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AgriDroGo

In partial fulfilment of the requirements for the degree of

Bachelor of Science in Computer Science

Supervisor: ZAKIR ALI

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C e r t i f i c a t e

We accept the work contained in the report titled

"AGRIDROGO",

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June4$_{th}$, 2018

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

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Specially dedicated to

my beloved grandmother, mother and father

(HUZAIFA ANIS)

my beloved grandmother, mother and father

(AYESHA ASHRAF)

my beloved grandmother, mother and father

(HIRA AZAM)

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AGRIDROGO

ABSTRACT

The purpose of this document is to present a detailed description of the injector AgriDroGo. It will explain the purpose, features and the interfaces of the injector, what the injector will do and the constraints under which it must operate. This document is intended for users of the injector that could be Farmers/Technicians mostly and engineers or researchers possibly. The purpose of this product is to facilitate the Agricultural department by automating soil testing system. As we live in an agricultural country, automated soil testing and prediction about future suitable crops, will be a game changing technique in the world of agriculture. It would help farmers to save their time, money and get instant results and a glimpse of future of their land too .This product would be able to revolute soil testing manual methods by testing soil through injector and displaying results at run time on android app and desktop application. (We're not using cloud server due to shortage of resources).

x

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS / ABBREVIATIONS

ph	Potential Hydrogen
N	Nitrogen
K	Phosphorus
P	Potassium

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A:	Dataset	20
APPENDIX B:	Graph	22

CHAPTER 1

INTRODUCTION

1.1   Background

Our venture is tied in with making an injector that would help in agriculture division. It will figure out which crop is reasonable for particular field. The injector will be able to test soil and measure its humidity, pH level and the temperature of soil, based on these calculations, we'll be able to define fertility rate of the particular field. In our nation, we've been utilizing manual framework up till now yet this thought of automaton is useful in mechanizing horticulture framework.

AgriDroGo is based on agricultural development and it will be the big revolution, in the history of agricultural. We are going to apply logic based algorithms. The DroGo will think efficiently according to the soil sample and suggest the appropriate crop for better yield production. The process of soil testing is complex procedure but with help of DroGo we can do this very easily.

We will use machine learning algorithm that will help to predict the suitable crops for the field. You can see injectors' data from anywhere because injector will have its own cloud (not using cloud due to lack of resources and shortage of time). You can see the injector's data through Bluetooth based android app.

Injector will be able to suggest the crop that suits the specific field and it will help better yield production. This will quick, simple and intelligent method for soil testing and will constrain labour that required for soil testing. This is the huge upheaval in the historical backdrop of soil testing on the grounds that nobody ever consider computerized soil testing module.

1.2 Problem Statements

- Soil testing is very expensive and difficult process and no one tried soil testing outside the lab at real time. The problems that can occur in automation of soil testing are unavailability of people knowing the use of this automated system.

- Farmers often have to pay substantial amount to get the soil tested before ploughing the field.

- This process is time consuming and due to this most of the time, the farmers judge the soil on the basis of their assumptions.

- Due to environmental changes that has affected the soil, their assumptions are not always accurate and this effects the yield of the crop.

1.3 Aims and Objectives

Our goal is to influence an insurgency in agriculture. As our nation is a horticultural nation, however we have exceptionally restricted programmed apparatus to utilize, so this could be an expansion to it and give better and prompt outcomes

1.4   Scope of Project

This product would be able to revolute soil testing manual methods by testing soil through injector and displaying result on lcd as well as on android app. And also by automatically updating its data on file through putty server by connecting arduino.

CHAPTER 2

LITERATURE REVIEW

2.1   Previous progress:

In countries such as Pakistan and India, the economy is based mainly on agriculture, but not optimal high sustainable use of profitability of land resources. The main reason is the lack of knowledge about the soil analysis of the growth of the crop. About soil sample of 9~10lakh is received in the laboratory, it is very difficult to test on time all of the soil samples in the laboratory. Until the test report is generated, the harvest is on the verge of completion. Therefore, there is a need to make available a soil analysis to farmers.

The main purpose of our work is to develop a test system that can be used to farmers soil analysis to help production to grow appropriate crops.Each field of the digital world has changed dramatically due to the influence of the IT field. However, it did not work much in the agricultural sector until today. The use of a variety of data mining technology in the agricultural sector, will be an ongoing area of research. The ultimate aim is to increase the yield of the agricultural sector. Omkar B. Bhalerao professor and LMRJ Lobo professor (Lobo., 2001) applies the data mining and optimization techniques, to understand the soil conditions, given the appropriate recommendations to the crops, soil conditions in order to obtain the results and other to provide the best foundation factors. The specific recommendations crops it is recommended that you use the fertilizer and pesticides. In this recommendation, they also propose a sideline for farmers.

It will help to improve his economic life. They suggested that the methodology is a two-stage model. In the first stage, to apply the relevant rules mining to historical data of agriculture, by applying the appropriate support and trust in each rule, to generate rules from frequent item set. Thereafter, the user gives the minimum support and confidence, is extracted on the basis of this initial best rule for forming an initial population of GA. In the second stage, by applying a genetic algorithm initial

Population rules obtained from the association rule mining. Therefore, the best rule to predict the production of as the best crops can not be obtained.

Soil testing is very expensive and difficult process, nobody never tried a soil test outside of the laboratory in real time. In addition to the time-consuming process.

The work done on behalf of the soil test technology is rare, also cost it takes. Problems that may occur in the automation of soil test is that the people who know the use of this automated system is not available. Since our country of farmers of the literacy rate is know that very low, it may be difficult to learn them how to use the created devices in order to promote. So they prefer to go to the laboratory in order to test the soil is a process that is very time consuming.

2.2 Technology in Soil testing:

Here is some of the technology done for soil testing according to different research papers:

1. **"Automated Soil Testing Device"**(D S Suresh, 2012)(D S Suresh, 2012) has been developed for the soil test of the farm. pH value and the N P K (nutrients of soil) depends on the type of soil. The N P K and pH value of the soil samples was measured in real time, compared with the previously stored value received from the agricultural sector. The system also offers information about the crops that can be grown in each of the soil. Wireless communication system is incorporated in order to interact with the experts.

