IOT BASED SMART FARMING

BY
Md. Kawsar Hasan
ID: 161-15-6951
AND
Abdul Hannan Sumon
ID: 153-15-6553
AND
Md. Mahmudul Haque Rubel
ID: 161-15-6950

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

Supervised By

Fahad Faisal
Assistant Professor
Department of CSE
DaffodilInternational University

Co-Supervised By

Nusrat Jahan
Lecturer
Department of CSE
DaffodilInternational University

DAFFODIL INTERNATIONAL UNIVERSITY
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APPROVAL

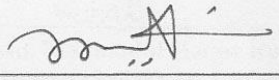
This Project/internship titled **"IoT Based Smart Farming"**, submitted by Md. Kawsar Hasan, ID No: 161-15-6951 and Abdul Hannan Sumon, ID No: 153-15-6553 and Md. Mahmudul Haque Rubel, ID No: 161-15-6950 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on Thursday, December 5, 2019.

BOARD OF EXAMINERS

Dr. Syed Akhter Hossain — **Chairman**
Professor and Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Nazmun Nessa Moon — **Internal Examiner**
Assistant Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Gazi Zahirul Islam — **Internal Examiner**
Assistant Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



Dr. Mohammad Shorif Uddin — **External Examiner**
Professor
Department of Computer Science and Engineering
Jahangirnagar University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Fahad Faisal, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

Fahad Faisal
Assistant Professor
Department of CSE
Daffodil International University

Co-Supervised by:

Nusrat Jahan

Nusrat Jahan
Lecturer
Department of CSE
Daffodil International University

Submitted by:

Kawsar

Md. Kawsar Hasan
ID: 161-15-6951
Department of CSE
Daffodil International University

Sumon

Abdul Hannan Sumon
ID: 153-15-6553
Department of CSE
Daffodil International University

Rubel

Md. Mahmudul Haque Rubel
ID: 161-15-6950
Department of CSE
Daffodil International University

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ABSTRACT

This paper gives the embedded system for automatic Smart Farming using the soil sensors.The concept of Smart Agriculture is becoming a reality as it evolves from conceptual models for the development of crop at different stages.Previously the agriculture is the cultivation of the plants which is used to sustain and enhance human life. Now a days the Smart Agriculture has come into the picture globally.Agriculture is the main occupation in Bangladesh and it plays a vital role in our country. Fertilizers are the most vital factors for the crop production. The measurement of soil nutrients is greatly required for better plant growth. Because using too much of fertilizers may lead to the inferior quality of the crop production. Determining the amount of nutrients in the soil is the key function. PH value is also one of the most important and informative soil parameter to detect the soil fertility and it is measured to identify the soil fertility. In the proposed system, it determines the crops which are suitable for the particular soil type. It will analyze moisture content, temperature and humidity in soil at real time and it will also suggest the crops based on determined PH of soil. This system is proposed to help the farmers to increase the production and the suggestions are shown in LCD display and Android Apps.

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CHAPTER 1
Introductions

1.1 Introduction

Internet of Things (IoT) may be a concept and model that empowers interaction among objects pervasively display in an environment. Internet of things nowadays, has come to numerous different regions, taken different forms and revealed a large number of applications. Bangladesh is a land of multifaceted soils. In Bangladesh economy is mainly based on agriculture and agricultural productivity is depends on soil type. But the major problem concern to the Bangladeshi farmers is lack of sufficient knowledge about their soil.Each soil type has different characteristics i.e. there are various nutrients present in the soil. Deficiency of the nutrients to impacts in productivity.So, there is need of soil analysis.The disturbing circumstance of less efficiency leads the thought to put the endeavors within the plan and improvement of a modern soil testing and fertilizer proposal framework.

The farmers measure the supplement fixation present in the dirt to get the dirt supplements to be given and select the appropriate yield for different occasions of trimming in the farmland.It incorporates testing of soils for different properties like surface, structure, pH, water-holding limit, electrical conductivity and parameters for enhancement of synthetically crumbled soils for prescribing soil changes, for example, gypsum for soluble base soil and lime for acid soil. Suitable crops will be recommended using nutrient status table stored in the database. By comparing values with table classification will be done. And accordingly suitable crops be recommended to the user. In our system it will help farmers for better crop yield which in turn maximizes profit.

1.2 Motivation

Our country is an agricultural dependent country. Horticulture plays a vital activity in the headway of the country. Although most of the world's land is cultivated, they are unable to cultivate agriculture properly due to lack of proper knowledge. In our country, the peoples of the primitive era, they have been cultivating the crops that they have seen in the past. They do not

know which field will produce a good crop. So we think we can't create something that observes everything then finally gave an output that which crops are suitable for this land..

As we are from a horticulture nation we need to consider utilizing innovation in our cultivating. The disturbing circumstance of rancher's less profitability drives the plan to place the endeavors in the structure and improvement of a refined soil testing and harvest suggestion framework. As the horticultural profitability for the most part relies on the dirt condition which for the most part relies on supplements present in the dirt. Along these lines, there is a requirement for a dirt testing framework. In view of soil investigation, appropriate harvests ought to be prescribed to the ranchers so as to build crop profitability and thus increment the money related status of the ranchers.

In this nation, we face numerous agrarian issues for the absence of legitimate development Technology.For increasing our agricultural production we take this project for better growth of crops.

1.3 Objective

Most of the farmers in our country are illiterate. They don’t have proper knowledge about science cultivation. As a result they don’t grow expected crops in the end of season. In our proposed system farmers who have no idea about science cultivation they can use it.

As a result they can use their land in a correct way for the cultivation in the help of this device. By using this device an illiterate farmer easily understand which crops in good for this land by the help of this device. The aim of this project is to use technology in our farming. This system can save our time which we spend in analyzing in books. In a short time by using this system any one can know a suitable crops for the land. It also can save money, time and energy.

1.4 Rationale of the Study

There is no doubt that there are many works done on IoT Based agriculture monitoring. This project is different from all of previous work. Because we are find out which crops are suitable for which lands. Something new has been added to our project so that the previous project can work like that. We have also stored and monitored all data previously then analyzing all the data will tell us which crop is best for which land. This project is to plan and build up a rural checking

framework utilizing a remote sensor system to expand the proficiency and nature of cultivating without announcing it for all the time physically and very helpful for a farmer.

1.5 Expected Outcome

We can automate the collection of environmental soil, fertilization and irrigation data. These Data save in a cloud and we build an app which shows which crops are suitable for this soil. Finally get the automatic correlate such data and filter–out invalid data from the outlook of assessing crop performance. In this section there is some points given that points was our min anticipated result. Expected outcome of this research based this project is to build a device which efficient procedure that will give a final results using dataset.

- Using wireless sensor network.
- Data Analysis.
- Showing Value of PH, Soil Moisture, Upper Temp, Humidity, inside the ground Temp.
- Finally Predict current data and Cloud data then give an output.
- Farmers can be benefited by this Device.

1.6 Research Questions

It was so challenging for us to complete this work. In order to have a realistic, efficient and accurate response to the problem, the researchers wishes to propose following questions to express this feelings and outcomes this problem

- What are the impacts of Agriculture?
- Can IOT based smart farming be a solution to predict suitable crops?
- How efficient will this project be in the long run?
- By what means can increase crops productivity?
- How is this project related to IOT?
- How accurate will the solution are outcomes will be?
- How effective will this project be on a largescale?

