Development of IoT based Smart security and Monitoring System for Agricultural Farm

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Submitted in partial fulfilment of the requirements
of the degree of Bachelor of Science in Computer Science and Engineering

June 28, 2021

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Abstract

In a smart agricultural farm every component and devices are always monitored using a smart device. Smart agriculture has come across a major change in the modern agriculture era. And also have a major impact in the IOT sector. We are on the verge to have an enormous amount of computer resource to be provided also with the storage as we will deal with great amount of data. We are focusing on latest technologies like sensors to IOT to have a great change in the field of agriculture by collecting data from soil and then find the best optimal solutions for any situation. We worked our way with several types of sensors and learned how to get devices working like a proper IOT system. Our main work was based on the sensors that we needed to accomplish our goal. We also researched our way into how we are going to have a transparent relation between software and the hardware. This system will always provide precise information about the elected farm's soil moisture, temperature, humidity and unwanted trespassing. We first researched on the devices and how it can be implemented. There we faced several challenge and overcame with major success. This research will provide smart approaches for a proper smart agricultural farm and also come up with the solutions also.

Acknowledgements

Our work would not have been complete without the contribution, assistance and support of many peoples throughout this trimester. We would like to express my gratitude to everyone who contributed to it in some way or other.

First, we would like to thank our project supervisor, Sumon Ahmmed Sir. He is the one who envisioned our project and gave us a clear idea about the IOT in agriculture. He gave us a complete idea about the project and let us think and plan it in our own way.

Our sincere gratitude goes to Hasan Sarwar Sir. He is our course teacher. He taught us on how a project should be planned. And let us create a project a plan which we followed and were able to deliver our weekly goals successfully.

Last but not the least, We owe to our family including our parents for their unconditional love and immense emotional support.

Publication List

[Optional] The main contributions of this research are either published or accepted or in preparation in journals and conferences as mentioned in the following list:

Journal Articles

1.

Conference Papers

1.

Additional Publications

Following is the list of relevant publications published in the course of the research that is not included in the thesis:

1.

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Chapter 1

Introduction

In the following section we are going to know about the main planning state of our project. Here all the information about the thought process and total birds eye view is going to be stated. The objectives and why we thought of choosing such problem is being discussed in this state.

1.1 Project Overview

The project is based on IOT and completely revolves around the synchronization of the software and hardware. Here we planned and thought of how an agro farm can be smart and be one step ahead of any other agricultural farm by the help of modern technologies. The main concern is will the good connection between hardware and operating with software will be without errors. That is what we seek to accomplish through this project.

After the end of this system we are going to have a great monitoring system which will work as a security system and make sure that the agricultural farm is always being conducted in a great manner. Always be sure of the quality of the agro farm as it is always being occupied by modern technology and being conducted via experts to ensure no harm comes to the way. A feature also implemented as the Anti-Trespassing technology where unwanted entry at non-suitable hours is going to be prevented. So even at off-hours we can assure to have a safe farm.

Major problems for the systems applied in an agro farm has always been a hassle to deal with for every agro farm owners. They could not ensure quality. They had to themselves check the moisture level, temperature and many other aspects. But now by the help of this system. They can be sure of the quality for the agro farm and be relieved at all costs. As they are investing into the security and management of the agro farm.1.1

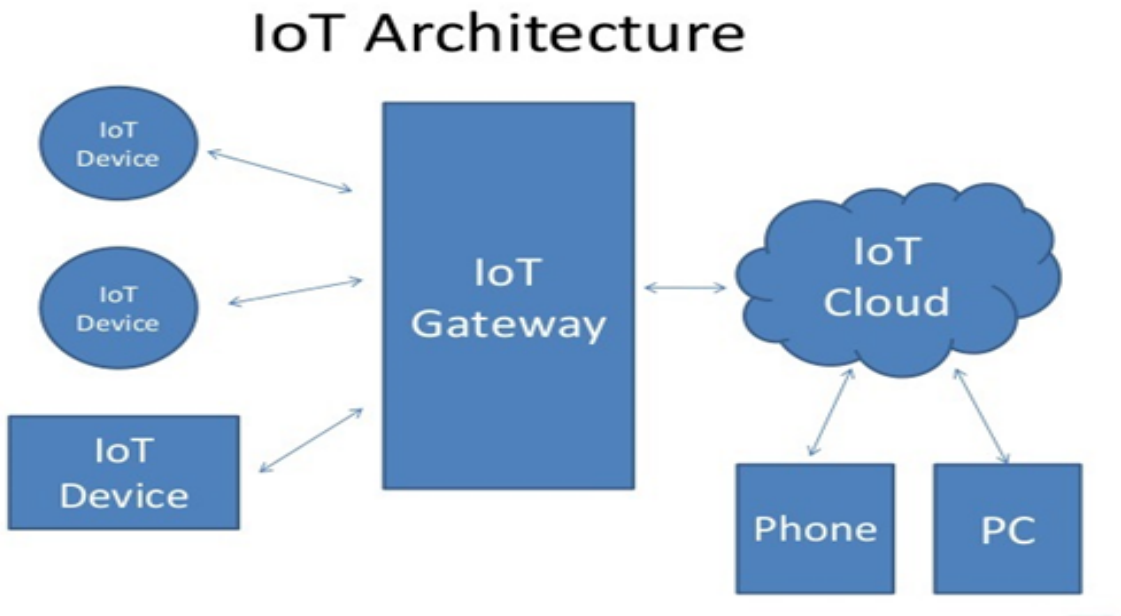

Figure 1.1: IoT Agriculture

1.2 Motivation

Here the main facts that motivated us to make possible changes and having a good impact in the field of agriculture:

1. Rapid shrinkage of agricultural land
2. Population growth
3. Inadequate supply of agricultural inputs like fertilizers and seeds
4. Climate change
5. Lagging technology

1.3 Objectives

Objectives are the main possible solution of every aspect which can be considered as big change in the project. Here main objectives or goals for us are:

1. Ensuring the security of an Agro farm
2. Ensuring the quality of an Agro farm
3. Checking the temperature, humidity, soil moisture etc.
4. Controlling service according to weather demand
5. Human presence detection at certain times