The value of the actual value and the measured value is displayed on the LCD. Radio trans receiver to send data to a remote location, or specified

The agricultural sector of the authority for the proposal and further analysis. Automated soil test equipment, usually so that there is no need to be a hard time to visit the soil testing laboratory in the district headquarters, is a portable device that can be used at a particular location or laboratories that have been selected on the farm. Automated soil test equipment, everyone is to be able to test the soil without the presence of an operator, is simple and user-friendly devices.

2. Artificial Neural Network (ANN) (Hergert, 2009)Map-Reduce framework has been implemented for rainfall prediction and crop proposal. Here ANN is used in the rainfall forecast for the next 7 days. They propose the use of an error correction technique to improve the accuracy of prediction result back propagation technique. Attempts to propose an optimal crop and the information based on location and weather conditions farmers to increase crop yields have been made. By implementing this solution to Hadoop, it will be scalable at a higher speed.

This Research Paper Includes:

i.   The weather forecast is a big problem. In this paper, we use the classification and clustering technique. It was obtained crop yield prediction results using the classification / regression model. Linear regression, K-NN, neural network is the model used for the prediction. Use the clustering algorithm of k-means, as district belonging to the similar values of the relevant attributes are in the same cluster, and then group the district in a separate cluster.

ii.   Parallelizing the machine learning algorithm is an important issue in order to speed up the application associated with machine learning. In this paper, since it is possible to describe the algorithm that is suitable for static query model in particular "Summation form", it shows that you can easily parallelized in multi-core computer. We introduce the use of

Google's map reduction techniques in a variety of learning algorithm. This indicates Navies Bayes on the multi-core map-reduce framework, K-means, neural networks, and the implementation of the logistic regression.

iii. Paper utilizes clustering algorithm for obtaining clustered regions according to the climate. Five major types of classifier are used in the experiment such as Linear regression, Non-Linear regression, Regression tree, Ensemble learning and Artificial Neural Network. The errors obtained by using these methods are compared by means of root mean square error (RMSE). The error between the expected output and the actual output is squared. It is then averaged and square root is found. This is the procedure is applied for 3 types of error i.e training error, testing error, and cross validation error.

3. This paper "Crop Recommendation and Fertilizer Purchase System" (Mansi Shinde)summarizes the efficient recommendation system of fertilizers and crop based on the NPK value and regions. In this application, users can also purchase the recommended fertilizer from the purchase portal. When used on a large scale, it would bring benefits to farmers in terms of crop production. Anyone can use because the application of user-friendly.

ADVANTAGES

i. It is beneficial for the farmers to increase their crop yield.
ii. It is user friendly.
iii. Requires less memory.
iv. Available in multiple languages.
v. Convenient for buying fertilizer after suggestion.

4. Digital Image Processing captures digital images, is the term that perform specific operations by calculating a specific value therefrom. Many algorithms have been used to perform mathematical and scientific operations on digital images. The use of digital image processing, can be implemented the system if necessary. Enter the image file of the soil samples to calculate the RGB values of

the soil samples in the digital image processing is calculated using a number of limitations as an output soil pH and soil constituents..

Several studies on soil test has been published in the past few decades. However, such software does not exist, it is possible to real-time testing and analysis of soil pH, type and characteristics. However, everyone does not have the exact output to up to now. Soil test is one of the most important issues in agriculture. The farmers analyze the soil, there is no software to apply the necessary fertilizer. Existing methods Soil tests are time-consuming, it is done manually by taking soil samples. The existing soil testing is done in Government labs by manually collecting the sample and then analysing it and generating results. This process is very time consuming and not readily available near all the farmers. India there was few laboratories available for farmer so they were not getting the use of soil testing. Because of this problem, farmers will not be able to identify the crop that is suitable for the soil, leading to loss or damage of the crop. We are depending on the growth of the technology that you want to focus, work of soil test is done using a number of modern technology. We, paper but has picked up a number of references from previous papers have found that it is based on the theory, the actual system has not been built until now. Some of the research papers based on the segmentation of the soil to take the soil Photo by satellite, the result does not look like a proper calculation of the agricultural component.

DroGo Scope:

What	Why
We are aiming to design a injector that would be capable of testing soil and displaying the run time results. It wouldn't take samples for testing but he will inject injector in the soil and will display immediate results. It would make determination of pH level of soil easy, it would immediately display amount of temperature as well as humidity and nitrogen and Ph level, all by one device and at immediate time. It would reduce the amount of time, cost and man-power needed for taking sample and then testing each of them separately.	Soil testing is very expensive and difficult process and no one tried soil testing outside the lab at real time. Farmers often have to pay substantial amount to get the soil tested before ploughing the field. This process is time consuming and due to this most of the time, the farmers judge the soil on the basis of their assumptions. Due to environmental changes that has affected the soil, their assumptions are not always accurate and this effects the yield of the crop

Table: 1

2.3   Our Vision:

Our economy is mostly based upon agriculture. In Pakistan 60% population is resident in villages and most of them are earning from agriculture. But if we talk about progress and technology, we are far behind from many other agriculture countries. Our agriculture department is still using those old means of soil testing which generally are slow, time taking and expensive. In this digital world each and every sector is undergoing a dramatic change due to Information Technology. But, in agriculture field, most of the progress is restricted to ideas and suggestions and no practical progress is made. The ultimate goal of our project is to increase the crop yield and making soil testing more efficient, easy, cheap and less time consuming.

For this, We have proposed an Injector Module with the help of data mining and Machine learning Algorithm which will help to find out the condition of soil, and perfectly suitable crop for a field based on soil condition, weather conditions and crop details.

The purpose of this product is to facilitate the Agricultural department by automating soil testing system. As we live in an agricultural country, automated soil testing and prediction about future suitable crops, will be a game changing technique in the world of agriculture. It would help farmers to save their time, money and get instant results and a glimpse of future of their land too.

CHAPTER 3

DESIGN AND METHODOLOGY

3.1   Drogo's Overview:

The purpose of this product is to facilitate the Agricultural department by automating soil testing system. As we live in an agricultural country, automated soil testing and prediction about future suitable crops, will be a game changing technique in the world of agriculture. It would help farmers to save their time, money and get instant results and a glimpse of future of their land too. This product would be able to revolute soil testing manual methods by testing soil through injector and displaying results at run time and automatically updating its database through putty server by connecting it to arduino and it will suggest appropriate crop with the help of machine learning algorithm.