1.7 Report Layout

- Chapter one have demonstratedpresentation to the project with objective, motivation, research questions, and expected outcome, this section describes the whole layout of this report.
- Chapter two provides the discussion on what already done in this domain before. Then the later section of this second chapter shows the scope arisen from their limitation of this field. And very last, the root obstacles or challenges of this research are explained.
- Part three gives the Requirement Specification which is business procedure demonstrating, necessity accumulation, use case displaying, and legitimate information model and plan prerequisites of IoT Based Smart cultivating which are quickly portrayed in this section.
- Chapter four provides the Design Specification, Front-end, Back-end design and Implementation discussion.Some method pictures and database are presents in this chapter to make realize the project.
- Chapter five provides the Usage and testing, Execution of Database and Implementation of front-end and back-end structure discourse.Some design pictures and database are presents in this chapter to make realize the project.
- Chapter six discussed with summery of the study, future work and conclusion. This chapter is responsible to show the whole project report adhering to recommendation. The chapter is closed by showing the limitations of our works that can be the future scope of others who want to work in this field

CHAPTER 2
Background

2.1 Introduction

In this area,we will examine related works, research summary and challenges about this research based project. In related works section, we will talk about other research paper and their works, their methods, andtheir project which are related to our work. In research summary section we will give the summary of our related works. In challenges section, we will discuss how the device will provide farmers with good decision to which crops is suitable for which land.

2.2 Related Works

In 2017,Arora Sagar is try to “IoT Based Smart Farming Stick Using Arduino and Cloud Computing” on live checking of ecological information regarding temperature, dampness and different sorts relying upon sensors coordinated with it. Rural IoT stick gives us the idea of "plug and sense" in which ranchers can straightforwardly access with savvy cultivating by in that capacity putting the stick on the field and getting live information benefits from different gadgets like cell phones, tablets and so forth and information created by means of sensors can be effectively shared anyplace and seen by horticulture authority remotely by means of distributed computing innovation.[1]

In 2018,P. Sindhu , G. Indirani In this “IoT Enabled Soil Testing” system, takes readings from soil moisture sensor and humidity sensor and store it in a cloud server. They are also take soil moisture, temperature and humidity level of the soil.The sensors and microcontroller are successfully combine with the cloud. And the data stored successfully.User can have access to the data and can know if there are any inconsistency with respect to pH value and soil moisture. Implementing this system will allow users like farmers tomonitor andupgrade the productivity of the vegetables. They are used cloud serveris Thingspeak.com by using WiFi. [2]

In 2017,K. Spandana, Sai, Supriya KPL “Soil Qualitytesting usingSensors in SmartAgriculture forCrop Productionand Maintenanceusing IOT” system, Only Soil Moistureis tested using thissystem. They also use Decision tree algorithm. [3]

In 2016, “IoT based smart Agriculture” [4] gives data about water system having offices like shrewd control and settling on wise choice relying on constant information from fields. Every one of these tasks will be controlled through any brilliant gadget set remotely and the interfacing sensors are utilized to perform activities alongside Wi-Fi, actuators and other equipment gadgets. [4]

In 2013, Automated Soil Testing Device [5] we know that,In nation like India the economy is primarily based on agribusiness, still we are not able to create ideal, productive and economical use of our arrive assets. The most reason is the need of information with respect to the soil examination for the development of crops. In each state around 9 to 10 lakhs soil tests have been gotten in research facilities and it is exceptionally troublesome to test all the soil tests in time by the research facilities. By the time test reports are generated, harvesting is on the skirt of completion. Subsequently there's a need for soil examination to be made accessible to the agriculturist. The most objective of our work is to create a testing framework which can be utilized for soil examination, which in term makes a difference the ranchers to develop and deliver the right edit. The remote communication framework has been consolidated to associate with the specialists.

In 2018,R. Nageswara Rao, B. Sridhar “IoT based smart crop-field monitoring and automation irrigation system” [6]Agribusiness has a vital influence on the advancement of a rustic country like India. Issues concerning horticulture have been persistently counteracting the improvement of the nation. The so to speak plan to this issue is astute cultivation by modernizing the current traditional procedures of farming. Thus the proposed system focuses on making cultivation savvy utilizing motorization and IoT progresses. Internet of Things (IoT) empowers various applications trim advancement checking and choice, water framework decision support, and so forth. A Raspberry Pi-based programmed water framework IoT system is proposed to modernization and pushes ahead productivity of the alter. principal purpose of this work to trim improvement at moo sum water use, In request to fixate on water available to the plants at the necessary time, therefore the vast majority of the agriculturists waste part-time inside the regions. A capable organization of water should be created and the structured circuit multifaceted nature to be diminished. The proposed structure made on the source.

2.3 Research Summary

In this digital world each and every sector is undergoing a goodly change due to IT Sector. But, in agriculture field is not update than other sectors. We have proposed a model for advanced farming using multiple methods: IOT, Cloud-Computing, and Data Mining. Previously who have work with IOT Based farming, they didn't give accurate decision which crop will be good for any soil .For our farmers who invented any device that is tell the farmer which crop will be good for any soil. After Research we have get that, our project is very helpful for farmer. Because this is only device which is given optimal answer.In this project we firstly check the Soil type and later the Soil Quality (pH, Temp, Humidity and Moisture) is to be tested using sensors. [3]

We have given such privilege like as farmer need not take agony of going laboratory for soil testing, find out moisture value, inside soil temperature, humidity value as our system. In this method this value are automatically stored in Database. Then we compare cloud data and current data and then finally give a decision. Moreover in our project we have collected data in a different way and will forward it.Based on all this data, our machines will make decisions. Farmers also see the all of value such that (pH, Moisture, Temp, etc.). We did not allow all these decisions to work on any other project.We think our project will help create something new.

2.4 Scope of theProblem

In this section we discuss about the scope of the problem which can be occurred in future.

- Data Collect.
- Uneducated Farmer.
- Device Cost.
- Database.
- Invalid Output

Since we will use our farmers for the benefit of farming,So that they can use it wellit is important to be sure.Most farmers in the country are not educated. So they can have a lot of problems.The price is very important to them. So we think we have to be careful about the price of the device.Many times it will be difficult to get data into the dataset.

2.5 Challenges

The main challenges of this work is collecting and processing the dataset, dealing with the data set was too hard. Previously who have work with IOT Based farming, they didn't give accurate decision which crop will be good for any soil .For our farmers who invented any device that is tell the farmer which crop will be good for any soil. That's why we face many problem to collect data. Then it's justify used to our device.Practical Experiments is a big challenge for us. Our Research based project is not a completely device.The amount of data we will input into this devicethen compare that data with the previous average data. Now we collect few amount types of paddy in Bangladesh. If we collect more data it will help to predict to valid result.Power management must be available for this device.There was no enough data before so we have to start from our own motivation

CHAPTER 3

Requirement specification

3.1 Introduction

In this section we are going to discuss about our project requirement. Our Research based project also need to research methodology. We are also discuss there are some key point like data collection, processing, proposed model also described with relevant equation, graph, table and description.. The section is being shut by giving the clarification of our undertaking's measurable speculations what's more, giving the unmistakable idea of the usage prerequisites.

