CSE 499

Project Report

On

Agro Tracker

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Approval

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Student’s Declaration

This is to inform that the Project Report on titled **“Agro Tracker” has been** submitted by Shah Tuhin Ahmed ID: 132 093 642, Md Mikdadul Islam ID: 141 0768 042, Annoor Ayesha Siddika ID: 141 1306 042, Sakibul Hassan Rifat ID: 141 0325 042

of the Department of Electrical Engineering & Computer Science, North South University, Bangladesh has only been prepared as a partial fulfillment of the requirement for the degree of Bachelors of Science in Electronics and Telecommunication Engineering Program. It has not been prepared for any other purpose reward or presentation. I certify that I have compiled with the rules, requirements, procedures and policy of the university.

ACKNOWLEDGEMENT

Our project report titled **“Agro Tracker”, would not have been successful without the collective collaboration of our friends, respected faculty members and of course, last but not the least, our families and friends.**

- I would like to thank my supervisor **Dr. Nova Ahmed** who is a prestigious faculty member of Electrical Engineering and Computer Science department, for overseeing our project with a keen eye and giving us valuable advice and suggestions along the way to complete the project in an appropriate manner.

- I would also like to thank North South University, Dhaka, Bangladesh for providing an opportunity in our curriculum which enables a student equip themselves with both decent facilities and opportunities, which enabled us to engage in our project with an able mind and sound confidence.

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ABSTRACT

This report describes the low-cost design and implementation of fertility test of soil. Farmers in Bangladesh have fewer knowledge about farming technology than other farmers across the world. They tend to work on their farming without the help of technology as they are not aware of those technologies. In this paper, we report on a qualitative study conducted in rural areas of Bangladesh about how farmers and land owners manage their farming and growing crops and what are the problems they face on current situation. So we present a device that will be attached to their land, which will sense the fertilizer amount in their land so that farmers can get notified about the amount of fertilizer present in their land. Also we developed an app that will give the land owner a notification about the result sensed by the device in their lands. The main initiative is to develop the farming technology in Bangladesh, as many people of our county are dependent on

farming, this can help them to achieve more profit from their farming land and also it's a good prospective to Digital Bangladesh.

CHAPTER 1:

Overview

1.1 Introduction

Being an agricultural country, maximum people of rural areas are involving themselves in agricultural activities. Mainly the problem is maximum farmers are illiterate. They don't know what's the exact amount of fertilizers to apply on their lands. For that reason, they face problem in applying fertilizer in the exact time. It is important to solve the problem for the nutrition of soil, better growth of crops, identifying deficiency.

Some works have been done on sensor based soil moisture, Irrigation control, Nutrient management etc. For example, in China the high-frequency resonance measurements method is used to design the soil moisture sensor. This paper is the first study on soil moisture sensor design based on soil dielectric. [1] In India a Site-specific nutrient management(SSNM) System was built to maintain soil productivity and hence better crop, the mobile phone based service to help the farmers receiving information about nutrient management at timed intervals through personal cell phones as per as the crop cycle and variety, hence helping increased farm yield. [2]

But it is still a problem because many farmers are not conscious of using correct amount of fertilizers. Though there have some project related with this yet this is not usable because this is not user friendly device. Land owners can't maintain a good communication with the farmers. So our approach is to make a device using sensor for testing soil and fertilizer test and moister test. We tried to make the device cost efficient so that everyone can buy the device and also we worked with those components which are available in our country.

Depending on users demand we made a device which is useful for both farmers and land owners.

- We applied the device in the farmland with the presence of farmers so that they can test the device in field level.
- There were some problems in implementing the device, but we overcame the problems and modified our device.

Chapter:2

Related Works

1.2 Related works

Related Works In Bangladesh:

A lot of ideas are being implemented to counterfeit the aerial challenges of today's modern world, some of which were successfully implemented, while others failed. In a paper we present a research [1] on the performance of a gravity irrigation system in Bangladesh. In this study they discussed for a different water supervision. Other crops can be grown through this in dry season. The schedule of pumping will not be changed even after a year and the cost will be reduced with a great percentage. E-village project [2] was launched to boost agricultural production in Bangladesh. The sensor would give farmers an early signal about pest infections and soil condition. Jol Shinchon [3] is an intelligent auto irrigation system that utilize natural resources for purpose and very useful for northern areas of our country. To prevent inefficient use of Nitrogen fertilizers, Leaf Color Charts (LCC) [4] indicates whether rice plants need more fertilizers or not.

Related Work In Asian Region:

In Asian region there are plenty of works on irrigation system. A system for nutrient management decision for support system for farmers was published by Vijay Pratap and Sasikumar [5] It provides an automated system on mobile which provides text or voice mail on farmers' phone via local languages. By this application farmers can get to know about their soil. To get detailed information they can visit website by any community information centre. Paper of Jonilyn A. Tejada and Glenn Paul P. Gara [6] introduces a mobile and web application to detect malnutrition from the leaves of plants named LeafCheckIT. By using data mining software it results 100% of accuracy. Tatsuya Yamazaki and Kazuya Miyakawa [7] presented a paper on water management using two types of soil moisture sensors in pear fields. Daniel Winkler and Alberto E. Cerpa [8] presented a paper on irrigation control system. In this work, they propose that irrigation systems with distributed independent actuation can substantially reduce water consumption in lawn irrigation. To test this theory, they develop a computationally light fluid flow model that allows the optimization of valve scheduling using standard optimization techniques.