3.2   Tools and Hardware used

- Hardware used:
  a. PH Sensor Arduino
  b. Nitrogen Sensor Arduino
  c. Temperature Sensor Arduino
  d. Humidity Sensor Arduino
  e. Bluetooth Module Arduino

f. Arduino UNO Board

- Framework used:
  a. IDLE Python
  b. Android Studio
  c. Arduino Sketch
  d. Anaconda Python

3.3   Interfaces:
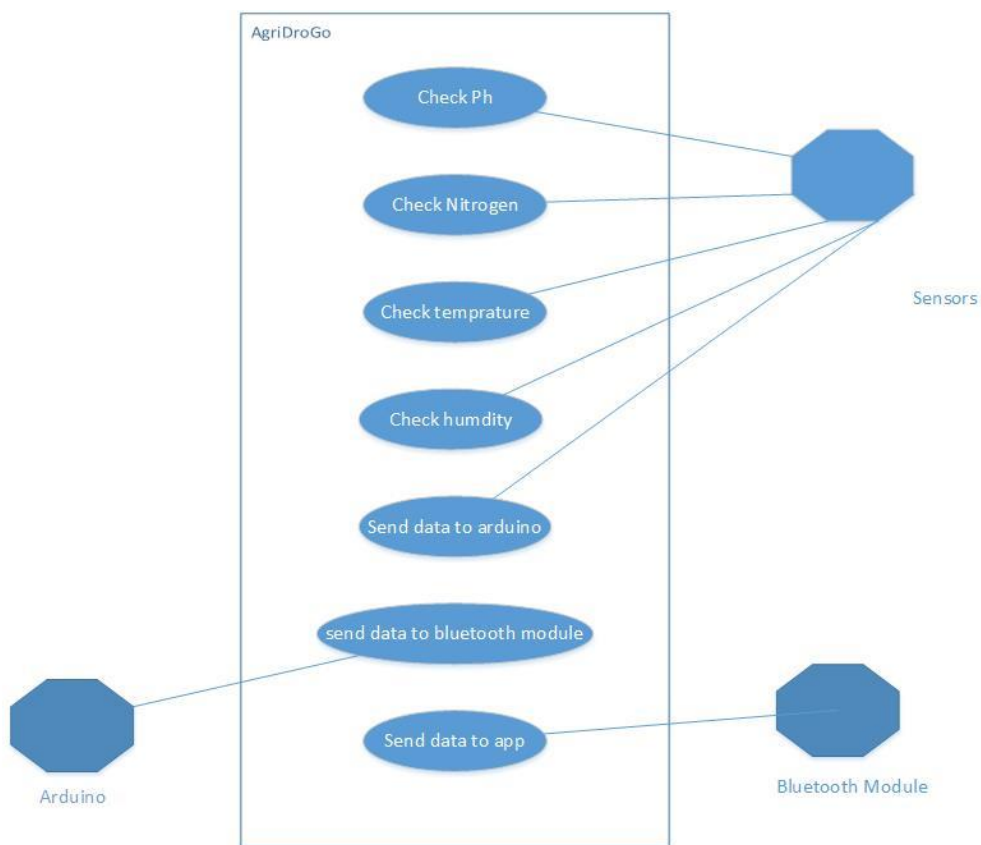
3.3.1 Use Case Diagram:

Figure 3.1: Use case

Diagram Description:

Sensors send output to aurdino which is forwarded to LCD and bluetooth module and through bluetooth module, sent to application.
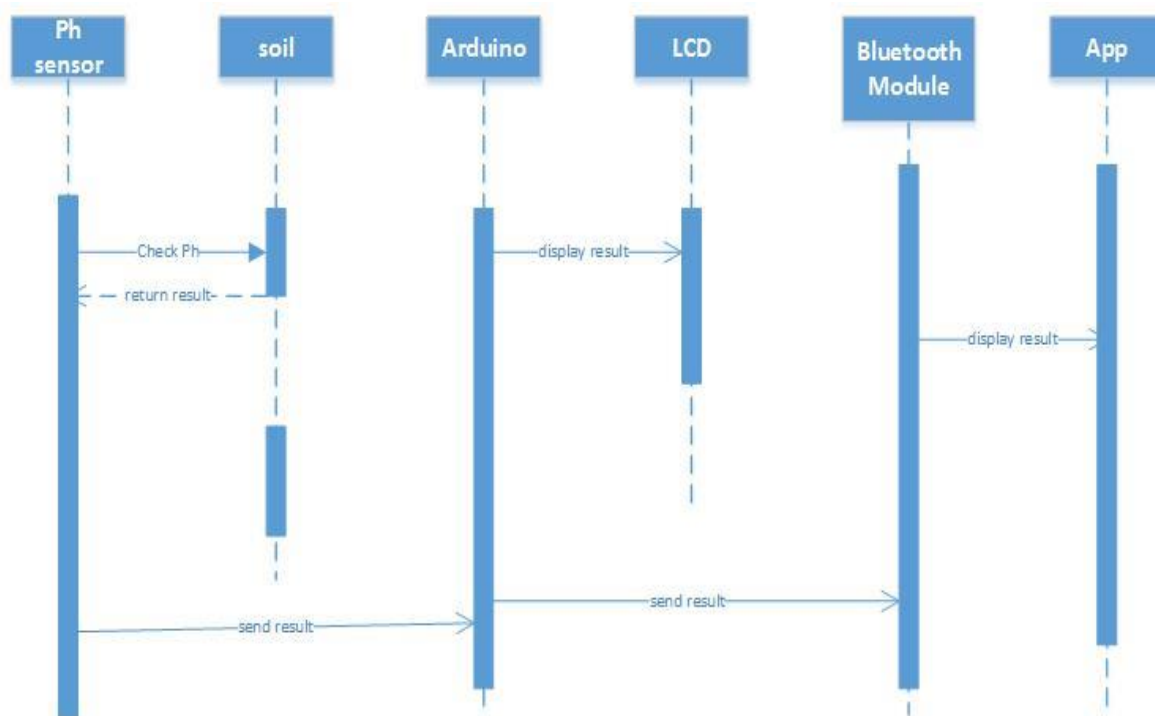
3.3.2 Sequence Diagrams:

 1. **Ph Sensor:**

Figure 3.2: Sequence Diagram (ph sensor)

Diagram Description:

Ph sensor injects in soil check Ph and displays result on LCD and transfer it into App.
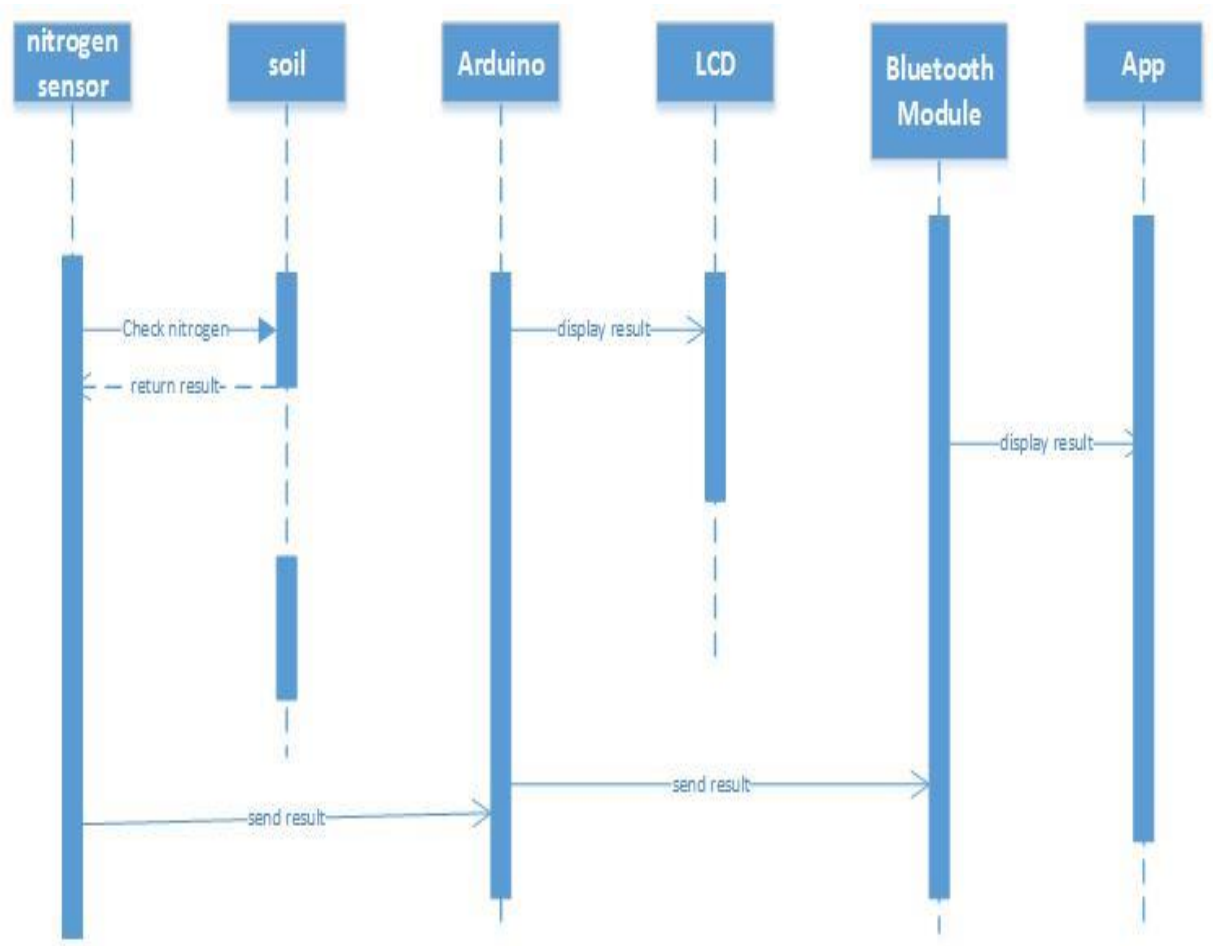
2. Nitrogen Sensor:

Figure 3.3: Sequence diagram (Nitrogen sensor)

Diagram Description:

Nitrogen sensor injects in soil check Nitrogen and displays result on LCD and transfer it into App.