3.2 Business Process Model:

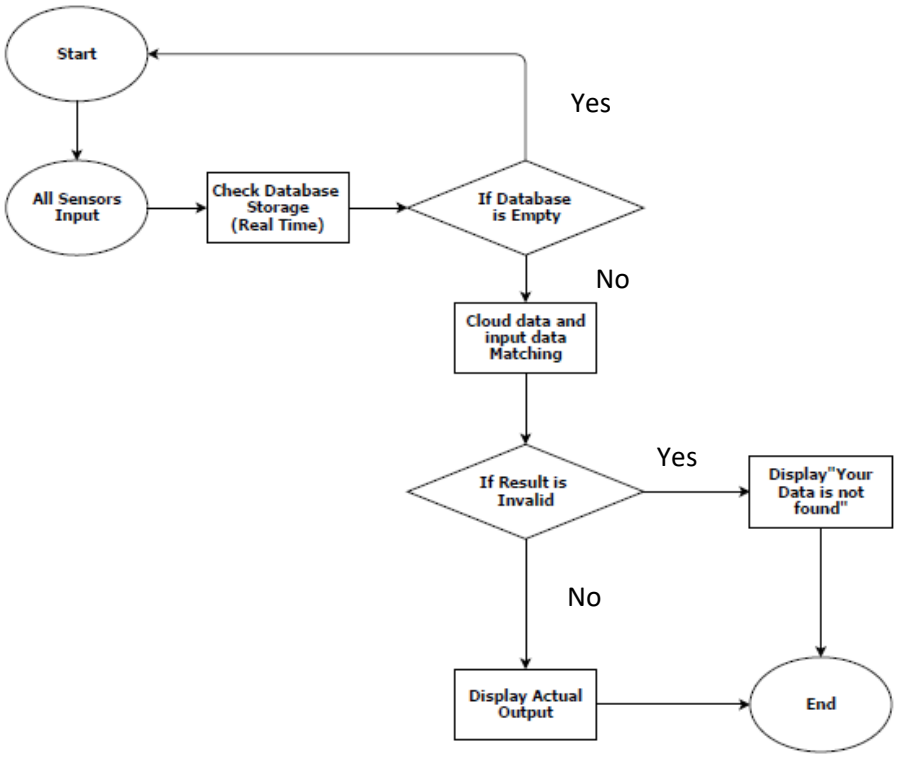


Figure 3.1: Business process model

3.3 Components List

In this Table we have given component list which we used in our project

TABLE 1: COMPONENT LIST OF PROPOSED SYSTEM

SL NO	NAME OF COMPONENTS	QUANTITY
1.	Solderless Breadboard	2
2.	Node MCU 1.0 (ESP8266 12E Wi-Fi module	2
3.	Temperature Sensor	1
4.	Humidity Sensor	1
5.	PH Meter	1
6.	Water PH Sensor	1
7.	Soil Moisture Sensor	1
8.	USB cable	2
9.	Jumper wire	10
10.	Battery	1

3.3.1 Soil moisture Sensor

Soil dampness sensor is utilized to gauge the dirt resistivity or volumetric water substance of soil as far as a limit. At the point when a sensor is set up in the field, it checks the soddenness or water level substance in it. It gives an electronic outcome of 5V when the moistness level is high and 0V when the sogginess level is low in the earth. The Amplifier has a Vcc, GND, Analog and Digital Data Pins. This implies you can get the qualities in both Analog and Digital structures

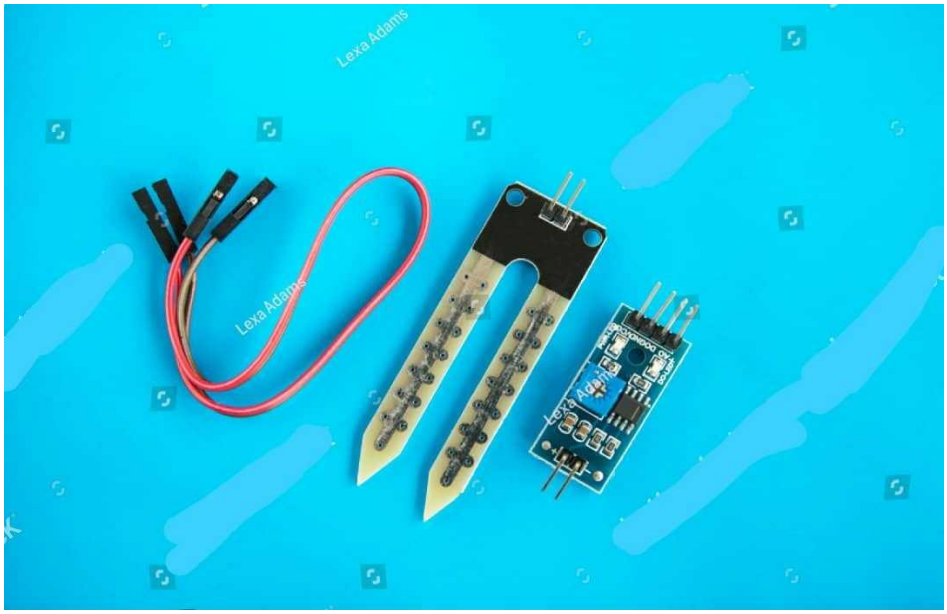


Figure 3.3.1: Soil moisture sensor [7]

3.3.2: Node MCU 1.0 (ESP8266 12E Wi-Fi module)

It is an integrated version of the popular Esp8266 Wi-Fi system on a chip that operates first on a system. The Esp8266 EX is integrated with a 32-bit ten silica processor standard digital peripheral interface, antenna, switches, RF balloon, power amplifiers, filters and power management modules. It achieves extra low power consumption and reaches a clock speed of 160MHZ. It has power sparing engineering with three methods of activity, rest mode, dynamic mode, and profound rest mode. The ongoing working framework (RTOS) and Wi-Fi stack about 80% of the preparing capacity to be accessible for client application programming and improvement. [4]

Figure 3.3.2: Node MCU 1.0(ESP8266 12-E Wi-Fi) [4]

3.3.3: Liquid pH Meter

Simple pH meter V2 is explicitly intended to gauge the pH of the arrangement and send back the acridity or alkalinity. It is usually work in different applications, for example, aquaponics, aquaculture, and ecological water testing.

As a redesigned adaptation of pH meter V1, this item extraordinarily better the exactness and client experience. The installed voltage controller chip gives a wide voltage supply of 3.3~5.5V, which it fits with 5V and 3.3V fundamental control board. The yield sign filter by equipment has low jitter. The product library influences the two-point adjustment strategy. And furthermore can naturally recognize two standard cradle arrangements (4.0 and 7.0), so straightforward and proper

. The pH is a worth that figure the sharpness or alkalinity of the arrangement. What's more, It is likewise called, the hydrogen particle fixation file. The pH is the size of hydrogen particle movement in arrangement. The pH has a spread out scope of

employments in medication, science, and farming. Generally, the pH is a number between 0-14. Under the thermodynamic standard conditions, pH=7, which means the arrangement is unbiased; pH<7, which means the arrangement is acidic; pH>7, which means the arrangement is basic [8]

Figure 3.3.3: Liquid pH Meter [8]

3.3.4: Temperature and Humidity Sensor – DHT22

The DHT22 is an ultra-low-cost and fundamentalcomputerized temperature and stickiness sensor. It employments a thermistor to degree the encompassingdiscuss, a capacitive mugginess sensor and spits out an advancedflag (no require of analog input stick. This sensor is simple to utilize but requires a few time to seize the information. The as it were a drawback of the DHT22 sensor is for every 2 seconds as it werewe are able to get moderninformation from it, appeared we utilizing the libraries, readings of the sensor can be up to 2 seconds ancient. [4].