Related Work In International:

Edyn app consists of a Wi-Fi-connected sensor and water valve that assesses soil nutrition and waters your plants based on actual data. Stick the sensor it in the ground, and it gathers all sorts of information—things like ambient temperature, humidity, light intensity and soil electrical properties. Soil fertility is an important factor to measure the quality of the soil as it indicates the extent to which it can support plant life. Amrutha A, Lekha R and A. Sreedevi [9] presented a paper on automatic soil nutrient detection and fertilizer dispensary system. Soil Sampler app is a real time-saver, navigating the user straight to the soil pick-up position, avoiding unnecessary movement around the field whilst doing so. This app uses the sensors and helps the user to identify the soil pick up position of land but our app uses sensor to detect the amount of fertilizers in soil. SoilTestPro app makes soil sampling easier for you as a grower or service provider. Get lab results, fertilizer recommendations and controller files for all leading monitors, tractors and implements. The sensor senses the soil and sends result to the app.

Chapter:3

Methodology

Our research was based on introducing a device which would help the land owners to direct the farmers in most of the cultivation process. We conducted focus groups consisting of a total of 28 participants, which included both farmers and landowners (14 farmers, 14 landowners). It was conducted on the first week of July. It took us about a week to perform the field work, across certain villages. We carried it by dividing into two groups consisted of two members. We chose focus groups as it would be helpful in becoming familiar and also by making them comfortable in providing information required. Each of the session lasted for the period of 4 hours. The focus group discussions were structured in nature, and were questioned about their understanding of the properties and the conditions of the land. We thereby ended every focus group by asking the participants whether they would like raise/highlight any problems/suggestions which they would prefer in the device. The study followed a comparative fieldwork format rather than a thick description of behavior and context.

CHAPTER 4:

Evaluation

We have tested our device depending on various conditions. For instance we tested moisture level, temperature level, water level and pH level both in indoor and outdoor condition also we have tested on different weather condition. We experimented in Daylight, Fog and Night Time. We tried to evaluate the different values our device shows on different conditions and based on that we tried to show the status of the soil whether it is good or bad.

4.1 Setup:

We had to apply different kind of setup for different conditions. When we experimented on indoor condition we inserted our sensor on flower vase which had enough lighting condition as it was on the balcony, but we also adjusted the sunlight and shadow to take values on different lighting conditions.

Fig 4a: Indoor Testing

For outdoor condition we applied our sensor on fields which had enough lighting but we also adjusted the lighting by creating shadow while taking readings.

Fig 4b: Outdoor testing

We have tested moisture level, temperature level, water level and pH level on our sensor Water level and pH level were almost fixed for a specific soil on every condition, what varied was the moisture and temperature. So we tested them on sunlight and shadow, also on Daylight, Fog and Night condition. We took reading on every minute for 50 times and made an average out of them to summarize the values we got from our testing. We analyzed the graphs and their values and showed result based upon them to show our work and testing.

4.2 Result:

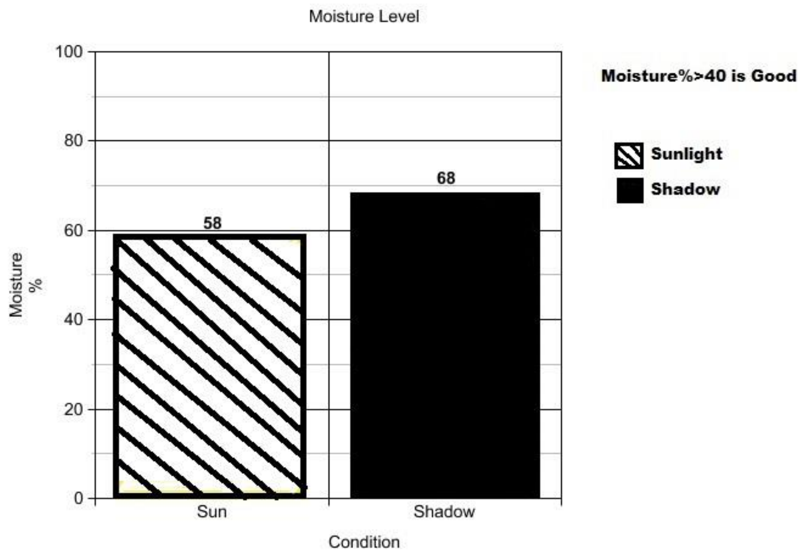


Fig 4.c: Moisture Level Graph

This graph shows the moisture level on sunlight and shadow. On the X-axis of the graph we have two conditions, Sunlight and Shadow and on Y-axis we have moisture% level. If moisture is above 40% the soil is considered to be in good condition. Here on sunlight moisture is 58% and on shadow moisture is 68%. Though moisture level is a bit high on shadow condition but both the condition is good for soil.

