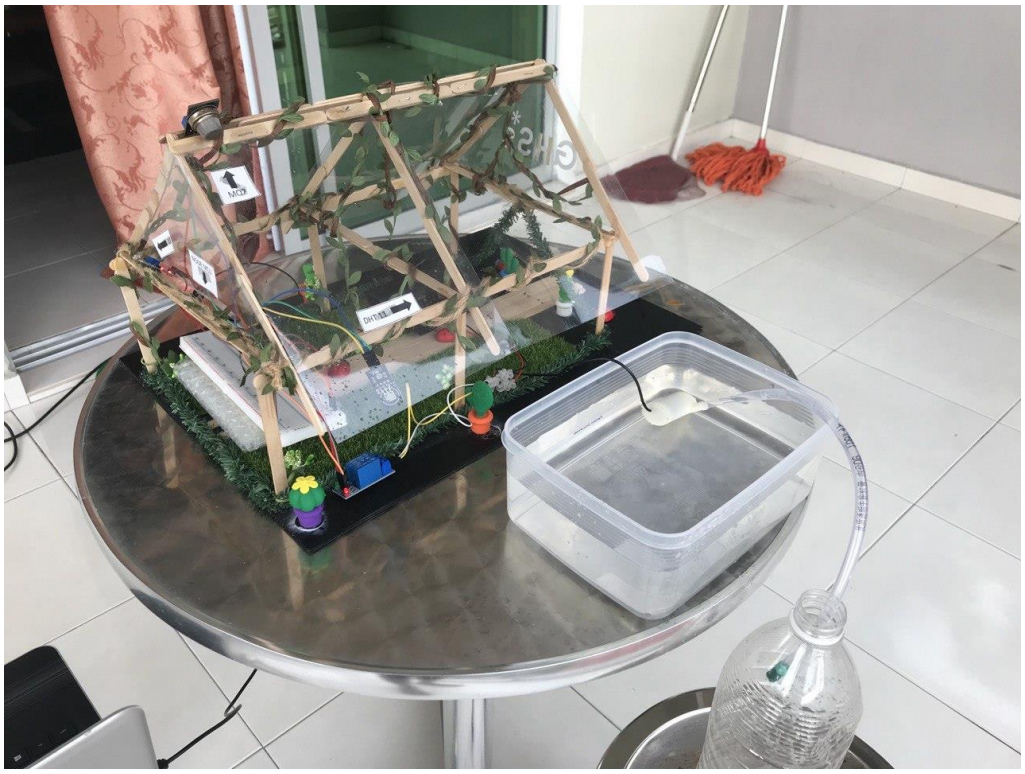
Suggest a idea that can be added in this project.

33 responses

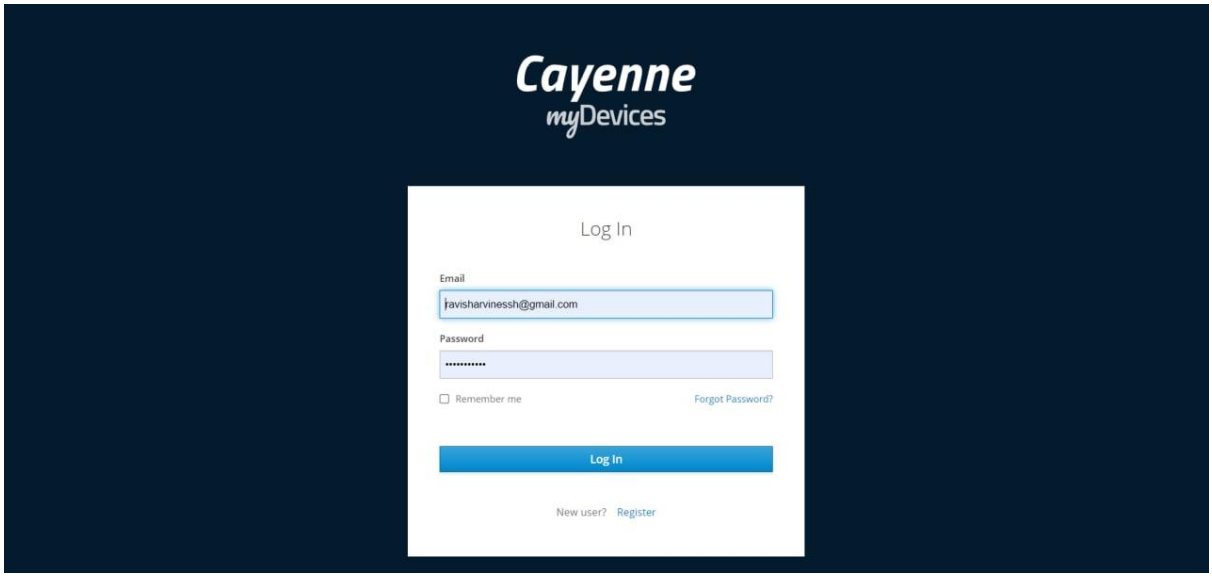
- Send the temperature rise reading to the owner
- Mobile app installation
- No ideas for now
- The system should be affordable for a large scale of use
- This should be fine
- no, but the smoke sensor is a great addition!
- Nil
- Solar panel which turns light to electric

Appendix C: Greenhouse Sensing Station and Cayenne Web/App Interface

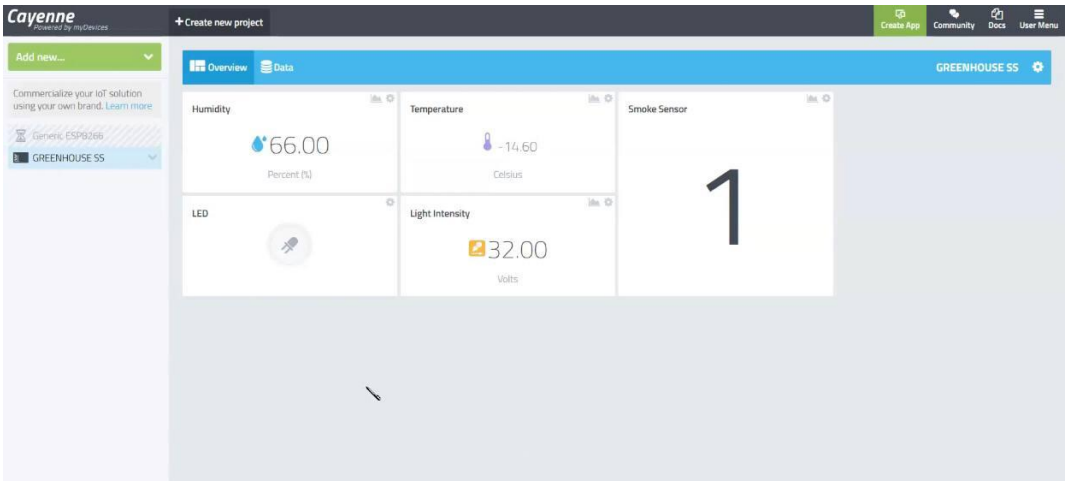
a) Project Design



b) Cayenne Web/App Login



c) Monitoring View



d) Proof of getting notifications