Figure 3.3.4: DHT22 Digital Temperature and Humidity Sensor Module [9]

3.3.5: Project Board

Project boards are made up of issues, pull requests, and notes that are classify as cards in columns of your choosing. We can also drag and drop or use keyboard shortcuts to re-order cards within a column, move cards from column to column, and change the order of columns.

Venture board cards incorporate significant metadata for issues and drag demands, like names, assigners, the status, and who opened it. Ready to see and make light-weight alters to issues and drag demands inside your extend board by clicking on the issue or drag request's title.

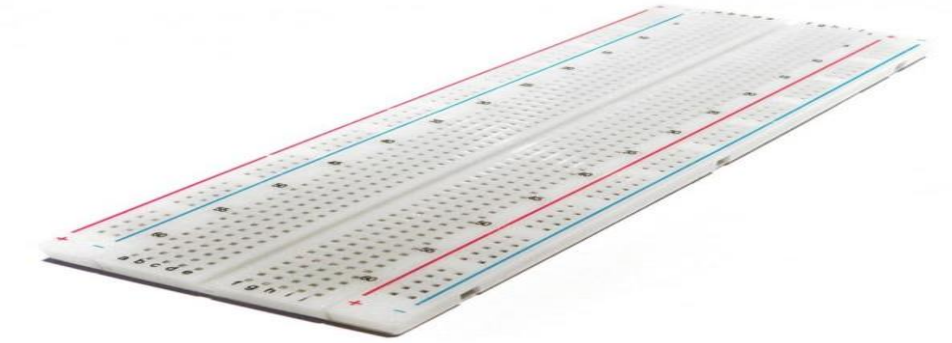


Figure 3.3.5: Project board

3.3.6: Soil pH Meter

It is 2 in 1 pH Meter for soil. It will give Soil Moisture and pH of the soil. Three in one pH meter and soil tester is a perfect tool for every farmer. This handy tool facilitates easy reading of the pH of the soil as well as its moisture and also find out lighting value. This tool represents a clear outline when to water the soil and keep the water content optimal which is essential for its healthy plant growth, the main characteristic of this tool is that it can be used to find out the pH of the soil. Uncommon plants require different pH for their fast and healthy growth. This tool analyses pH and helps you to give us fertilizers as required. [4]

Figure 3.3.6: Soil pH Meter

3.3.7: Soil Temperature Sensor

To calculate the temperature of the soil, utilize an instant-read thermometer made for cooking. Thrust the thermometer's test as profound into the soil as conceivable to induce a correct perusing of the soil temperature.

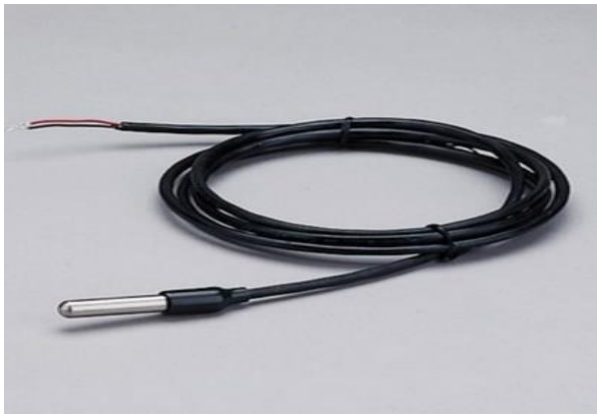


Figure 3.3.7: Soil Temperature Sensor

3.3.8: Battery

Batteries are basically used in PV systems for the explanation behind taking care of essentialness made by the PV show during the day and to supply it to electrical loads as required (during the night and times of obscure atmosphere). Various reasons batteries are used in PV systems are to work the PV display near its most extraordinary powerpoint, to control electrical troubles at stable voltages, and to supply flood streams to electrical weights and inverters. When in doubt, a battery charge controller is on a very basic level used in these systems to shield the battery from cheat and moreover over-discharge.

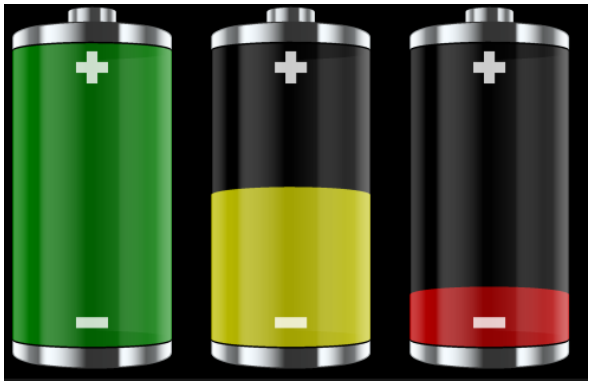


Figure3.3.8: Battery

3.4: Use case Diagram:

A use case diagram at its most straightforward is a portrayal of a client's cooperation with the system that shows the connection between the client and the diverse use cases in which the client is included.

In this process sensors get the values to Node MCU and Node MCU sends data though wireless in Firebase Server. The admin only controls the Firebase server.