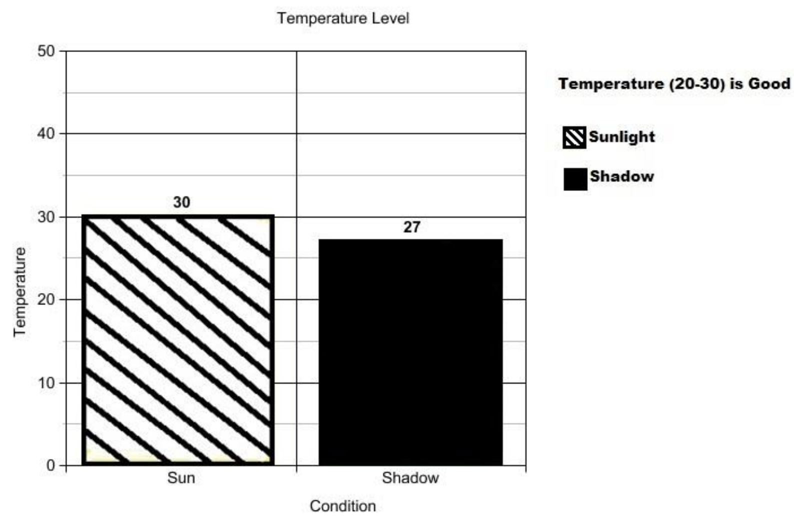


Fig 4.d: Temperature level graph

This graph shows the temperature level on sunlight and shadow. On the X-axis of the graph we have two conditions, Sunlight and Shadow and on Y-axis we have temperature level. If temperature is within 20-30 degrees then the soil is considered to be in good condition. Here on sunlight temperature is 30 degrees and on shadow temperature is 27 degrees. On both condition temperature is good for soil.

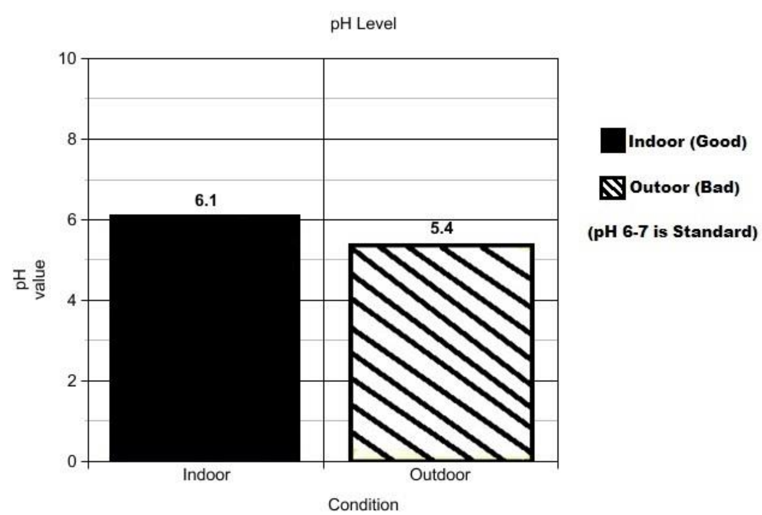


Fig 4.e: pH level graph

This graph shows the pH level on indoor and outdoor. On the X-axis of the graph we have two conditions, indoor and outdoor, on Y-axis we have pH level. If pH is within 6-7 the soil is considered to be in good condition. Here on sunlight pH is 6.1 and on shadow pH is 5.4. pH level is good on indoor condition but pH level is bad on outdoor condition.

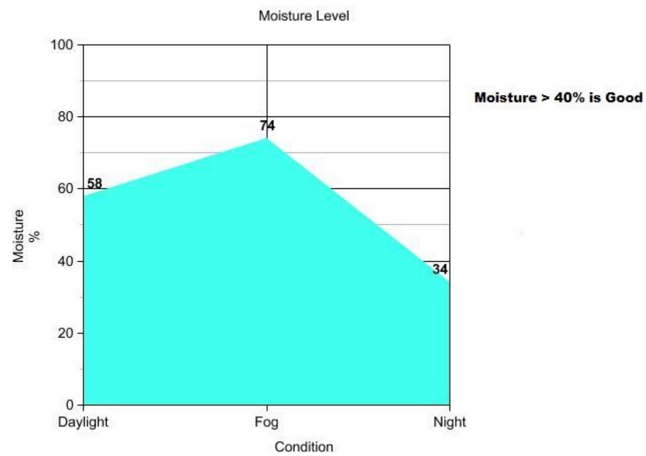


Fig 4.f: Moisture Level Graph

This graph shows the moisture level on Daylight, Fog and Night. On the X-axis of the graph we have three conditions, daylight, fog and night, on Y-axis we have moisture% level. If moisture is above 40% the soil is considered to be in good condition. Here on daylight moisture is 58% and on fog moisture is 74% and on night moisture is 34%. Moisture is good on daylight and fog but bad on night condition.