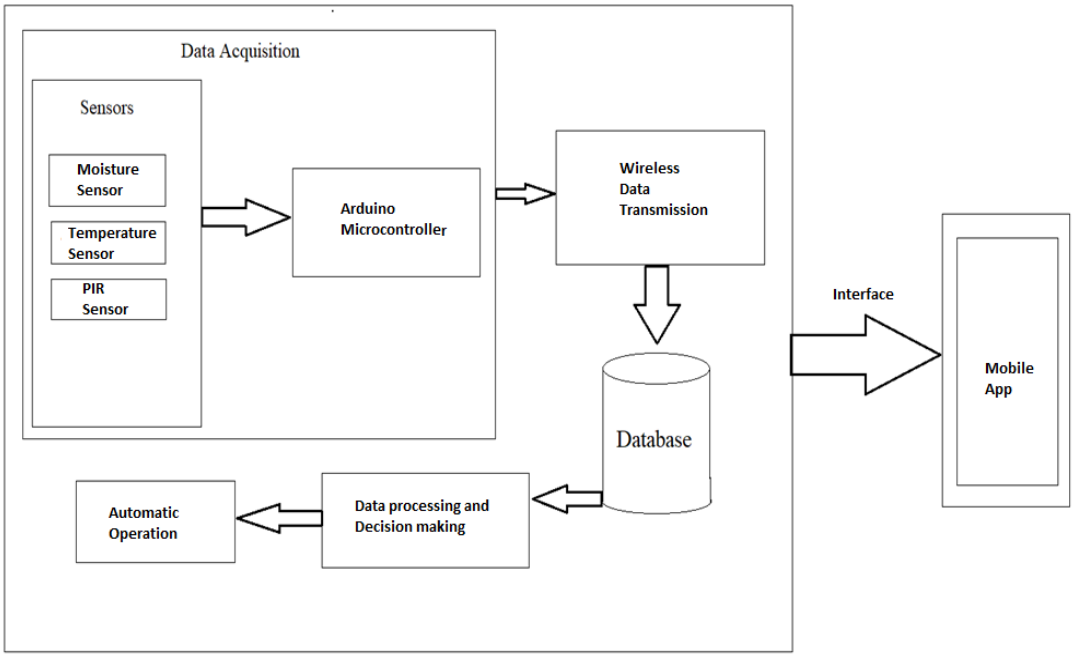

Figure 1.2: Basic Model of Agro farm

1.4 Methodology

The proposed system as shown in the Figure-1.2 will be developed for monitoring the agricultural farm and ensure quality. The system is going to appear in a mobile app where any person can see the state of the agricultural farm. Here the user can see the soil moisture, temperature, trespassing and humidity of the agricultural farm. After getting the data the user will be able to know the condition of the farm and what are the steps needed if any kind of problems occur.

The main part of the system as shown in the Figure-1.2 is the arduino or the microcontroller. After doing necessary computations on the following device the result is going to be shown in a mobile app. As environmental conditions will most certainly affect the overall yield of the crop.For that reason the modules are going to be used. The arduino is going to check four conditions:

1. Temperature of the farm
2. Humidity of the agro farm
3. Soil moisture of the agro farm
4. Trespassing at certain hours

1.5 Project Outcome

After accomplishing the objectives the main outcomes of the project will be:

1. Ensuring the moisture level of the soil
2. Having precise water level
3. Keeping sure of the temperature
4. Preventing unexpected entrance
5. Monitor the farm with proper care

1.6 Organization of the Report

Every data will be organized and computation is going to be done in the arduino. All the features will be shown in the mobile app. There also going to be a section in mobile app where weekly report is going to be generated. So after entering the weekly sector there will show an overall report that what was the average condition of every state.

Chapter 2

Background

In the following chapter after discussing the objectives and the solutions. There comes a part on researching on other similar system. The main motives, objectives, accomplishments on this agricultural field and what was the approach. This is more like a benchmark analysis. For any kind of project benchmark analysis is always a key to know our own objectives by understanding other products. By comparing the objectives we can have a clear vision on the future.

2.1 Preliminaries

This can be considered as the big picture of any project. In this section we see on the steps necessary to be stated in any project. Here we discuss what are the major impacts our project is going to develop. Important modules needed and the software which will help us do the following computations and show in a mobile application.

After doing the research. The knowledge that we gather about are:

1. Modules
2. Software
3. Connections
4. Data acquisitions
5. Reformed objectives

2.2 Literature Review

This section is where we are going to show the analysis that we have done throughout studying several research papers.

The below table shows the issues, obstacles, and future works pointed out from the research papers:

Table 2.1: Table on the Literature Review

Title of the research paper	Objectives	Problems faced	Future plans
IoT Based Smart Agriculture System	1. Having adequate water level. 2. Ensure complete water supply. 3. Checking moisture level.	Establishing connections with the system and showing data in mobile applications.	Having a better community with UBIDOTS.
IOT BASED SMART SECURITY AND MONITORING DEVICES FOR AGRICULTURE	1. Ensuring soil moisture 2. Anti-Tresspassing system with the help of PIR sensor	As the system was first created for a local state. It was difficult to accomplish success if applied in a high scale of agro farm.	In future adding water consumption lesser and having a system with less power consumption is the next goal.
IOT BASED SMART SECURITY AND MONITORING DEVICES FOR AGRICULTURE	1. Auto irrigation system 2. Automatic water wiping	Implementing Drip irrigation system which makes the efficient use of water and fertilizer.	Utilizing the use of water and less power consumption.
Use of IOT for Smart Security Management in Agriculture	1. Water management 2. weather forecasting 3. cannel management 4. grain stores management 5. crop production management	Finding crop management system and grain store management.	Applying machine learning and deep learning techniques.