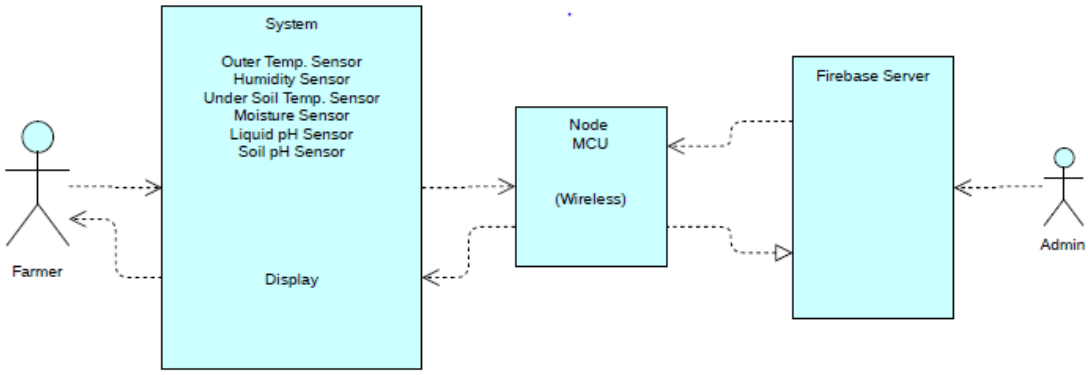


Figure 3.2: Use Case Diagram

3.5 Circuit Diagram

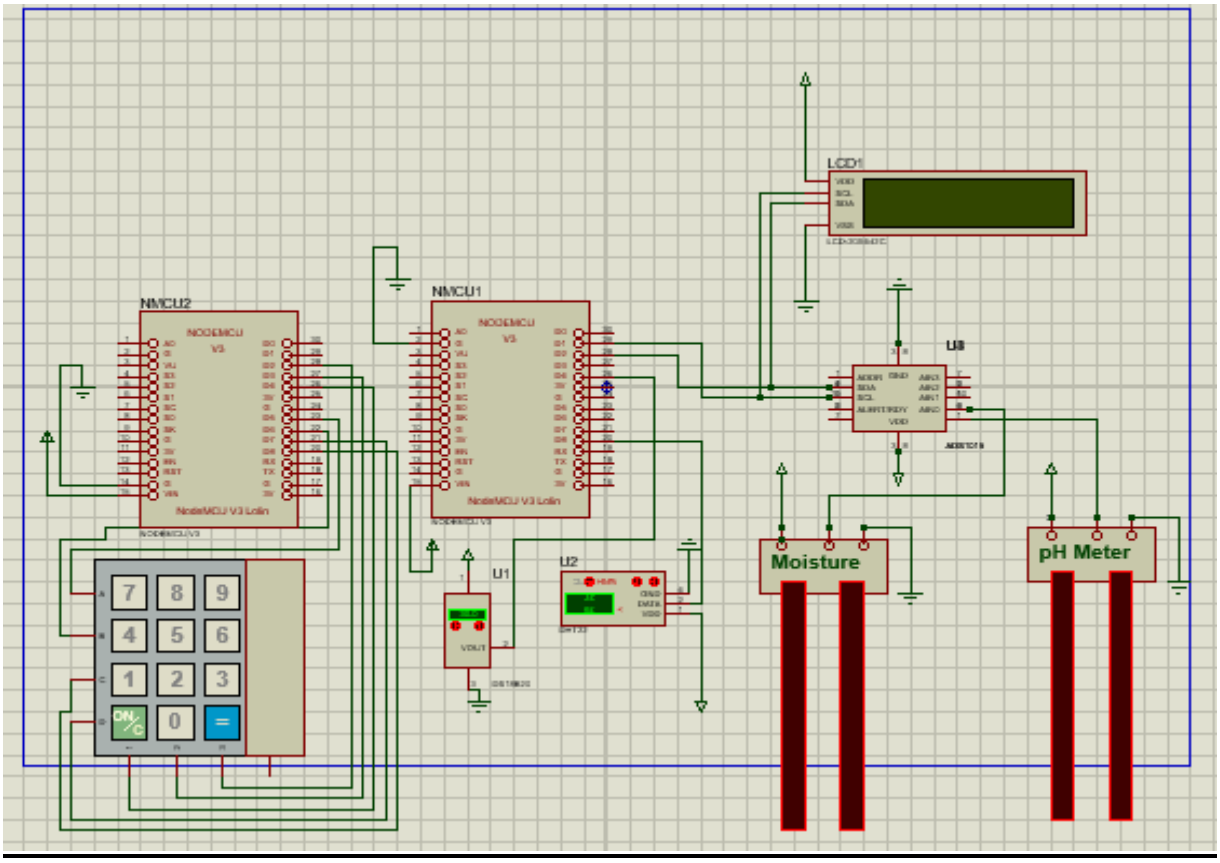
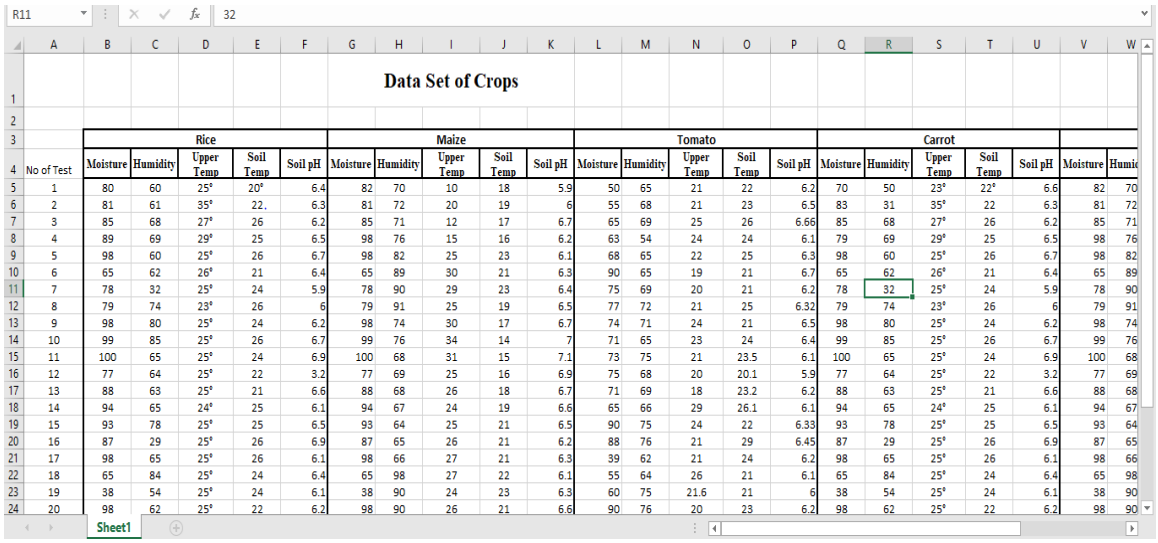


Figure 3.3: Circuit Diagram

3.6 Data Collect Procedure:

First of all, we are collect all of data from Bangladesh Agriculture University (BAU) campus.There are many crops in Bangladesh but we didn't collect all of testing data for our project.We try to verify the data better, that's why we collect some more data from Bangladesh Agriculture Research Council (BARC).We are chose some specific data for our research based project. And some of list are given below:

- Rice
- Maize
- Mung bean
- Tomato
- Carrot
- Mango



Data Set of Crops

		Rice					Maize					Tomato					Carrot						
	No of Test	Moisture	Humidity	Upper Temp	Soil Temp	Soil pH	Moisture	Humidity	Upper Temp	Soil Temp	Soil pH	Moisture	Humidity	Upper Temp	Soil Temp	Soil pH	Moisture	Humidity	Upper Temp	Soil Temp	Soil pH	Moisture	Humic
5	1	80	60	25°	20°	6.4	82	70	10	18	5.9	50	65	21	22	6.2	70	50	23°	22°	6.6	82	70
6	2	81	61	35°	22.	6.3	81	72	20	19	6	55	68	21	23	6.5	83	31	35°	22	6.3	81	72
7	3	85	68	27°	26	6.2	85	71	12	17	6.7	65	69	25	26	6.66	85	68	27°	26	6.2	85	71
8	4	89	69	29°	25	6.5	98	76	15	16	6.2	63	54	24	24	6.1	79	69	29°	25	6.5	98	76
9	5	98	60	25°	26	6.7	98	82	25	23	6.1	68	65	22	25	6.3	98	60	25°	26	6.7	98	82
10	6	65	62	26°	21	6.4	65	89	30	21	6.3	90	65	19	21	6.7	65	62	26°	21	6.4	65	89
11	7	78	32	25°	24	5.9	78	90	29	23	6.4	75	69	20	21	6.2	78	32	25°	24	5.9	78	90
12	8	79	74	23°	26	6	79	91	25	19	6.5	77	72	21	25	6.32	79	74	23°	26	6	79	91
13	9	98	80	25°	24	6.2	98	74	30	17	6.7	74	71	24	21	6.5	98	80	25°	24	6.2	98	74
14	10	99	85	25°	26	6.7	99	76	34	14	7	71	65	23	24	6.4	99	85	25°	26	6.7	99	76
15	11	100	65	25°	24	6.9	100	68	31	15	7.1	73	75	21	23.5	6.1	100	65	25°	24	6.9	100	68
16	12	77	64	25°	22	3.2	77	69	25	16	6.9	75	68	20	20.1	5.9	77	64	25°	22	3.2	77	69
17	13	88	63	25°	21	6.6	88	68	26	18	6.7	71	69	18	23.2	6.2	88	63	25°	21	6.6	88	68
18	14	94	65	24°	25	6.1	94	67	24	19	6.6	65	66	29	26.1	6.1	94	65	24°	25	6.1	94	67
19	15	93	78	25°	25	6.5	93	64	25	21	6.5	90	75	24	22	6.33	93	78	25°	25	6.5	93	64
20	16	87	29	25°	26	6.9	87	65	26	21	6.2	88	76	21	29	6.45	87	29	25°	26	6.9	87	65
21	17	98	65	25°	26	6.1	98	66	27	21	6.3	39	62	21	24	6.2	98	65	25°	26	6.1	98	66
22	18	65	84	25°	24	6.4	65	98	27	22	6.1	55	64	26	21	6.1	65	84	25°	24	6.4	65	98
23	19	38	54	25°	24	6.1	38	90	24	23	6.3	60	75	21.6	21	6	38	54	25°	24	6.1	38	90
24	20	98	62	25°	22	6.2	98	90	26	21	6.6	90	76	20	23	6.2	98	62	25°	22	6.2	98	90

Figure 3.4: Dataset of crops

From the above dataset we are trying to build a data table which are given below. We used average algorithms for this table.