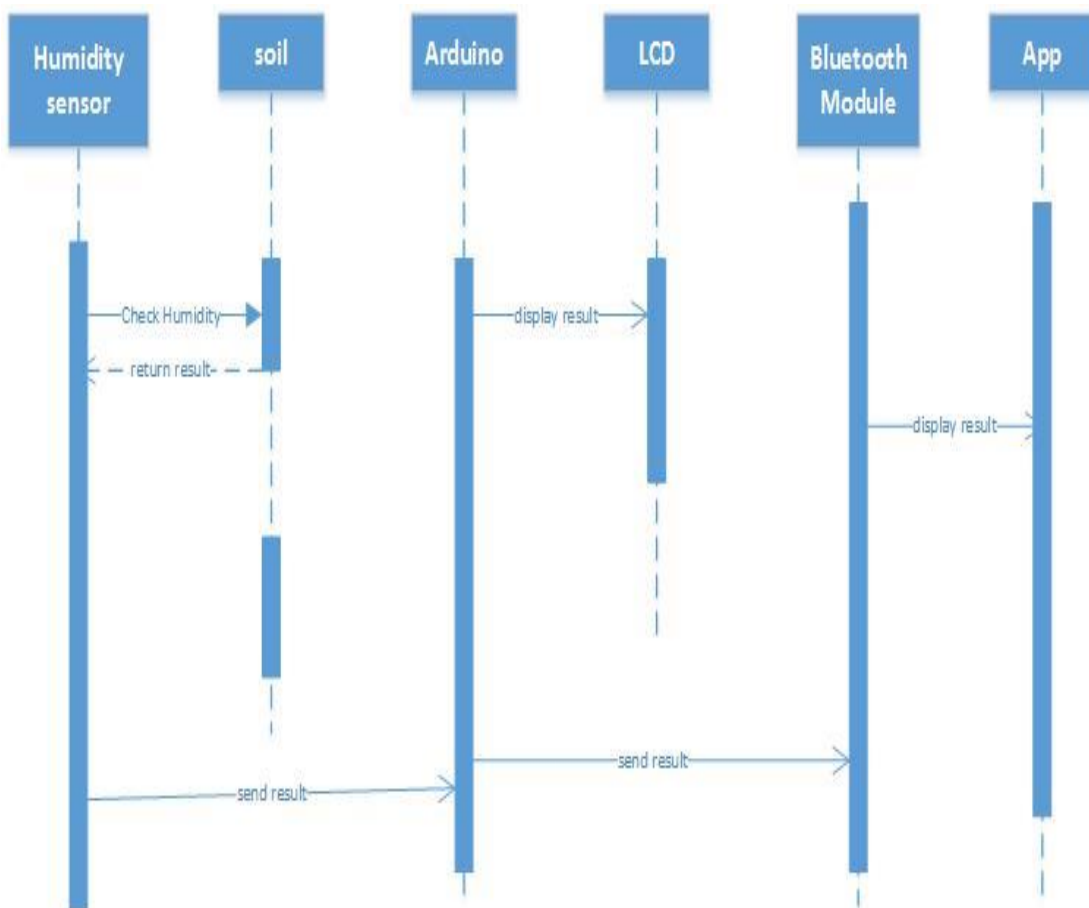**3. Humidity Sensor:**

Figure 3.4: Sequence diagram (humidity sensor)

Diagram Description:

Humidity sensor injects in soil check Humidity and displays result on LCD and transfer it into App.
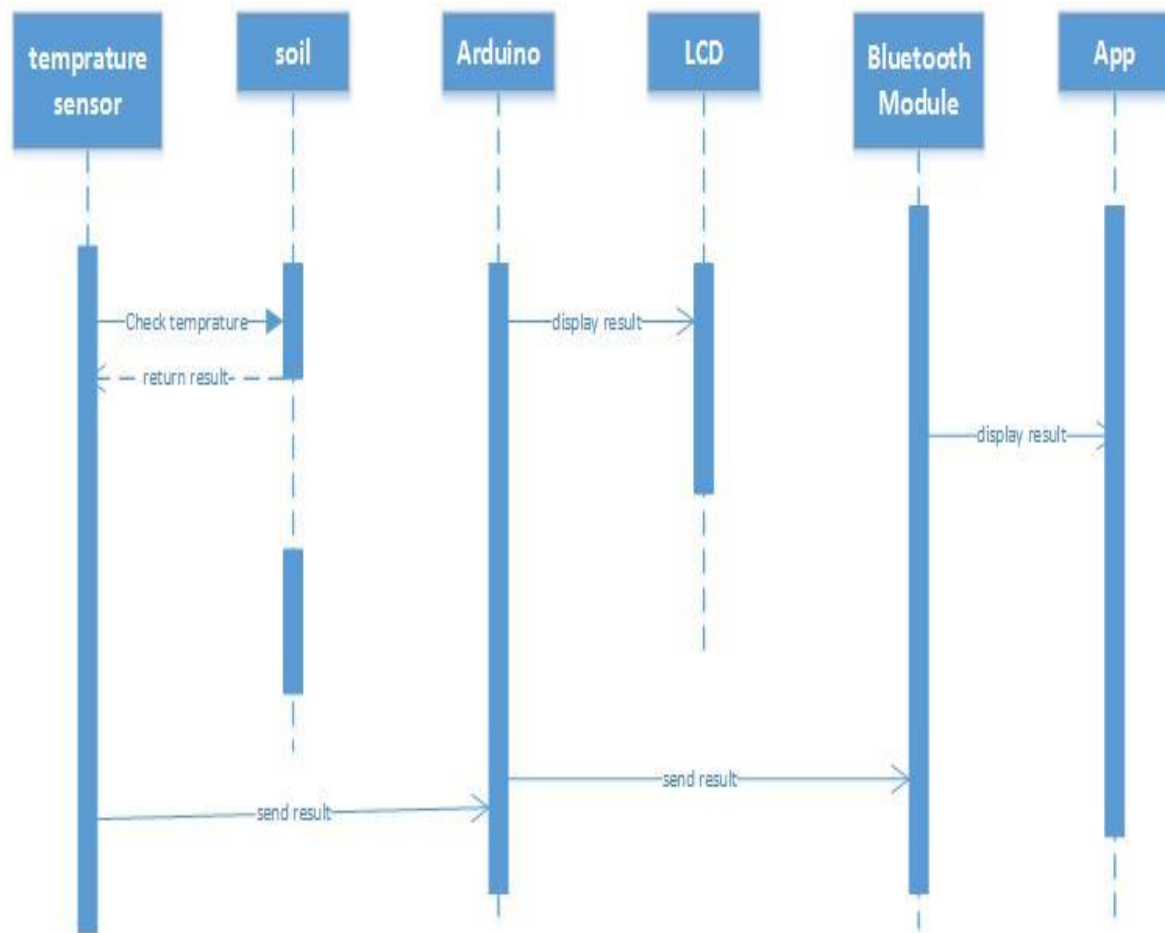
4. Temperature Sensor:

Figure 3.5: Sequence diagram (temperature sensor)

Diagram Description:

Temperature sensor injects in soil check Temperature and displays result on LCD and transfer it into App.
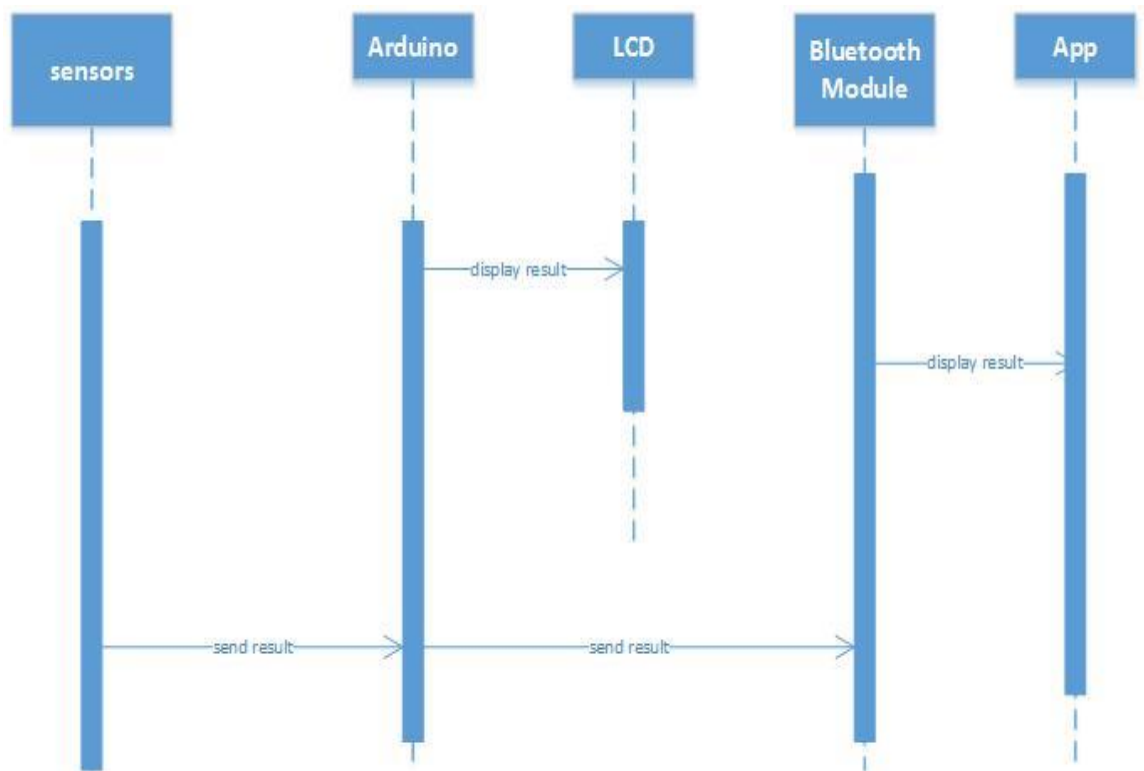
5. Arduino functioning:

Figure 3.6: Sequence diagram (Arduino functioning)

Diagram Description:

Sensors injects in soil check Sensor and displays result on LCD and transfer it into App.
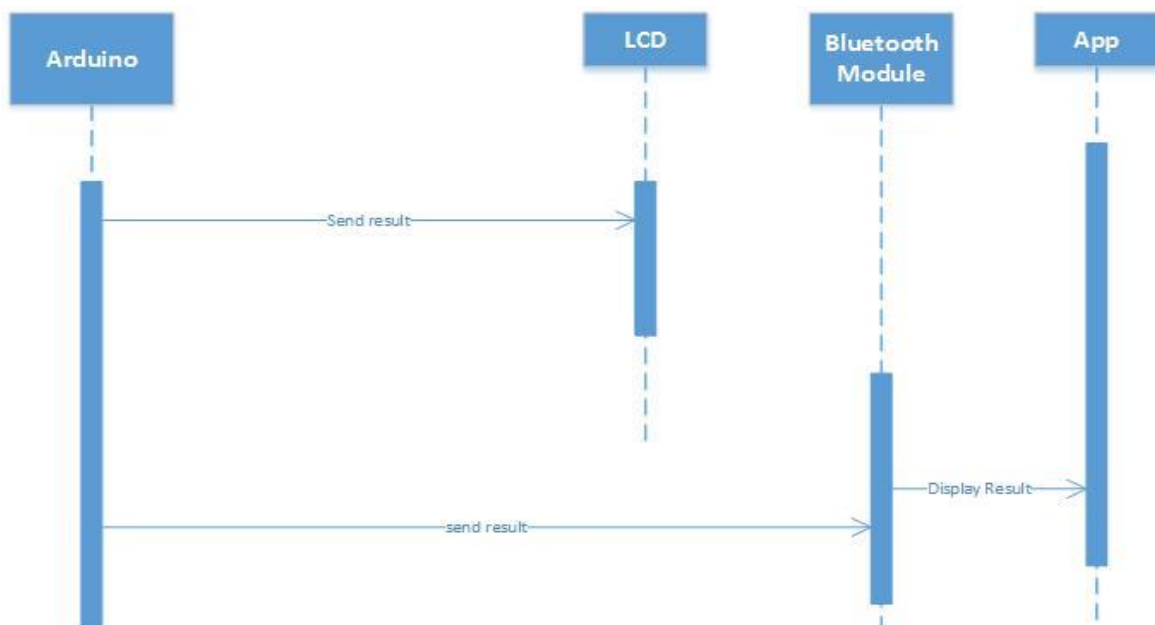
6. Bluetooth module:

Figure 3.7: Sequence diagram (Bluetooth module functioning)

Diagram Description:

Arduino check inputs and displays result on LCD and transfer it into App.

7. Android App:

Figure 3.8: Sequence diagram (Android App)

Diagram Description:

Bluetooth sends inputs and displays result and transfer it into App.

CHAPTER 4

IMPLEMENTATION

4.1   Technology Used:

1. **Android Studio**

   Android Studio is used for android app development that will display modules data.

2. **IDLE python**

   Python is used for machine learning algorithm that will suggest crop on the basis of data of soil that sensors obtained from soil.

3. **Sklearn/Cikit Learn:**

   Sklearn/Cikit Learn are the libraries of python that used for machine learning.

4. **Putty Server:**

   It stores and display data that receive by Arduino in text file

5. Dataset:

Crop Name	PH	Temp	Humidity			
Potato	4.5-6.0	150C-250C	50-70			
Peanut	5.0-7.5	21C-30C	20-40			
Apple	5.0-6.5	0C-20C	30-80			
Carrot	5.5-7.0	15C-21.1C	20-60			
Cauliflower	5.5-7.5	10C-25C	20-70			
Corn	5.5-7.5	29C-32C	40-60			
Garlic	5.5-7.5	2C-10C	25-55			
Melon	5.5-6.5	21C-32C	24-56			

Figure 4.1: Dataset

4.2   Systems Design:

- **Injector Module Working:**

It's is the arduino powered board that contain sensors that will sense the soils details and process it. The sensors that are used are Temperature Sensor, Ph Sensor, Humidity Sensor and Nitrogen Sensor.