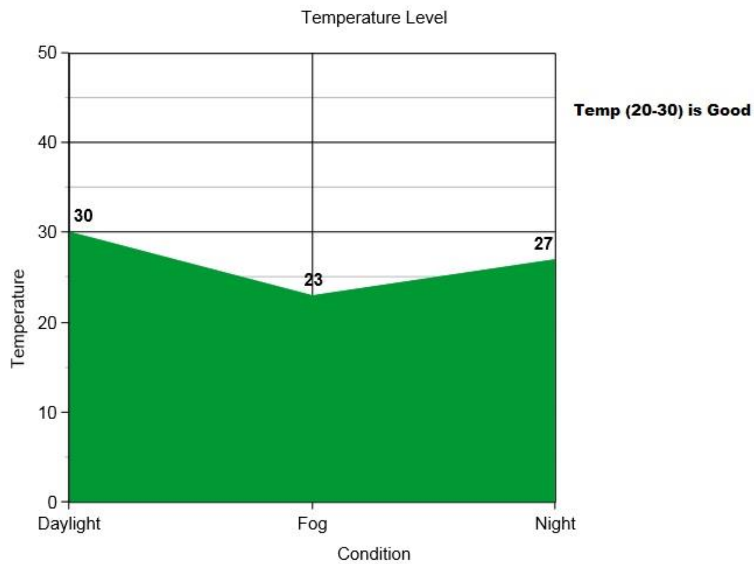


Fig 4.g: Temperature Level Graph

This graph shows the temperature level on Daylight, Fog and Night. On the X-axis of the graph we have three conditions, daylight, fog and night, on Y-axis we have temperature level. If temperature is within 20-30 degrees then the soil is considered to be in good condition. Here on daylight temperature is 30 degrees and on fog temperature is 23 degrees and on night temperature is 27 degrees. Temperature is good in daylight condition, fog condition and night condition. So temperature didn't make any factor in our result based on these conditions.

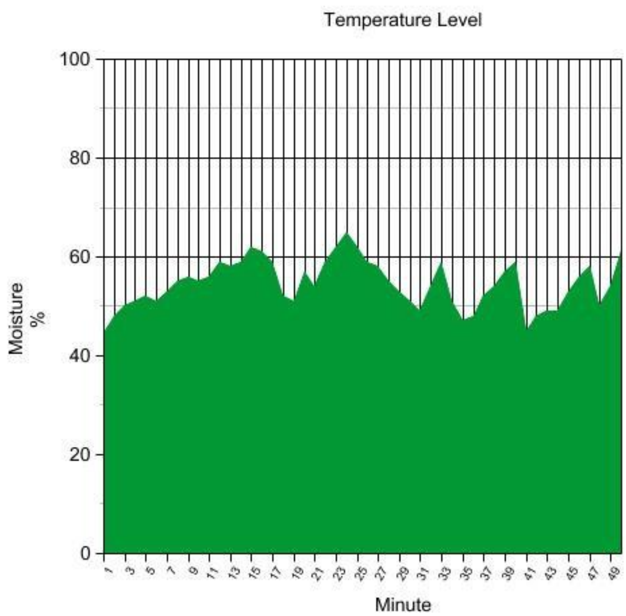


Fig 4.h: Moisture Level Graph

This graph shows the moisture value that has been taken after every minute for 50 times, so it shows how moisture varied for about 50 minutes. On the X-axis of the graph we have minutes, on Y-axis we have Moisture level. If moisture is above 40%, the soil is considered to be in good condition.

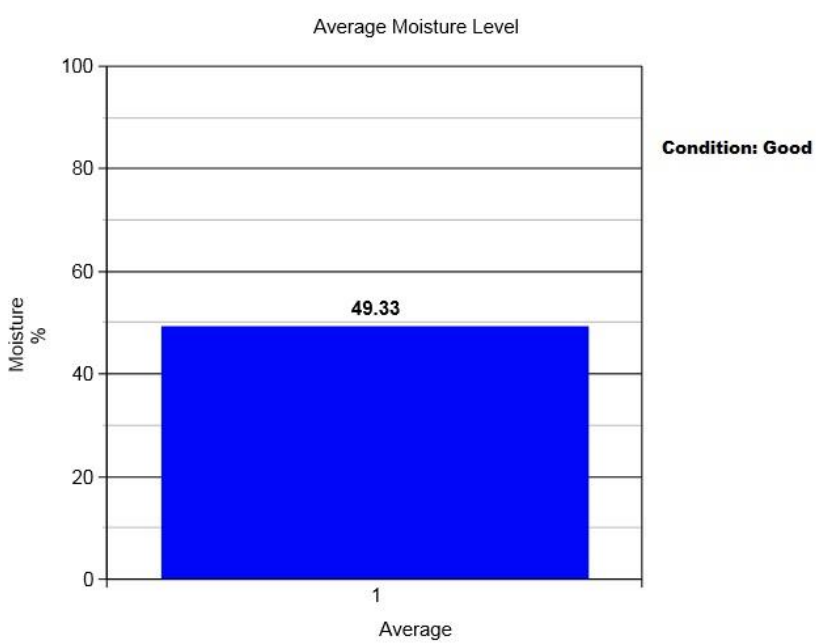


Fig 4.i: Average Moisture Graph

This graph shows the average moisture value of the readings that we took for 50 minutes. On the X-axis of the graph we have minutes, on Y-axis we have Moisture level. If moisture is above 40%, the soil is considered to be in good condition. Here the average of the moisture values are 49.33% that means the average moisture is good for soil.