Average = $\frac{\text{number1} + \text{number2} + \text{number3} + \cdots\ldots}{n}$---------- (1)

Rice, Maize Mung bean, Tomato, Carrot and Mango's Moisture, Humidity, Upper Temperature, Soil Temperature Soil pH moderate outcome are given below. By based this value we will find our final expected outcome.

Table 2: Average Value Of crops.

Crops Name	Moisture	Humidity	Upper Temperature	Soil Temperature	Soil pH
Rice	81-100%	60-80%	25° -35° C	20° -30° C	6.5 -7.5
Maize	81-100%	70-90%	10° -30° C	18° -24° C	6.0-7.0
Mungbean	50-75%	70-85%	10° -30° C	20° -30° C	6.2-7.2
Tomato	50-90%	65-75%	21° -24° C	21° -24° C	6.5-7.0
Carrot	60-85%	60-70%	15° -25° C	15° -18° C	5.5-6.5
Mango	70-90%	65-95%	20-45 °C	24° -30° C	5.5- 7.5

CHAPTER 4

Design specification

4.1 Front-end Design

The layer over the back end is the front end and it consolidates all PC program or gear that is bit of a customer interface.Human or propelled customers related explicitly with various points of the front decision of a program, checking client entered data, catches, projects, sites and different features.

Figure 4.1: Front end Design (Apps)

The Working principle of this system is not so complex. Here all the sensors senses the values from soil .Here soil temperature, soil moisture, pH sensor is used I this model

.When the sensors find the values it sends to microcontroller. The microcontroller send the data in a data base and in microcontroller predict a result in a LCD display and Android Apps which is suitable for this soil.

4.2 Back-end Design

A back-end configuration is a sort of programming where makes a coherent information execution of site, programming or any sort of data framework. Back end Development alludes to the server side of improvement where you are on a very basic level fixated on how the site capacities.

Code composed by back end designers is what passes on the database information to the program.Anything you can't see adequately with the eye, for instance, databases and servers are made by a back-end engineer. Our back end is done by:

- Firebase Dataset.

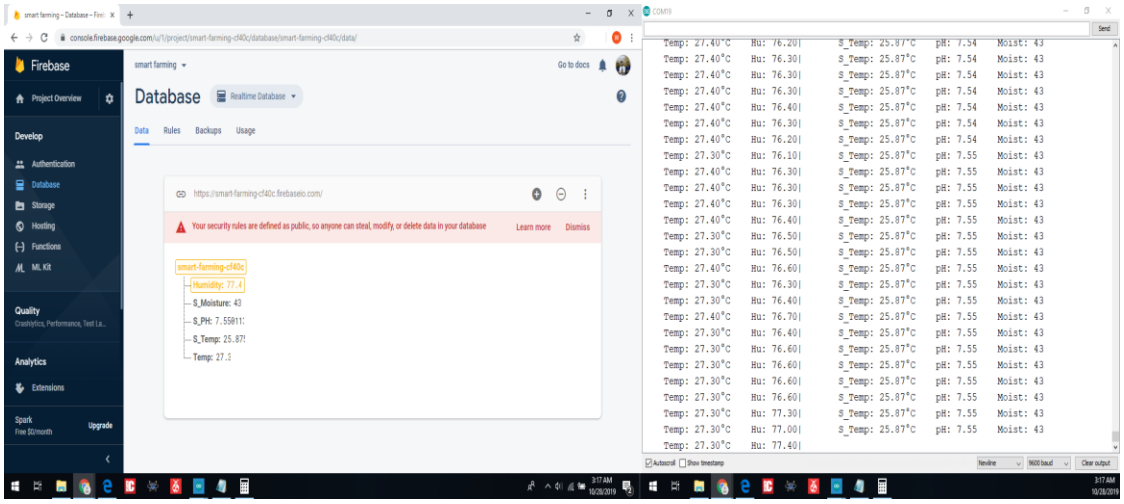


Figure 4.2: Firebase Database

Firebase could be a completely overseen stage for building iOS, Android, and web apps that gives programmed information synchronization, confirmation administrations, informing, record capacity, analytics, and more. Beginning with Firebase is an effective

way to construct or model versatile backend administrations. We use our project firebase database for data stored and real time data.

4.3 Interaction Design and UX

Interaction plan can be caught on in basic (but not rearranged) terms: it is the plan of the interaction between clients and items.

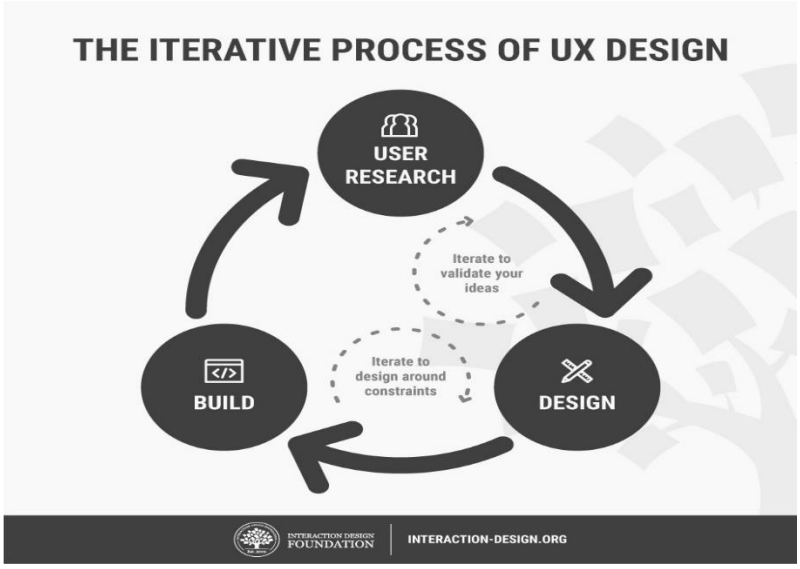


Figure 4.3.1: The iterative process [10]

For Our Projects: First of all we had to collect our all require sensors. Such as (Liquid PH sensor, Moisture sensor, Humidity sensor, Temperature sensor). Finally we had to face silly problem to collect Soil pH sensor.