IOT Based Smart Security and Monitoring Devices for Agriculture	1. Controlling water use in an agro farm 2. Automated Irrigation system 3. Full wireless controlled devices	While implementing automated water supply system.	As water is a source of life so saving water and unused water to be sent back to the tank to be used for later.
Development of Iot based Smart Security and Monitoring Device using Digital Defence for Agriculture	1. Live camera to monitor the state of the farm 2. Include PIR sensor to sense trespassing	Establishing connection with app for the live camera system	The system to keep under surveillance all the time. And be able to see live footage from anywhere.
IoT Based Smart Farm Monitoring System	1. Checking the humidity of the farm 2. Checking temperature of the farm 3. Checking soil moisture of the farm	Making the hardware and software connection and let it work precisely by the help of the microcontroller.	The automated irrigation device may be triggered when soil moisture content is going under the brinkstage
Development of IoT based Smart Security and Monitoring Devices for Agriculture	1. Identifying rodents 2. Identifying threats for the crops 3. Viewing field using camera	Using application in a state where the field can be in danger randomly.	Will be able to provide real time data transmission while keeping quality

IoT BASED SMART AGRICULTURE MONITORING SYSTEM	1. To update farmers with the new technology and to avoid manual labour. 2. To reduce wastage of water and enhance productivity of crops by providing them ideal condition. 3. To meet the difficulties such as severe weather conditions and advancing climate change, and environmental consequences resulting from intensive farming practices. 4. Design a model and connect it to the android app and cloud server.	1. Cost ineffective 2. Standard testing time for NPK	The future scope of this project could be including variety of soil sensors like pH sensor, Rain sensor and then collecting and storing the data on cloud server. This would make the predicting and analysing processes more accurate.

Internet Of Things(IoT) for Smart Agriculture And Farming In Developing Nations	1. The real time data about crop, environment and cattle help to act immediately improving yield. 2. Detection diseases and malfunction at early state so that problem can be isolated and resolved. 3. The climatic change record can help to maintain condition of green house.	1. While acquiring small bandwidth 2. When getting Low latency 3. Unable to get low power requirement 4. Aqcuiring low complexity	1. Getting anti-theft system 2. Having easier for system implementation 3. Having available systems for ecommerce sites and internet based market system

2.3 Summary

Main purpose of this system is that we are going to provide total security insurance of the agricultural farm. And also keep a sector for monitoring it as this fulfills our main purpose also. By the end of the work user will be able to login via Mobile App and can see the soil moisture, temperature, humidity and unwanted trespassing in the agricultural farm.

Chapter 3

Project Design

Project design is the phase where we discuss about how we are going to setup and organise the project. In this part a main prototype design will be shown and thinking process of the project will be showcased. This is one of the major parts of a project. By reading this chapter anyone can easily get to know on how we designed and thought of completing the project.

Every chapter should start with 1-2 sentences on the outline of the chapter.

3.1 Requirement Analysis

In this part we are going to show the tasks and for the following tasks the tools that we needed to accomplish the project.

The main tasks of our project are:

1. Adopting new technologies in Agro farms
2. Will always be assured of the safety of the farm
3. Be able to keep track of the progress
4. Ensure the quality through the monitoring system
5. Balanced maintenance
6. Environmental safety
7. Digitization of Agro industry

Hardware which were needed for the following project are stated below:

1. Capacitive Soil Moisture Sensor(3.3)
2. DHT11 Temperature and Relative Humidity Sensor Module for Arduino(3.2)
3. Arduino Uno R3(3.1)
4. Breadboard(3.6)
5. LCD Display (16X2)(3.4)
6. Automatic Infrared PIR Motion Sensor Switch 12V(3.5)
7. Arduino Ethernet Shield W5100(3.7)

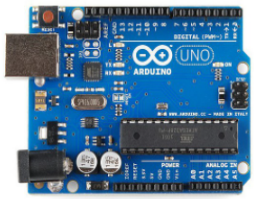

Figure 3.1: Arduino UNO R3

Figure 3.2: DHT11 Temperature and Relative Humidity Sensor Module for Arduino

Figure 3.3: Capacitive Soil Moisture Sensor

Figure 3.4: 16x2 LCD Display

Figure 3.5: PIR Sensor

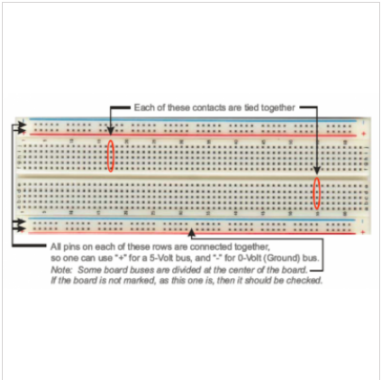

Figure 3.6: Breadboard

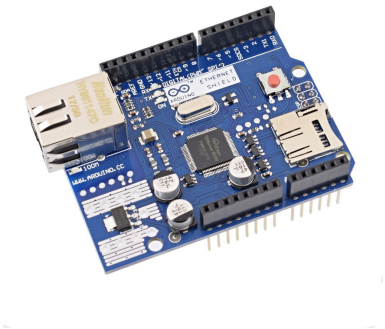

Figure 3.7: Arduino Ethernet Shield WS5100

3.2 Methodology and Design

If considering the solutions that we gathered does not give our cherished outcome. Then there is an alternate solution.

1. Message alert except Mobile App notification

Because if mobile app development does not go under as planned then message notification is going to be the next move. As it is much more easier version. But it will have some drawbacks such as that there is not going to be a dynamic view of the features.

2. Monitoring system be shown in raspberry pi except mobile app

In the following process the user cannot be able to see the features from anywhere in farm. User must be in front of the monitor. Though it will not be relaxing model as the mobile app but it will get the work done in a static way.

2. Without any App or monitor show data in every section of the other field

In this process no Mobile App or Raspberry Pi is not needed. Here as there will be lanes in the field. So people will be able to see the progress and state of different aspects. But for this they have to visit the whole agro farm which is a tiresome thing for any user.

3.3 Summary

Here after collecting methods, completing processes of the following project. All that comes down to the design fact that it has advanced our way to the completion of the project. And has let us accomplish all the objectives that we had wanted to get over the past couple of months. As per the requirements.

Chapter 4

Implementation and Results

Implementation is the part where we have assembled a few works of our system and did a test run on the following project. Here we have completely accomplished our goal but yet a minor achievement has been unlocked by the help of this.

4.1 Environment Setup

Here we have done test on the basis of soil moisture and also the temperature and humidity sensor. For the soil moisture we have used The Capacitive soil moisture sensor(3.3). With the help of the soil moisture sensor we are going to acquire the moisture of the soil on percentage value.

And we will do a test on the humidity and temperature using the DHT11 temperature and humidity sensor(3.2). After completing the testing we will get our data of the temperature and humidity of the following area.

All the testing has been done on a normal environment. After progressing to further work and research we will implement it in a real agricultural farm environment.