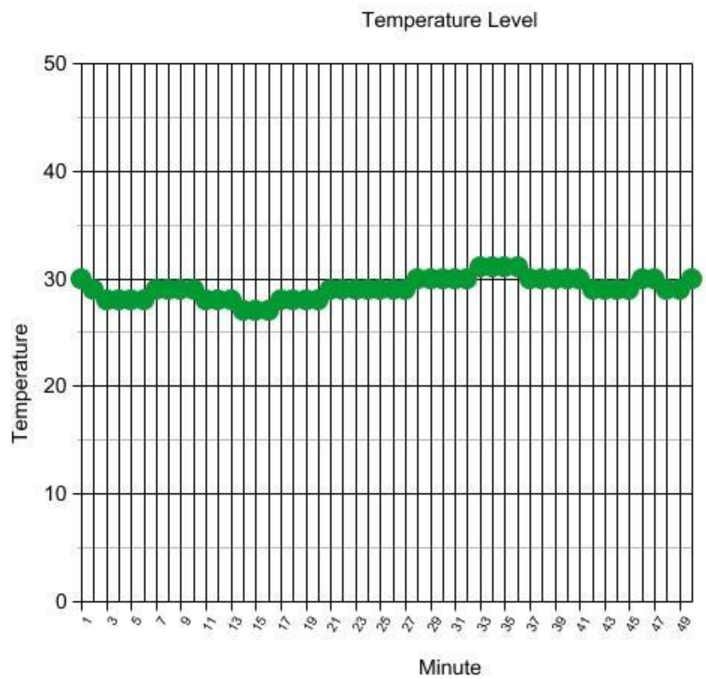


Fig 4.j: Temperature Level Graph

This graph shows the temperature value that has been taken after every minute for 50 times, so it shows how temperature varied for about 50 minutes. On the X-axis of the graph we have minutes, on Y-axis we have Temperature level. If temperature is within 20-30 degree the soil is considered to be in good condition. Here we can see that the temperature mostly varied from 26 degrees to 31 degrees, so we can say that at most of the time the temperature was in good condition.

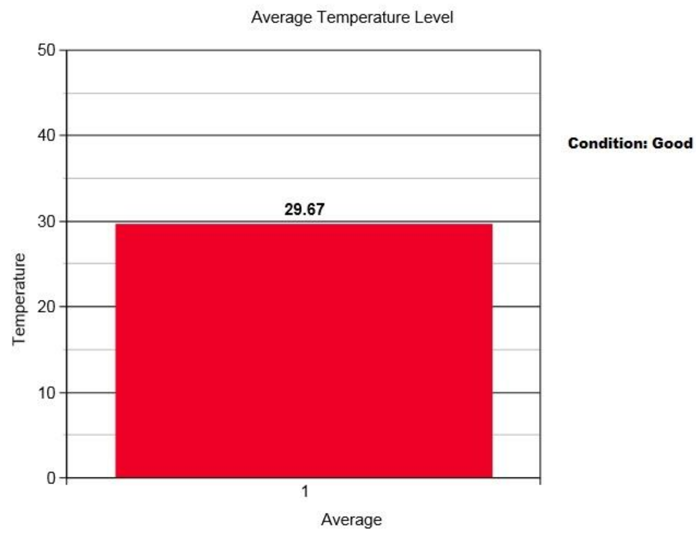


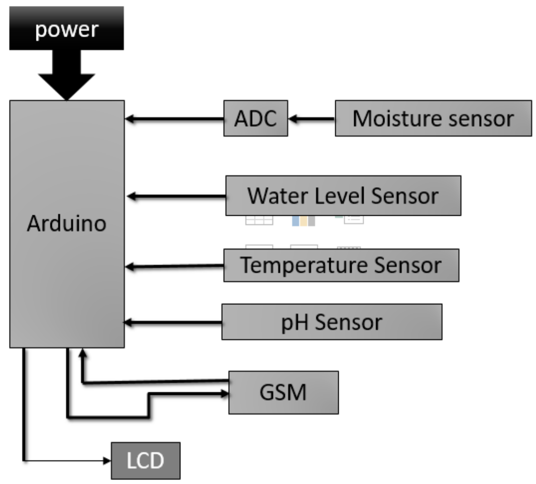
Fig 4.k: Average Temperature Graph

This graph shows the average temperature value of the readings that we took for 50 minutes. On the X-axis of the graph we have average, on Y-axis we have Temperature level. If temperature is within 20-30 degrees then the soil is considered to be in good condition. Here the average of the temperature values is 29.67 degree that means the average temperature is good for soil.