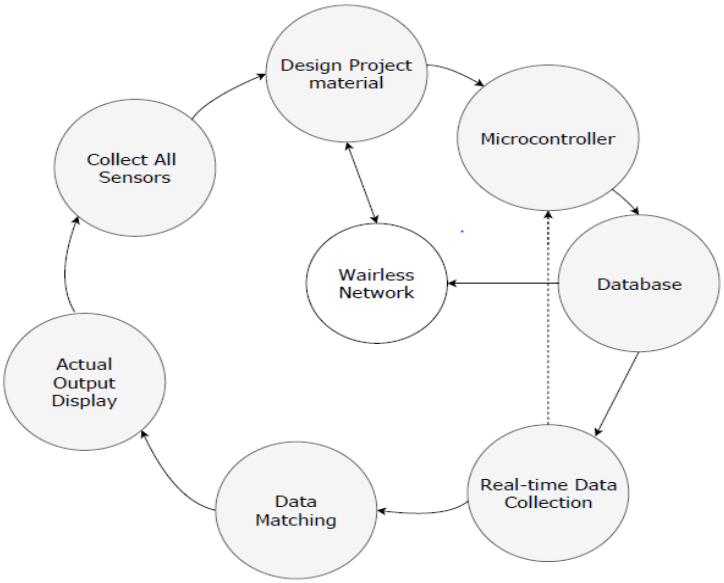


Figure 4.3.2: Interaction Design

Then we had to simulate design our method. Such that circuit diagram, Use case Diagram, Business process model. That this process depends on wireless networking. Then all data are stored in cloud via micro-controller. Micro-controller also can store data and data process in its memory. But we need real time data. That's why we use firebase database. Next step is that we had to matching between our data of all sensors and database values. Finally we have to say that, in this Ux design here all of circle are inter-connected with each other.

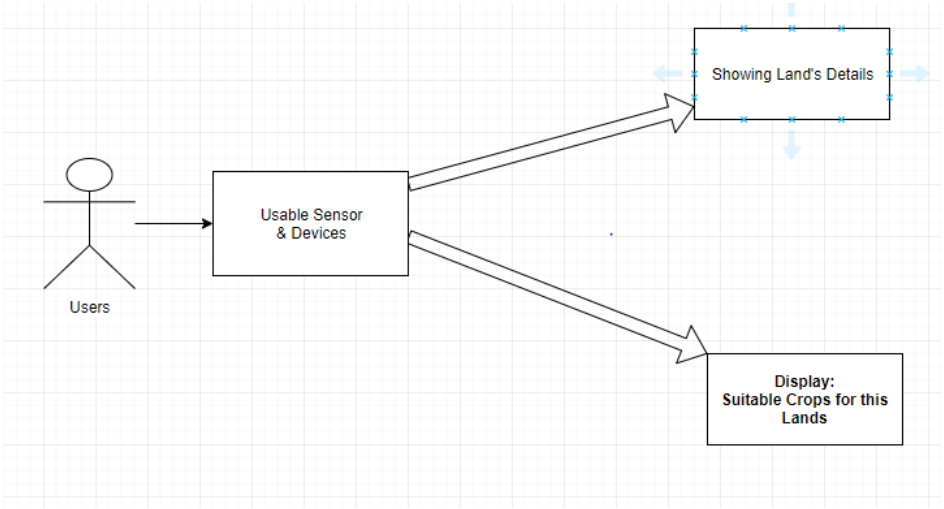


Figure 4.3.3: User's Interface

4.4 Implementation Requirements

In implementation we are using 5 kind of sensors. Such that:

- Soil Temp. Sensor. (Upper)
- Soil Temp. Sensor (Inside).
- Humidity Sensor.
- Moisture Sensor.
- Liquid pH Sensor.
- Soil pH Meter.

For Implementation, we must need this sensor.The foremost principal region for encourage investigate lies in the design and improvement of modern sensors suited to agricultural applications. Sensors for dampness and temperature of soil are commercially accessible but are subject to fetch constrains. Cheap soil dampness and temperature sensors are a requirement, particularly in creating countries, where small scale ranchers cannot bear the tall costs of available sensors. pH sensors, in spite of the fact that accessible, are rare, and also very expensive. Those that are comparatively cheaper are not digital and cannot be promptly coordinates with ICT infrastructure.

Then all data are stored in cloud via micro-controller. Micro-controller also can store data and data process in its memory. But we need real time data for give Output.

CHAPTER 5

Implementation and testing

5.1: Introduction

Implementation is the method that turns methodologies and plans into actions in arrange to achieve key goals and objective. Execution testing, by and large, alludes to the method of testing usage of specialized details. Quality test materials moreover offer assistance move forward the conformance of usage by giving strategies of checking conformance to well-defined criteria in a steady way.Testing is required for the practical execution of adventures. It's Imperative to ensure that the application should not bring about any mistake since it very well may be particularly exorbitant inside the future or the subsequent phases of improvement.

5.2 Implementation of Database

The execution sort out is the put you present the DBMS on the perfect device, update the database to run best on that gear and programming organize and make the database and weight the information. The key information may be either unused information has gotten obviously or existing data imported from any DBMS. Makers also make database security in this sort out and give the different customers that architects perceived to get to reasonable to their necessities.

The taking after are the steps within the usage stage:

- Create FIREBASE Database.
- Tune the setup factors as demonstrated by the equipment, programming, and use conditions.
- Create database tables.
- Load the data from sensors.
- Set up the security.

5.3 Implementation of Interactions

To make our system (IoT Based Smart Farming) interactive we use the large display for showing value and final results. Too, we construct a well-strong server for a hassle-free benefit. The plan of the framework is user-friendly. When the user place all the sensor in correct way it will able to show all the sensors data and show a prediction result that easy to understand.

5.4 Testing Implementation and Report

Implementation testing and report is the most important part in a development project. In this way we verify the output is it give the expected output. When we execute the system it will clarify the testing result. For specific sensors it will get us unique results. Testing in every sensor will get the results for different objects to give output which is a running process.

TABLE 3: TESTING REPORTS

Test No	**Test Input**	**Expected Outcome**	**Obtained Outcome**	**Status**	**Date**
Object 1	Upper Temp Under Soil Temp Moisture Value Liquid pH Value Soil pH Value	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2019
Object 1	Upper Temp Under Soil Temp Moisture Value Liquid pH Value Soil pH Value	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2019

Object 1	Upper Temp Under Soil Temp Moisture Value Liquid pH Value Soil pH Value	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • Yes	Pass	29 October, 2019
Object 1	Upper Temp Under Soil Temp Moisture Value Liquid pH Value Soil pH Value	• Get sensor value • Successfully store in database • Predict the result	• Yes • Successfully stored • No	No	29 October, 2019
Object 1	Upper Temp Under Soil Temp Moisture Value Liquid pH Value Soil pH Value	• Get sensor value • Successfully store in database • Predict the result	• No • Successfully stored • Yes	Fail	29 October, 2019

5.5 Summary

In this chapter after doing all the testing, we got that the sensors plays a great role. Without sensor it's quit impossible to get output in this system. As an example if the soil moisture sensor can't get the input it won't store in data base and also it can't predict the result. Not only soil moisture but also all the sensors are most important and initial part on this system. If the sensor senses the values it will sends it though wireless device in database which is store. If any error happens for store in database it will not store. If it is no data store in database we will not find it in database. After all the steps final stage is predicting. If the values are valid then it gives a suitable result. If the sensors range cross the given range in code part which not match will give prediction wrong. So placing sensor is most sensitive objective in this system.