Figure 4.1: Soil moisture sensor implementation

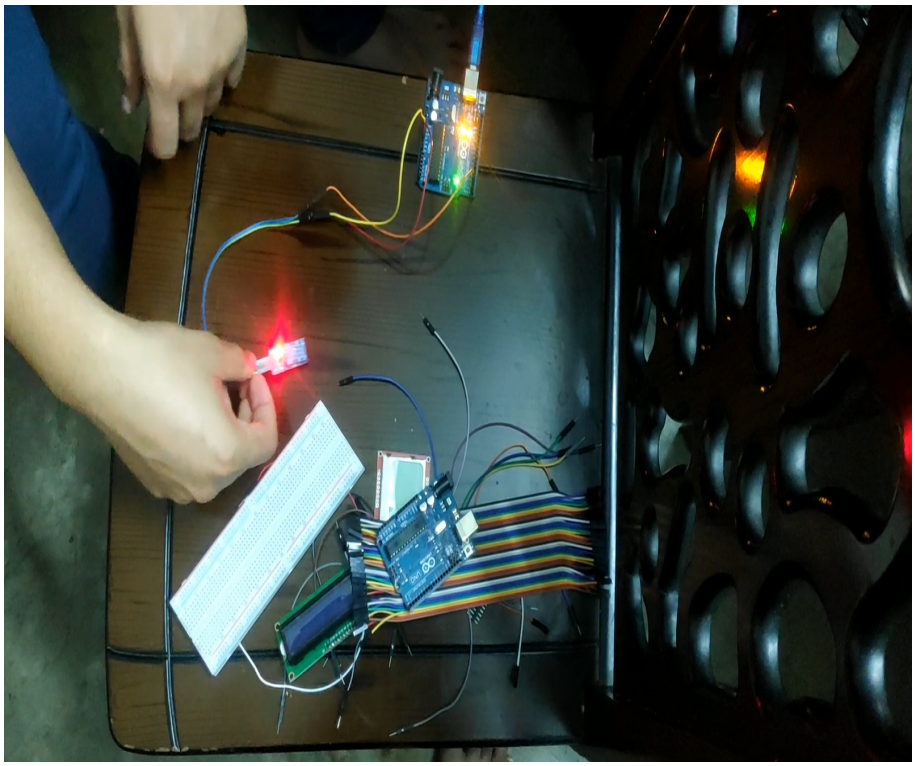

Figure 4.2: DHT11 sensor implementation

4.2 Evaluation

Here the tests that we did using the capacitive soil moisture sensor. Where both the system testing has been done separately. As shown in the Figure-(4.1) and Figure-(4.2).

The code implementation parts for the both sectors is now being shown below.

Code Implementation Demonstration

Soil Moisture Sensor

In the following section we are showing on how we checked the soil moisture . Here we are going to show the software part as hardware part has been shown in Figure-(4.1).

We worked with the hardware and transmitted data to the Database. Necessary hardware and software information is stated below.

1. Arduino UNO R3 (Hardware)
2. Capacitive Soil Moisture Sensor (Hardware)
3. Breadboard (Hardware)
4. Jumperwire (Hardware)
5. ARDUINO (Software)
6. PHPMYSQL (Software)

We then ran code and got the readings in both the serial monitor and Database.

In the following section we are showing on how we checked the temperature and humidity . Here we are going to show the software part as hardware part has been shown in Figure-(4.2).

We worked with the hardware and transmitted data to the Database. Necessary hardware and software information is stated below.

1. Arduino UNO R3 (Hardware)
2. DHT11 Temperature and Humidity Sensor (Hardware)
3. Breadboard (Hardware)
4. Jumperwire (Hardware)
5. ARDUINO (Software)
6. PHPMYSQL (Software)

We then ran code and got the readings in both the serial monitor and Database.