On our evaluation, we have tried to test our device in different condition to assess its capability to compare and visualize the results. We have tested our device both in indoor and outdoor condition to get the best results. We have noticed many changes in soil conditions of different types. We tried to measure Moisture, Temperature and pH level on different kind of soils in different situations. We have manipulated the light and shadow in order to test on low lighting and good lighting conditions, we also tested on different times of the day, mostly daylight and also foggy weather and night time. In order to get the best result, we took value 50 times for about 50 minutes having gap for one minute and made an average so that we can compare the best result with the worst. In some case temperature varied and on some cases moisture varied but pH level was almost same in all condition for same soil but different in different soil. Overall we implemented our device on lands and recorded all results on our app for future planning.

Chapter 5:
System Design

Block Diagram:



Project Description:

This project is based on arduino which cost is less. Arduino is based on flexibility so that user can easily handle it. It is easy to use in both hardware and software. Arduino gets power from 9v battery. We have used four types of sensors, 1) water level sensor 2) moisture sensor 3) Temperature sensor 4) pH sensor. In our project water level sensor will calculate the amount of liquid or water in the soil. For temperature reading we have used LM35 series which will give us the Celsius temperature. It is low cost and works within 4v to 30v. For pH reading we have used pH sensor. For moisture we have used moisture sensor which will give a result. For showing result we have used 16x2 LCD display.

For sending sms to farmers and land owners we have used GSM Module. It will fetch all the reading from the hardware and will send sms. This is an offline sms system.

In the software part we have implemented an application which shows the result of soil with moisture, temperature, water level and pH. It will also show if the soil status is good or bad based on the readings. This app shows logs of previous data. It also shows graph on temperature, moisture, water level and pH and shows the average of them. After fetching data from hardware it will send SMS to the farmers and land owners about the soil condition. By this they will get information whether the soil is good or bad.

Chapter 6: Implementation

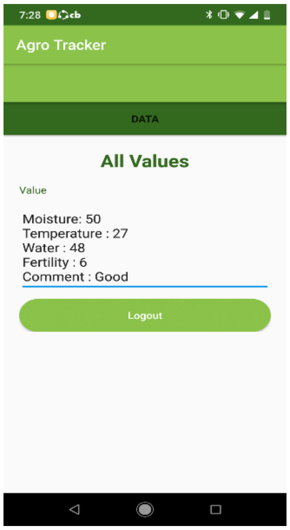


Figure 6a: App interface

Figure 6b: options

The readings will be shown like this in our app. If the readings are according to the standard value, the status will show good. We can logout if we want. The data will be saved in the history option.

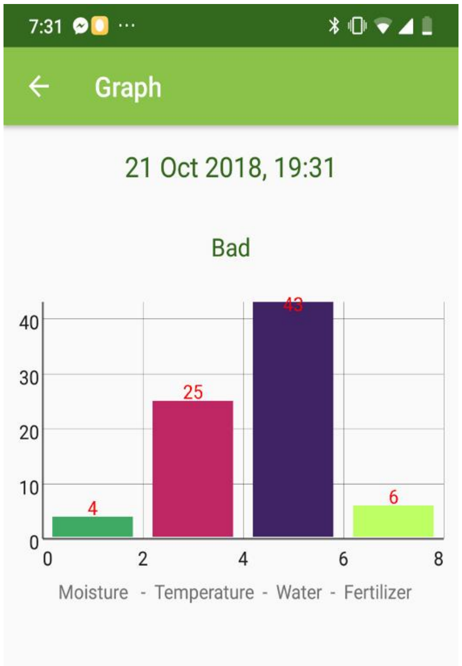


Figure 6c: graph for bad status

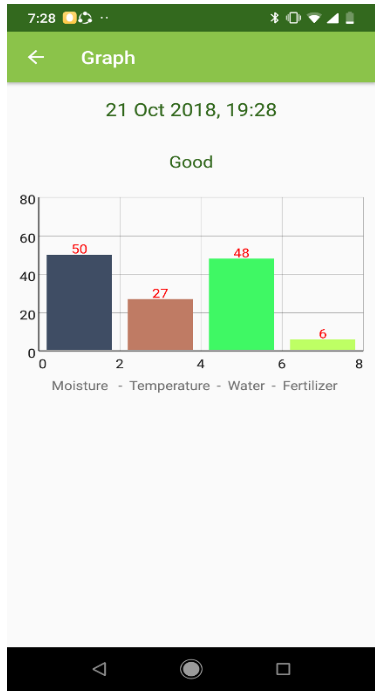


Figure 6d: graph for good status

The graph shows the result of the readings per day. There are four columns for moisture, temperature, water level and fertilizer. We have the graph for both good and bad status.