CHAPTER 6

Conclusion and future scope

6.1 Introduction

In this stage, we will discuss the results which we get from this system, conclusion, recommendation of and implication for future research of the study in the agriculture sector, first, it'll be examined the major discoveries of each study as affirmed within the investigate destinations, the moment the conclusion from the discoveries of the ponder, in conclusion the inquire about will propose proposal of the think about and zones future inquire about.

6.2 Summary of the Study

In this project to increase the productivity for the land by predicting crops. By the sensors we get the values and predict suitable crops for the testing land. Sensors get the values from the soil. By the microcontroller getting values store in database though microcontroller and also predict output shows in LCD display and Android Apps.

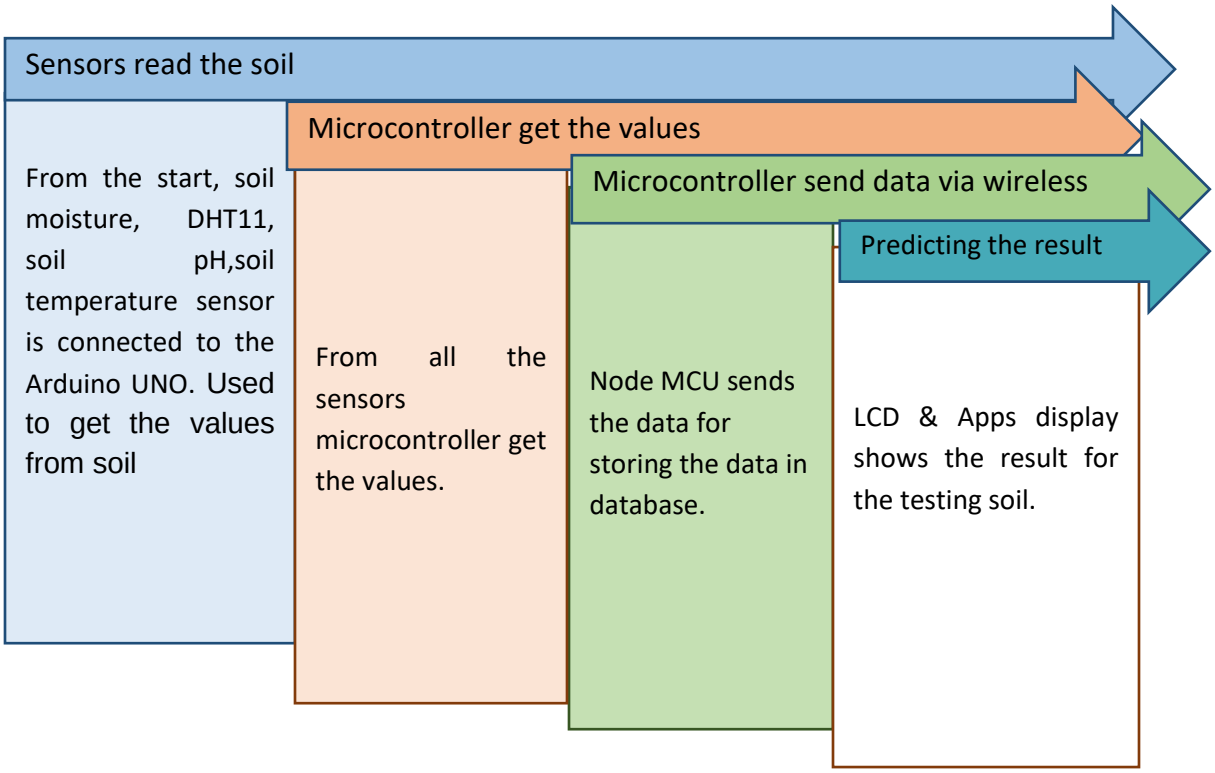


Figure 6.1: Work flow of the study

6.3 Scope for the Further Developments

In the agriculture sector there are many scope to develop this system. This system features will upgrade day by day for a better experience. The unused highlights will be included based on client feedback. System can be implemented by new User Interface if needed. As an example we use LCD display & Apps for the output. Here we can use prediction and also can add a web page to show on it. Further we can also use.net application for the User Interface. In this system we can also add some sensors like NPK sensor which gives us Nitrogen, Potassium and Phosphorus values. These values can be used as the lacking fertilization. It can makes the system suggesting the fertilizer for the testing soil.

6.4 Conclusion

In this paper, we provide an approach of a specific soil to predict suitable crops to grow. We used 4 sensors which gives 4 different values. The sensors give microcontroller as an input. Microcontroller take decision though conditions and get a suitable crops which store in database. The outcome we've accomplished is truly encouraging. Hopefully this approach will be pursued and developed in future as part of further contributions in agriculture sector and play an important role to increase the productivity of the crops.

REFERENCES

[1] Anand Nayyar,Er, Vikram Puri "IoT Based Smart Farming Stick Using Arduino and Cloud Computing." The International Conference on Communication and Computing Systems, 2016

[2] P. Sindhu, G. Indirani, "IoT Enabled Soil Testing", ISSN: 2249-0701, Vol.7 No.S1, pp. 54-57, 2018

[3] K. Spandana, Sai, Supriya KPL. "A Survey on Soil Quality Testing using Sensors in Smart Agriculture for Crop Production and Maintenance using Internet Of Things (IOT)" ISSN: 2231-5381, International Journal of Engineering Trends and Technology (IJETT) – Special Issue – April 2017.

[4] Nikesh Gondchwar, Prof. Dr. R.S.Kawitkar, "IOT based Smart Agriculture", International journal Of Advanced research in computer and Communication Engineering (IJARCCE), Vol. 5, Issue6, June 2016.

[5] D S Suresh, Jyothi Prakash K V & Rajendra C J, "Automated Soil Testing Device", ISSN (PRINT) : 2320 – 8945, Volume -1, Issue -5, 2013

[6] R. Nageswara Rao, B. Sridhar, "IoT based smart crop-field monitoring and automation irrigation system", IEEE Xplore Compliant - Part Number: CFP18J06-ART, ISBN: 978-1-5386-0807-4; DVD Part Number: CFP18J06DVD, ISBN: 978-1-5386-0806-7, 2018.

[7] "LogicInside Soil Moisture Sensor Module", Available at <<https://www.flipkart.com/logicinside-soil-moisture-sensor-module/p/itmetg8kuxmbhxjh >>, [Last accessed 15 October, 2019 at 7.00 pm]

[8] "Analog PH Sensor/Meter Kit V2", Available at <<https://www.dfrobot.com/product-1782.html>>, [Last accessed on 23-10-2019 at 10.00 AM]

[9] "DHT22 Digital Temperature and Humidity Sensor Module", Available at <<https://bit.ly/2rBwN5P>>, [Last accessed 2 November, 2019 at 7.00 pm]

[10] "The iterative design of UX Design", Available at <<*https://bit.ly/36tn95x*>>, [Last accessed on 24-10-2019]

[11] M A H Chowdhury; M S Hassan, "Hand Book of Agricultural Technology", Bangladesh Agricultural Research Council, 2013, 230p.

APPENDIX

Appendix:

From the Fall-2018 Semester, we had started our journey to make a system through that we can know which crops are suitable for the selected land that can helpful for the Agriculture sector. A farmer can benefits though this system. We also thought about an easy and hassle-free system so it can be saved valuable time. We followed the model to implement and monitor our system with the all hard work and spending a lot of time and finally, we were able to reach our goal at last. This is our keen believe that our — IoT based Smart Farming System will have a useful and positive thing for the users. Very soon we will ready to upgrading our system with a regular basis as it required.

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