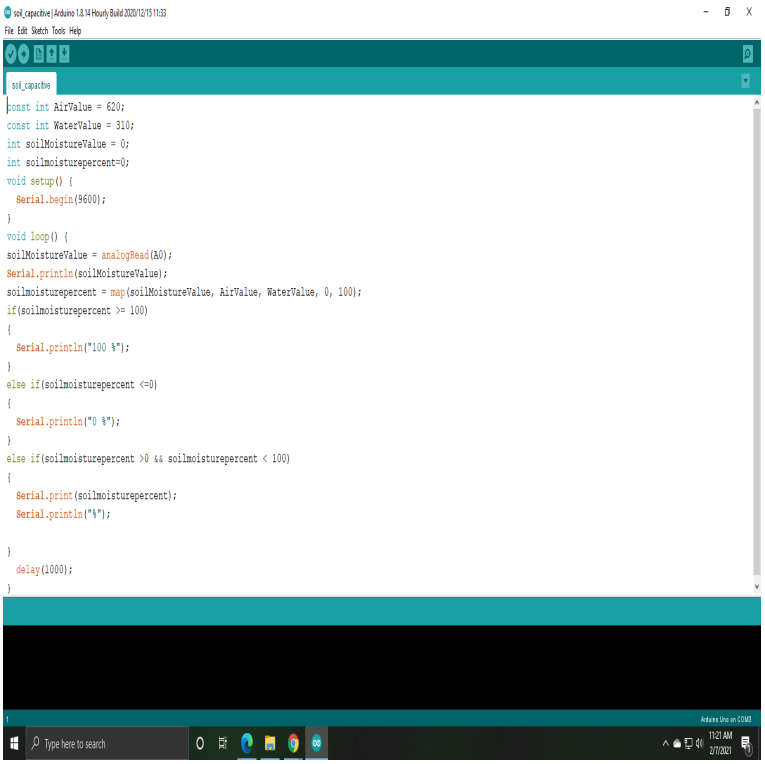

Figure 4.3: Soil Moisture Sensor Code in Arduino

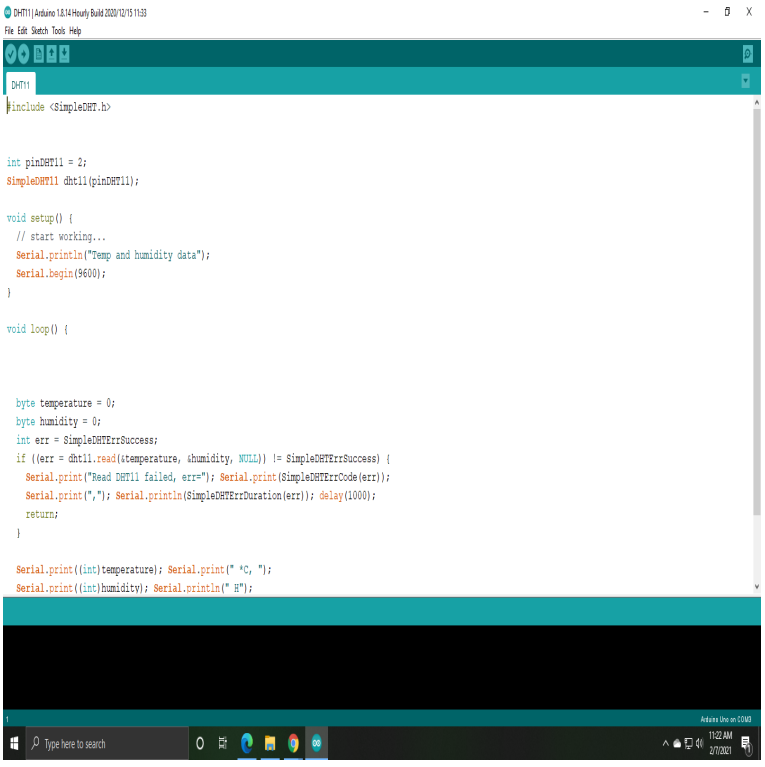

Figure 4.4: DHT11 Temperature and Humidity Sensor Code in Arduino

4.3 Results and Discussion

Here the tests done before the results will be shown and how we received the data.

The soil moisture readings have come in percentage as shown in the code in Figure-(4.3). We have got the three state readings.

First one we tested the Moisture Sensor in Water and saw 100%. Then we collected the data by putting the sensor in the soil. And saw it shows 0-1%. Then after putting water into the soil the percentage gradually increases starting from 2-14%. Shown in the Figure-(4.5) and then Data is sent to the Database as shown in the Figure-(4.7).

So here 2 works are done:

1. Showing data in Serial Monitor
2. Sending data to the Database

Mainly for the future purpose of proposing the data and getting it under a mobile application data storage is key. For that reason we have used Database to store the data and send the data into the mobile application. Where the user will be able to see the real results.

The temperature and humidity readings have come in temperature and humidity format and Celsius and Fahrenheit format as shown in the code in Figure-(4.4). We got the readings and shown in Figure-(4.6)

Here we mainly did the work of obtaining data from the DHT11 Temperature and Humidity Sensor and send the data directly to the database. From there we can proceed to work with the Data obtained from the sensor. As shown in the Figure-(4.8)

So here 2 works are done:

1. Showing data in Serial Monitor
2. Sending data to the Database

Mainly for the future purpose of proposing the data and getting it under a mobile application data storage is key. For that reason we have used Database to store the data and send the data into the mobile application. Where the user will be able to see the real results.

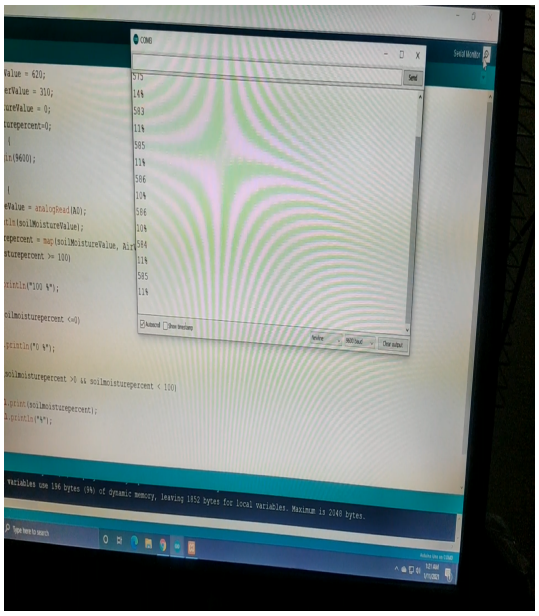

Figure 4.5: Soil moisture in serial monitor

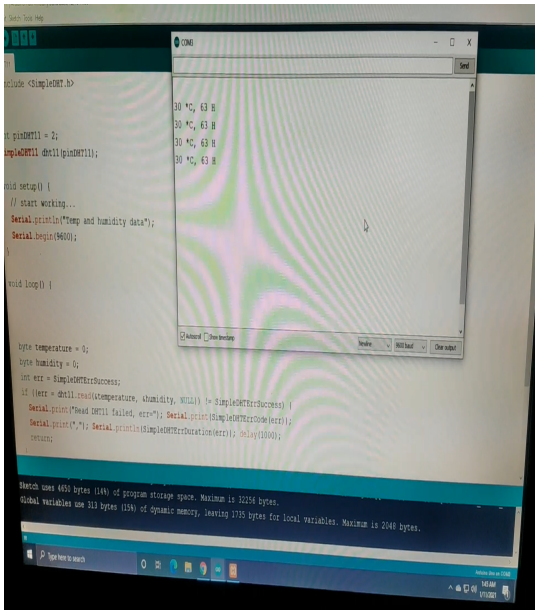

Figure 4.6: Temperature and Humidity in serial monitor

+ Options

	id	moisture	date
Edit Copy Delete	15	14	2021-01-11 01:18:18
Edit Copy Delete	16	100	2021-01-11 01:18:23
Edit Copy Delete	17	74	2021-01-11 01:18:29
Edit Copy Delete	18	0	2021-01-11 01:18:44
Edit Copy Delete	19	85	2021-01-11 01:18:52
Edit Copy Delete	20	0	2021-01-11 01:39:35
Edit Copy Delete	21	0	2021-01-16 10:57:58
Edit Copy Delete	22	0	2021-01-17 00:52:59

Figure 4.7: Soil moisture Readings in Database

+ Options

	ID	humidity	temperature	date
Edit Copy Delete	6	66	29	2021-01-11 01:40:45
Edit Copy Delete	7	66	29	2021-01-11 01:40:45
Edit Copy Delete	8	66	29	2021-01-11 01:40:46
Edit Copy Delete	9	66	29	2021-01-11 01:40:46
Edit Copy Delete	10	66	29	2021-01-11 01:40:47
Edit Copy Delete	11	64	30	2021-01-11 01:41:57
Edit Copy Delete	12	64	30	2021-01-11 01:41:59
Edit Copy Delete	13	64	30	2021-01-11 01:41:59
Edit Copy Delete	14	64	30	2021-01-11 01:42:00