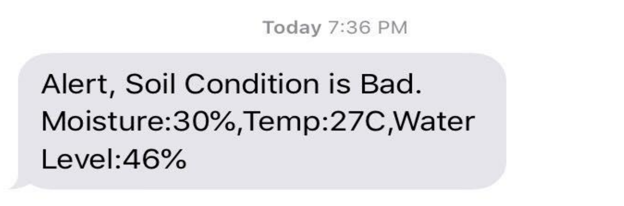
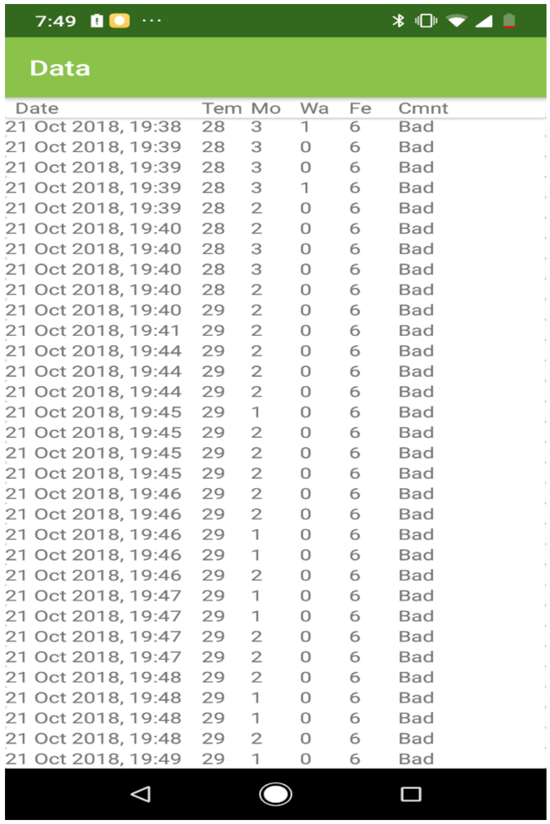


Figure 6e: SMS for the land owner

When the soil status is bad, it will send an SMS with all the readings to the land owner. By this he will confirm with the soil condition.



Date	Tem	Mo	Wa	Fe	Cmnt
21 Oct 2018, 19:38	28	3	1	6	Bad
21 Oct 2018, 19:39	28	3	0	6	Bad
21 Oct 2018, 19:39	28	3	0	6	Bad
21 Oct 2018, 19:39	28	3	1	6	Bad
21 Oct 2018, 19:39	28	2	0	6	Bad
21 Oct 2018, 19:40	28	2	0	6	Bad
21 Oct 2018, 19:40	28	3	0	6	Bad
21 Oct 2018, 19:40	28	3	0	6	Bad
21 Oct 2018, 19:40	28	2	0	6	Bad
21 Oct 2018, 19:40	29	2	0	6	Bad
21 Oct 2018, 19:41	29	2	0	6	Bad
21 Oct 2018, 19:44	29	2	0	6	Bad
21 Oct 2018, 19:44	29	2	0	6	Bad
21 Oct 2018, 19:44	29	2	0	6	Bad
21 Oct 2018, 19:45	29	1	0	6	Bad
21 Oct 2018, 19:45	29	2	0	6	Bad
21 Oct 2018, 19:45	29	2	0	6	Bad
21 Oct 2018, 19:45	29	2	0	6	Bad
21 Oct 2018, 19:46	29	2	0	6	Bad
21 Oct 2018, 19:46	29	2	0	6	Bad
21 Oct 2018, 19:46	29	1	0	6	Bad
21 Oct 2018, 19:46	29	1	0	6	Bad
21 Oct 2018, 19:46	29	2	0	6	Bad
21 Oct 2018, 19:47	29	1	0	6	Bad
21 Oct 2018, 19:47	29	1	0	6	Bad
21 Oct 2018, 19:47	29	2	0	6	Bad
21 Oct 2018, 19:47	29	2	0	6	Bad
21 Oct 2018, 19:48	29	2	0	6	Bad
21 Oct 2018, 19:48	29	1	0	6	Bad
21 Oct 2018, 19:48	29	1	0	6	Bad
21 Oct 2018, 19:48	29	2	0	6	Bad
21 Oct 2018, 19:49	29	1	0	6	Bad

Figure 6f: Data History

This is the history of previous data collections. It has been collected with date and time. The soil status has also shown there. User can see the history for overview.

CHAPTER 7:

Conclusion

In conclusion we have implemented a digital agricultural system which can be used in testing the fertility of soil. Generally most of the farmers in our country are illiterate, they do not know the proper use of pesticides and chemical fertilizers. That's why they suffer a great loss. Even owners cannot get the information of the soil using in their lands. They literally have no idea how farmers applying fertilizers, how much cost has been needed for buying fertilizers. The main problem is there is a communication gap between the farmers and the land owners. In this case they are unaware of their investment. With the help of this machine, a farmer can get the idea about the chemical remaining in soil which is balanced or not. It can detect the moisture level of soil and notify it by giving a message to the farmer as well as landowner. So wastage or lack of agricultural material can be balanced by using it. Rating system with a comment can help the farmer to take the necessary steps for the best use of soil because it provides them an advice what they should do. So it helps them to use the fertilizer properly. Depending on it, farmer can know that whether it is time to irrigation or not. This machine shows the way of balancing the chemicals for a good harvest. Besides, apps is the best part for landowner to see the statistics of the land. All data can be saved in it by which a landowner can calculate and save the investment as well as profit of the whole period. In future we are planning to make more advance changes so that the problems of farmers and owners can decrease a bit more.