- **Working of Injector Module with Bluetooth Module:**

After processing and sensing the input from soil the Bluetooth module will sends the data to the to android app.
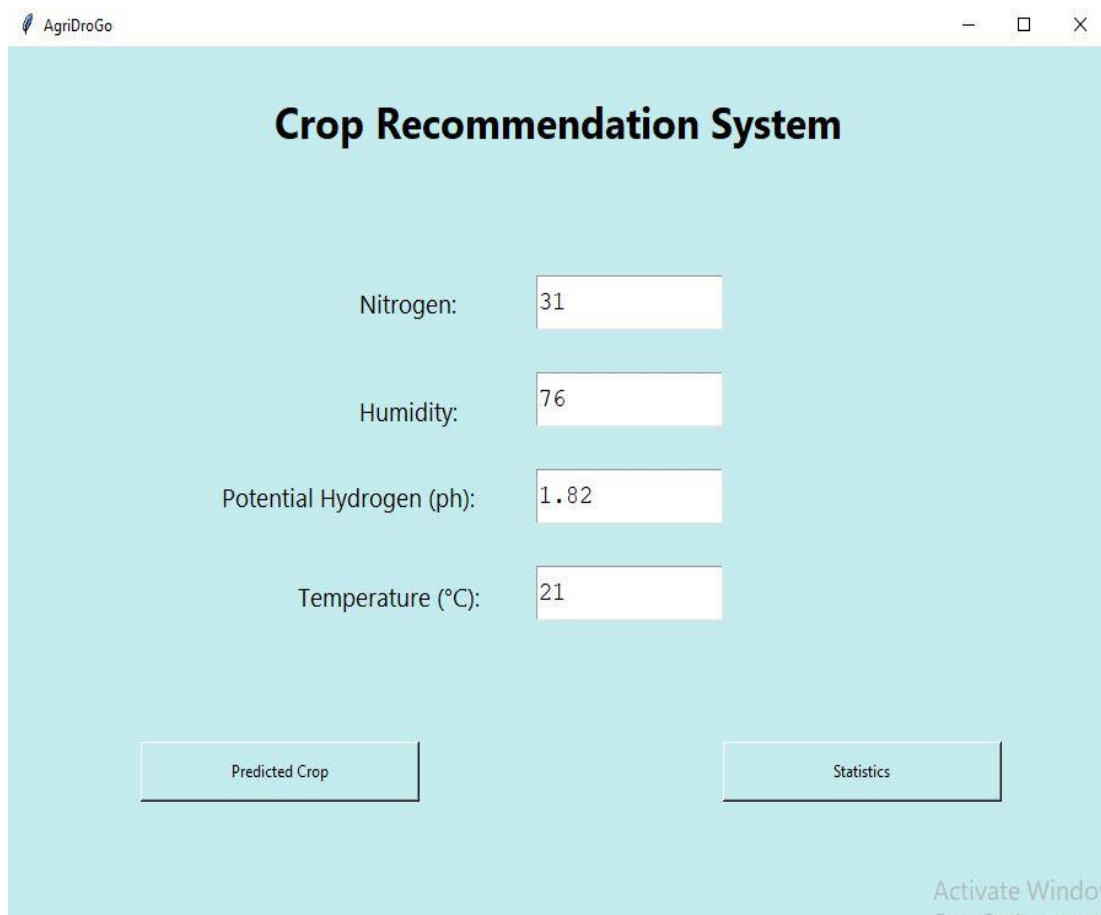
- **Working of Android App:**

Android app will displayed the data that has been sends to app through Bluetooth.

- **Windows GUI App:**

Python GUI based desktop app will recommend appropriate crop by taking data from Arduino and comparing it with training dataset through soil recommendation   algorithm.
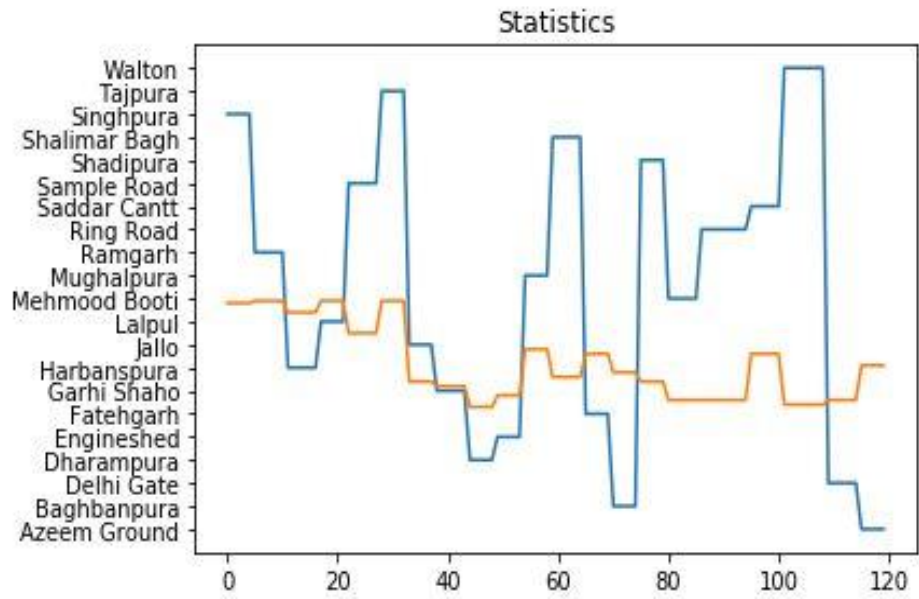
4.3   Screens:

4.3.1   Desktop GUI:

GUI Diagram: 4.3.1

GUI Description:

GUI displays the result that sensors got from the sensor and transferred into file with the help of Arduino and Algorithm predict the Crop by clicking on Predicted Crop button.

4.3.2   Bluetooth Device:

- **Graph:**

Graph: 1

Graph Description:

This graph displays the realtion between Areas and Ph and shows the Ph ranges according to different Areas.