Figure 4.8: Temperature and Humidity readings in Database

Figure 4.9: Temperature in Mobile App

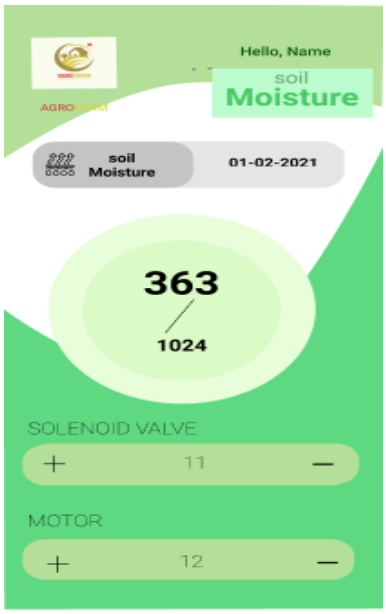

Figure 4.10: Moisture in Mobile App

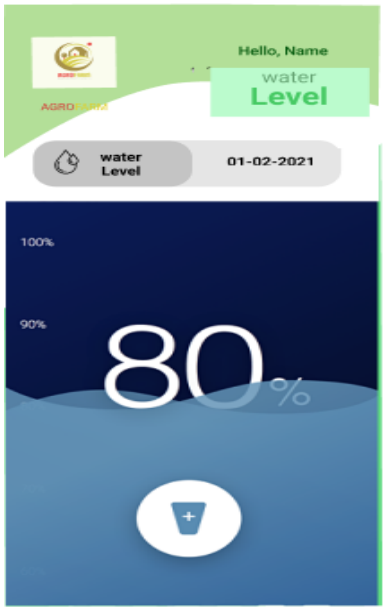

Figure 4.11: Water level in Mobile App

4.4 Summary

As we done a primary set of hard work here. And also included some software works. By this we got the data of soil moisture, temperature and humidity. And we successfully sent the data to the database for the future purpose to use in a mobile application.

Chapter 5

Standards and Design Constraints

Here we are mainly going to discuss about the standards of our project. Also the limitations of the whole system is also going to be mentioned and discussed thoroughly in the following chapter. We have done our research and all the project standards are shown alongside the limitations or the constraints are discussed in this chapter.

5.1 Compliance with the Standards

The project that we are proposing is targeting the agriculture for any country willing to ensure safety and the standard of their farms. Our standards are:
1. Ensuring temperature and humidity of the agricultural farm
2. Perfecting the soil moisture of the farm
3. Having precise water level
4. Prevent unexpected entrance
5. Keep everything monitored

To accomplish the objectives and match our expectations we decided to work on Phase Based Structure. Because we complete the objectives phase by phase. One phase of the project is covered then other phase has been taken care of.

We complete one phase which already has some sub-sections and then go to the other phase of the following process. Following the rules of the Phase Based Structure from the WBS, it was easy for us to meet our expectations of the project outcome. And we have done the part with more confidence.

5.1.1 Software Standard

To follow the software standards is the biggest challenge for any project. Whereas new software choices come and get changed time to time. As there are vast options to complete the project

Below the software list is given which are used in the following project:

1. MySQL
2. JAVA
3. Figma
4. Arduino
5. CodeVision AVR
6. PHP
7. VS Code
8. Lucidchart

These were the standard software choices for the project after knowing all the possible solutions for the work to be done.

5.1.2 Hardware Standard

Hardware section is where our main processing unit comes. All the data collection is done by the hardware selected. For the project our main purpose is to get exact value of every stage of the process. After research we selected these hardware as mentioned before:

1. Arduino UNO R3
2. Capacitive Soil Moisture Sensor
3. Breadboard
4. DHT11 Temperature and Humidity Sensor
5. Jumperwire
6. Arduino Ethernet Shield WS-5100
7. PIR Motion Sensor

These are the stable hardware choices for the project after doing thorough research on the system. We have tested the system in a smaller agricultural state and every value were mostly accurate depending on the state of the weather.

5.1.3 Communication Standard

Communication is the transparent part of the project it will hold the connection between the hardware and software. Which will synchronize the whole system and keep it together all the time. For the communication purpose we have used Android Application as our main bridge.

Every information is going to be shown in the android application.

Communication were done within these applications:

1. Jira
2. Google Meet
3. GitHuB

5.2 Design Constraints

The following project follows some prototype design at first for the project to be completed. After research on the literature review we created design on the basis of a perfect agricultural farm system. The design we followed is given below:

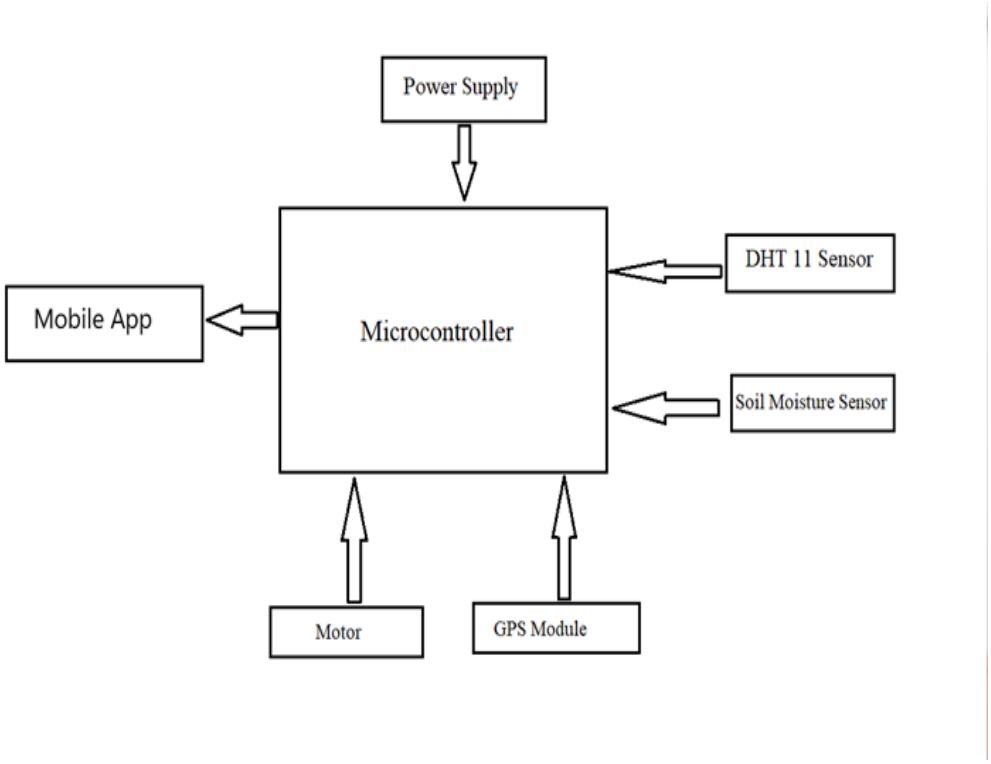

Figure 5.1: Prototype for Agro Farm Security System

The following system Figure-(5.1) is our standard design throughout the whole project. But has been some changes.

For the part of microcontroller we changed it and replaced it with multiple Arduino UNO R3 for the some basic causes. Which are given below:

1. Cost reduction
2. Space enhancing
3. Data processing flexibility
4. Separate data processing via multiple Arduino's

The constraints in the basis of the project to run accordingly are:

1. All the hardware running accordingly
2. Data passing accurately
3. Data storing in database
4. Application handling data from Database
5. Application Showing accurate data from Database

5.2.1 Economic Constraint

Here Economic Constraints stand for constraints that will have major impact on the result of the project. Because this keeps a major impact on the economic side and also keeps the business value straight in terms of budget and other major factors.

As agriculture is the most important aspect for any country. Without agriculture we cannot think of food be served in front of us everyday. So agriculture is the most important factor for any country.

If we discuss on the basis of our country Bangladesh, agriculture is definitely holds the most weight comparing with other occupations.

Even the most land of any agricultural based countries have the land to harvest. This is main advantage for agricultural main countries.

On the other hand for our Bangladesh occupations percentage is given in a Pi-Chart:

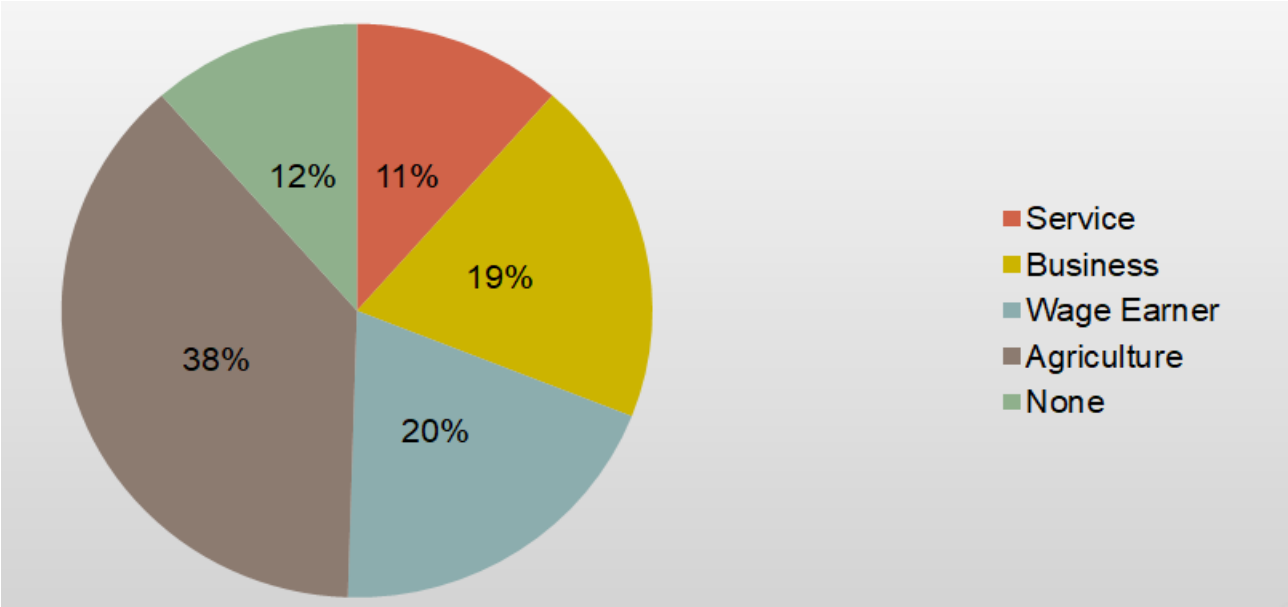

Figure 5.2: Occupational Pattern of Bangladesh

From the Pi-Chart above Figure-(5.2) we can see that Agriculture holds the most percentage in the occupational pattern.

Table 5.1: Table on the Agricultural Institution Review

Name of the Organization	Approval	Approval Rating in the following Manner: 1- Poor 2- Below Average 3- Average 4- Good 5-Very good
Bangladesh Agricultural Development Corporation	4	
Bangladesh Agricultural Research Council	4	
Bangladesh Rice Research Institute	5	
Bangladesh Sugarcrop Research Institution	3	

In terms of business value we know through the CSISA Mechanization and Irrigation project, CIMMYT will continue to transform agriculture in southern Bangladesh by unlocking the potential productivity of the region's farmers during the dry season through surface water irrigation, efficient agricultural machinery and local service provision. Even the following system was proposed to the top agricultural institutions of Bangladesh. Their response for the time being are given below:

This was the response based on the system that we proposed to the following organizations. They got to know about the project and reviewed the project in terms of agriculture and economic aspect of our country.

5.2.2 Environmental Constraint

The environment is quite friendly of our project. But there are always difficulties to accomplish such standards. Environmental constraints that might occur are:
1. Technical difficulties
2. Electricity outage
3. Need a technical team for every farm
4. Application minor errors
These are the difficulties that might occur on the environment. Even people with proper skills are must be to handle the system and take care of it all the time.