We have achieved our goal of implementing an agricultural system which is cost effective and user friendly. We found multiple ways to implement it but we select best and effective way to make a better and useful machine within a low cost. Thus it can be helpful for agricultural system.

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Source code

```
#include <LiquidCrystal.h>

#include <SoftwareSerial.h>

#include <OneWire.h>

#include <DallasTemperature.h>


int temp;

int smscount=0;

int  outputValue;

const int analogInPin = A2;

int sensorValue1 = 0;

int outputValue1 = 0;


// Data wire is plugged into port 2 on the Arduino

#define ONE_WIRE_BUS 12


// Setup a oneWire instance to communicate with any OneWire devices
 (not just Maxim/Dallas temperature ICs)
OneWire
oneWire(ONE_WIRE_BUS);
```

```
// Pass our oneWire reference to Dallas Temperature.

DallasTemperature sensors(&oneWire);

LiquidCrystal lcd(18, 17, 5, 4, 3, 2);

SoftwareSerial Blueboy(7, 8);

SoftwareSerial mySerial(9, 10);

void setup()

{

Serial.begin(9600);

Blueboy.begin(9600);
//Bluetooth module works at 9600 baudrate

 mySerial.begin(9600);
```

```
sensors.begin();

 pinMode(A0, INPUT);

lcd.begin(16, 2);

}

void loop()

{

    sensorValue1 = analogRead(analogInPin);

    outputValue1 = map(sensorValue1, 0, 700, 0, 100);
  //water level

 int sensorValue = (analogRead(A0));

sensors.requestTemperatures();

temp=sensors.getTempCByIndex(0);
```

```
outputValue = map(sensorValue, 0, 1023, 100, 0);


lcd.setCursor(0,0);
  //cursor will set at 1st digit of 1st row

lcd.print("Soil:");
  // print a sample message

lcd.print(outputValue);
 // print a sample message

lcd.print("%  ");

lcd.setCursor(10,0);

lcd.print("Tmp:");
// print a sample message

 lcd.print(temp);
 // print a sample message



lcd.setCursor(0,1);
 //cursor will set at 1st digit of 1st row

lcd.print("Wtr:");
  // print a sample message
```

```
  lcd.print(outputValue1);
 // print a sample message
 lcd.print("%,  ");
   // print a sample message




if(outputValue<40 || temp>34 || outputValue1<30)
{

  lcd.setCursor(10,1);

  lcd.print("S:Bad ");
  // print a sample message

 if(smscount==0)
{

 smscount++;

  sms();



  }

}

else
{
```

```
  lcd.setCursor(10,1);

    lcd.print("S:Good");
   // print a sample message

   smscount=0;

}

char e[5];

String str3;

str3=String(6);

str3.toCharArray(e,5);
```

```
char d[5];

String str2;

str2=String(outputValue);

str2.toCharArray(d,5);




char c[5];

String str1;

str1=String(temp);

str1.toCharArray(c,5);
```

```
char b[5];

String str;

str=String(outputValue1);

str.toCharArray(b,5);

Blueboy.write("");

Blueboy.write(d);

Blueboy.write(",");

Blueboy.write(c);

Blueboy.write(",");

Blueboy.write(b);
```

```
Blueboy.write(",");

Blueboy.write(e);

Blueboy.write(";");

  delay(1000);

//lcd.clear();

}
```

```
void sms()

{



mySerial.begin(9600);
  //Default serial port setting for the GPRS modem is 19200bps 8-N-1

mySerial.print("\r");

delay(1000);
       //Wait for a second while the modem sends an "OK"

mySerial.print("AT+CMGF=1\r");
    //Because we want to send the SMS in text mode
del
ay(1000);



mySerial.print("AT+CMGS=\"+8801626516276\"\r");
   //Start accepting the text for the message
//to be sent to the number specified.

//Replace this number with the target mobile number.

delay(1000);

mySerial.print("Alert, Soil Condition is Bad. Moisture:");
   //The text for the message
//
delay(1000);
```

```
mySerial.print(outputValue);
 //The text for the message

//delay(1000);



mySerial.print("%,Temp:");
   //The text for the message
//
delay(1000);

mySerial.print(temp);
   //The text for the message

delay(1000);



mySerial.print("C,Water Level:");
  //The text for the message

delay(1000);

mySerial.print(outputValue1);
   //The text for the message

mySerial.print("%");

delay(1000);
```

```
mySerial.write(0x1A);
//Equivalent to sending
Ctrl+Z




}
```