4.3.3   Bluetooth Device:
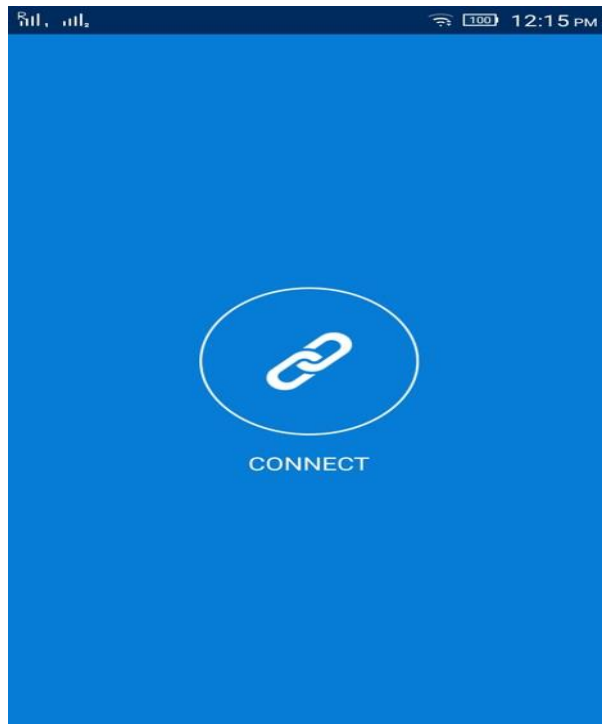
- **Bluetooth Connection:**

Figure 4.3.2: Bluetooth Connection

- **Bluetooth Device Searching:**

Figure 4.3.2: Bluetooth Device Searching
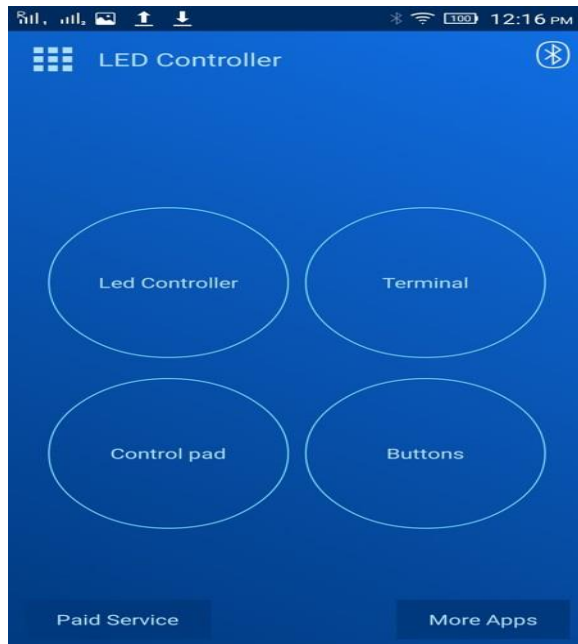
- **Terminal:**

Figure 4.3.2: Bluetooth Terminal

Output Terminal:

Figure 4.3.2: Output Terminal

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Agriculture growth in Pakistan:

Agriculture sector is the most important part of the economy of Pakistan. Agriculture sector is contributing almost 23.4% in the economy of Pakistan. Main focus of agriculture sector is provision of food security for our people relatively the maximization of production. It gives us livelihood and makes connectivity within the country. Approximately 70% of total population of Pakistan lives in rural areas. Almost 45% of work force is engaged with agriculture sector. Pakistan provincial government pays attention on priority bases to raise the productivity of agriculture sector of Pakistan. Agriculture is a main sector for the provision of raw material to the downstream industry for production. The fundamental role of agriculture sector is to minimizing poverty, provide employment opportunity which is country really desire. Main Purpose of our agriculture sector is to diversify it from self-reliance to profitability.

Agriculture growth is disturbing due to lack of technology use in Pakistan. Like Soil testing that occurs in laboratories is very time consuming and expensive for farmers.

Figure 5.1: Agriculture Growth in Pakistan

5.2 Cause of Low Productivity:

Unfortunately, Pakistan based on conservative method for production and also based on self- reliance which is main cause for low productivity. Most of the developed countries use advanced technology and go to maximize per acre productivity. When per acre productivity is low its mean that lower of former profit and when farmer did not earn more profit then they have not excess money to purchase high quality seeds, better pesticides , advanced technology due to lack of these things next productivity is also lower and this vicious circle is continue.

5.3 Aim of Project

Our goal is to influence an insurgency in agriculture. As our nation is a horticultural nation, however we have exceptionally restricted programmed apparatus to utilize, so this could be an expansion to it and give better and prompt outcomes.

As Soil testing is very expensive and difficult process and no one tried soil testing outside the lab at real time. So the main aim of our project is to give farmer a hand in

the form of technology so they can save their time and money in laboratories for testing and sampling the soil. DroGowouldn't take samples for testing but it will inject injector in the soil and will display immediate results. It would make determination of pH level of soil easy, temperature and humidity level, all by one device and at immediate time. It would reduce the amount of time, cost and man-power needed for taking sample and then testing each of them separately.

5.4 Benefits

1. One of the most major benefit is this, that the injector will suggest the suitable crop for the specific field. Machine Learning Algorithm will predict the field's suitable crop that would help in better yield production.

2. This is the first initiative of the soil testing technology in Pakistan.

3. A Step towards the better Agriculture growth in Pakistan.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Research Based Analysis

In this digital world each and every sector is undergoing a dramatic change due to IT field. But, in agriculture field, till date not much work has been done. The ultimate goal is to increase the crop yield of the agricultural field.

We have proposed an Injector Module with the help of Data mining techniques and Machine learning Algorithm which helps to find out the perfectly suitable crop suggestion for a farmer based on soil condition, weather conditions and crop details.

The purpose of this product is to facilitate the Agricultural department by automating soil testing system. As we live in an agricultural country, automated soil testing and prediction about future suitable crops, will be a game changing technique in the world of agriculture. It would help farmers to save their time, money and get instant results and a glimpse of future of their land too.

6.2 Conclusion

Till now in Pakistan, soil is being tested manually. Use of technology in this field is very rare due to less educated farmers. All the progress and automation is being done mostly in checking crop's sizing, pesticides, or fertilizer control. But the progress in

soil testing automation is just an idea, expected to be executed in future. To take an initiative in this regard, we are designing this module.

The purpose of this module is to automate soil testing to reduce cost and time consumption. This module will also predict changes expected in soil's nature and suitable crops according to these changes. So, this could prove to be a great revolution in agriculture department, which is the most important part of the economy of Pakistan. As we live in an agricultural country, automated soil testing and prediction about future suitable crops, will be a game changing technique in the world of agriculture. It would help farmers to save their time, money and get instant results and a glimpse of future of their land too.

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