5.2.3 Ethical Constraint

Main focus of our project is targeting the agricultural aspect of any country. This does no harm of anything. As it is targeting agriculture. We are creating completely harmless

system and moreover we taking care of the quality of the farms. Even it is keeping sure of the security part of any agricultural farm. This work is discussed in the following Section-(5.1)

5.2.4 Health and Safety Constraint

Health and safety has to be the top priority for any agricultural project. We make sure of health and safety every time. For this reason our project ensures the quality of the farm and also keeps the security system active over all the time. Health and Safety Constraints follow a certain diagram here. Which is given below: Following Flowchart for the health

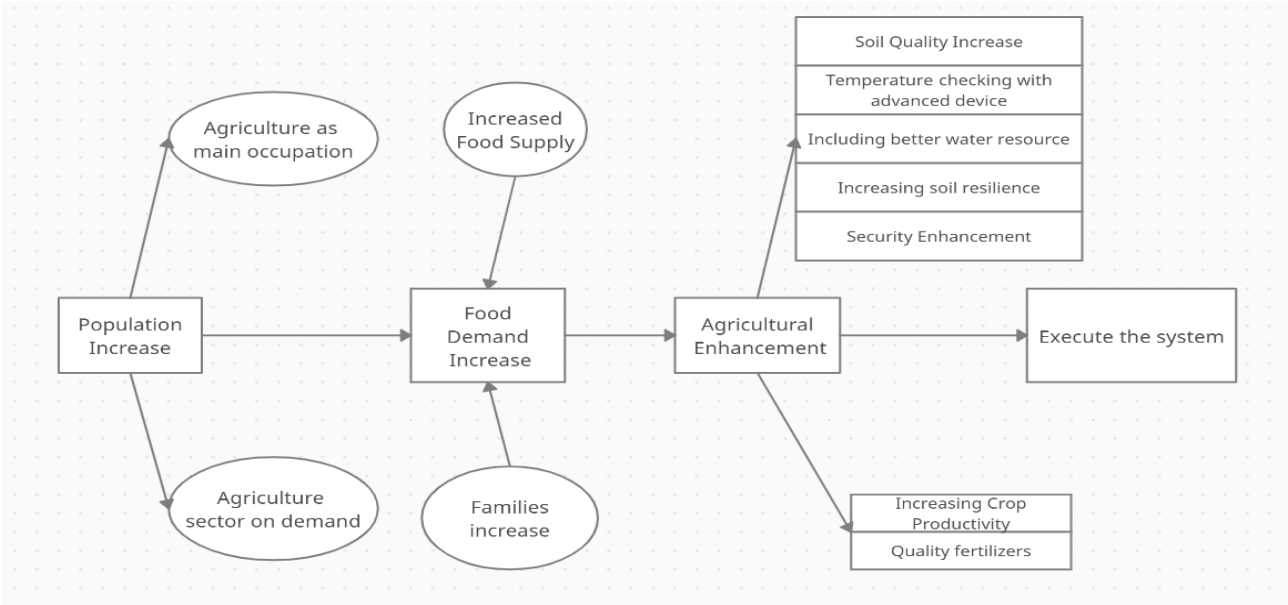

Figure 5.3: Health and Safety Constraint Diagram

and safety constraint has been followed.

5.2.5 Social Constraint

The pressure faced by the society which stated what kind of work are not possible to be done for the society. Mainly works which are not welcome by the society are included in such category.

As the project is based on agriculture and is for the betterment of the society it is quite to identify whether someone would not appreciate such project proposal. As it is going to enhance the quality of any agricultural farm. Even after contacting with certain agricultural institutes we got the response. The response is given in Table-(5.1) and the occupational importance is also given the following Figure-(5.2).

In terms of social constraints we are following strict measures as this project is built for the community.

5.2.6 Political Constraint

Politics is a very fragile topic in terms of any country. Specially for the countries in Indian Subcontinent. Political support keeps a very immense effect. But as the system considers about the agriculture so it might not have that much of a backlash from the political side of the project.

5.2.7 Manufacturability and Cost Analysis

For the following project total cost of the process has already been done. Hardware cost is the cost that we are considering. As we have done our research and test on a simple prototype small area. Our cost depending on our area is given below:

Table 5.2: Table of project cost(Prototype)

Name of the Device	Quantity	Price($)
Arduino UNO R3	3	12.74
DHT11 Temperature and Humidity Sensor	1	1.41
Capacitive Soil Moisture Sensor	1	2.36
W5100 Ethernet Shield for Arduino	1	8.33
10k Ohm Potentiometer	3	0.42
Buzzer	3	0.35
1k Potentiometer	10	0.57
1k Register	10	2.12
Bread Board	3	4.25
Total		32.55

This is on our normal project basis but if we take this for a small agro farm as an example as in for 3000 Square-Feet area of Agricultural Farm then the cost will be quite a bit more.

5.2.8 Sustainability

The sustainability is an issue for the project. To keep the devices and all the project materials safe just for the Arduino and fragile materials can be sealed with plastic bags which will keep the system safe.
Else other devices are quite heavy toll takers which cannot easily be broken or does not get damaged with the surrounding of water or other liquid materials.

5.3 Summary

From the following chapter got to know about the constraints which is quite helpful for any project to be standard.
Standard project is always greeted with recognition as there are fairly little amount of error to be present there.

Chapter 6

Conclusion

This the part which states all the post conditions needed for the project to be a success. This is the main stage of the project where main idea is summarized, the limitations alongside the future works are included in the project.

6.1 Summary

This project focuses on the agriculture of a country. By ensuring the quality of the Agro Farm using modern technologies. Showing all the stats in a mobile application which will be quite easy to access for any Agricultural farm manager. Thus, they can comfortably access the application and take of their farms without doing the rough works.
If any works are needed or technical difficulties occur then and only then one has to get involved, or else no such work will be needed.

6.2 Limitation

Limitations of our project is going to be considered as in the agricultural works. We are providing the quality of the farm by ensuring proper temperature, humidity and soil moisture alongside the tress passing issue.
But for the limitations part we cannot really control the temperature of the soil or the moisture of the farm. And cannot automatically take measures for tress passing. These are the main limitations of the project. These are for the future work.

6.3 Future Work

As for the Future work we have thought of taking measures such as:
1. Automatically increase water flow if moisture is low
2. Automatically decrease water flow if moisture is high
3. If temperature is not suited for the crops then take effected measures

4. For tress passing automatically call nearby police station for safety

These are the Future work which was though for the time being. And such measures will be taken in the near future.

Chapter 7

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