M.KUMARASAMY COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

A Minor Project Report

on

leaf disease detection using CROPCARE++

Submitted in partial fulfilment of requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHONOLOGY

Under the guidance of

Ms.A.NITHIYA

ASSISTANT PROFESSOR/IT

Submitted by

BOOPATHI M	(927621BIT013)
JAGADHEESWARAN T	(927621BIT037)
JANARTHANAN S	(927621BIT039)
KISHORE B S	(927621BIT053)

DEPARTMENT OF INFORMATION TECHNOLOGY

M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous)

KARUR – 639 113

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M.KUMARASAMY COLLEGE OF ENGINEERING

VISION

To emerge as a leader among the top institutions in the field of technical education.

MISSION

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.

- Create a diverse, fully engaged, learner-centric campus environment to provide quality education to the students.

- Maintain mutually beneficial partnership with our alumni, industry and professional associations.

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To create groomed, technically competent and skilled intellectual IT Professional to meet the current challenges of the modern computing industry.

MISSION

- To ensure the understanding of fundamental aspects of Information Technology

- Prepare students to adapt to the challenges of changing market needs by providing an environment.

- Build necessary skills required for employability through career development training to meet the challenges posed by the competitive world

PROGRAM EDUCATIONAL OBJECTIVE

I. Solve real world problems using learned concepts pertaining to Information Technology domain.

II. Encompass the ability to examine, plan and build innovative software products.

III. Carry out the profession with ethics, integrity, leadership and social responsibility.

PROGRAM SPECIFIC OUTCOMES

I. **Professional Skills**: Comprehend the technological advancements and practice professional ethics and the concerns for societal and environmental well-being.

II. **Competency Skills:** Design software in a futuristic approach to support current technology and adapt cutting-edge technologies.

III. **Successful career:** Apply knowledge of theoretical computer science to assess the hardware and software aspects of computer systems.

PROGRAM OUTCOMES

Graduates of Bachelor of Information Technology will have the following ability and capability at the end of course:-

a. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..

k. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

M.KUMARASAMY COLLEGE OF ENGINEERING

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BONAFIDE CERTIFICATE

Certified that this minor project report “leaf disease detection using CROPCARE++” is the bonafide work of “ BOOPATHI M (927621BIT013),JAGADHEESWARAN T(927621BIT037),JANARTHANAN S (927621BIT039),KISHORE BS (927621BIT053) ” who carried out the project work during the academic year 2022- 2023 under my supervision.Certified further ,that to the best of our knowledge the reported herein does not form of anyother minor project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

Signature

MRS.A.NITHIYA,M.Tech,

ASSISTANT PROFESSOR/IT

Department of Information Technology,

M.Kumarasamy College of Engineering,

Thalavapalayam, Karur-639113.

Signature

Dr. R. PUNITHAVATHI, Ph.D.,

HEAD OF THE DEPARTMENT,

Department of Information Technology,

M.Kumarasamy College of Engineering,

Thalavapalayam, Karur-639113

ABSTRACT

"Cropcare++" is an innovative and groundbreaking project that operates at the intersection of agriculture and technology. At its core, Cropcare++ leverages the power of Internet of Things (IoT) sensors to collect real-time data from crops. This data is then transmitted to the cloud, where advanced machine learning algorithms work their magic to analyze and process it. The result? A revolutionary system that simplifies the complexity of agricultural devices, empowers early disease detection for timely intervention, enhances crop yields, and offers the convenience of remote monitoring. The significance of Cropcare++ lies in its potential to transform the agricultural landscape. By harnessing the capabilities of IoT and machine learning, it offers a holistic solution for farmers and agricultural practitioners. This system simplifies agricultural device complexity, facilitates early disease detection, boosts crop yields, and offers remote monitoring capabilities. Cropcare++ aims to revolutionize agriculture by providing an integrated solution for disease detection and IoT-based pesticide recommendations, thus fostering more efficient, data-driven, and sustainable farming practices.

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INTRODUCTION

CHAPTER 1

Introduction

Agriculture is vital for feeding our growing world, but it faces problems like crop diseases and inefficient practices. Our project, "Leaf Disease Detection Using Cropcare++," is all about using smart technology to make farming smarter and more efficient. Imagine a system that can constantly monitor crops, detect diseases early, and help farmers make better decisions. That's what Cropcare++ does. It uses sensors to collect data from fields, sends it to the cloud for analysis, and then tells farmers what's happening with their crops.

1.1 Background

The "Leaf Disease Detection Using Cropcare++" project emerges against the backdrop of pressing challenges facing modern agriculture. Agriculture is a cornerstone of our global food supply, and as the world's population continues to grow, the demand for sustainable and efficient farming practices becomes increasingly urgent. However, traditional farming methods often fall short in meeting these demands. Conventional agriculture frequently relies on excessive pesticide use and lacks the precision required to maximize crop yields while minimizing environmental impact. In this context, emerging technologies such as the Internet of Things (IoT) and advanced machine learning offer transformative solutions.

1.2 Problem Statement

Takes real time sensor data of the crop field and upload them to the cloud. Analyze the obtained data using machine learning techniques and take accurate decisions on the cloud side. This drastically improves processing speed and reduce the complexity of the device compared to other architectures of similar kind. Detect the crop disease and give the suggestion of pesticides to the crop producer by using Internet of Things.

1.3 Objective

We aim to create a system that can detect crop diseases early, provide precise recommendations for intervention, and ultimately increase crop yields while minimizing the environmental impact. Through the integration of IoT sensors and advanced machine learning, we seek to offer a comprehensive solution that empowers farmers with real-time data and actionable insights. Our project's core objectives are to enhance food security, promote sustainable farming practices, and make agriculture more efficient and responsive to the needs of a growing global population. In doing so, we aim to contribute to the advancement of precision agriculture and support the livelihoods of farmers worldwide.

1.4 Existing System

Describe the current method of plant disease detection, which relies on naked eye observation by experts. Highlight that this method is manual and dependent on human expertise. Mention any limitations or drawbacks of the existing system, such as subjectivity, time-consuming, and potential for errors. We will create the separate software for leaf disease detection .

1.5 Proposed System

The proposed system, "Leaf Disease Detection Using Cropcare++," is designed to be a game-changer in agriculture. It combines IoT sensors and advanced machine learning to create a smart solution that monitors crops, detects diseases early, and suggests the best actions for farmers. This system is aimed at simplifying farming, increasing crop yields, and reducing the environmental impact of agriculture. By providing real-time data and easy-to-understand recommendations, our system empowers farmers to make informed decisions, ensuring healthier crops and a more sustainable future for agriculture.

LITERATURE REVIEW

CHAPTER 2

Literature Review

1. According to the authors of the paper “IOT Based crop-field monitoring”, System is developed to monitor crop-field using sensors (soil moisture, temperature, humidity, light) & automation system. Technique of Eva transpiration is used, which can be used to schedule irrigation. Electromagnetic sensors are used. Web application is developed to analyse the data received & check the threshold values for the parameters and then do the action.

2. The paper published by Mohanrah I, Kirthika Ashokumar, Naren J named “Field monitoring and automation using IOT in Agriculture Domain” [6], This paper proposes the advantage of having ICT in Indian agriculture sector, which shows the path for rural farmers to replace some of the conventional techniques. A comparative study is made between the existing system and the developed systems. The system overcomes limitations of traditional agriculture procedures by utilizing water resources efficiency and also reducing the labor cost.

3. According to the authors from the paper “IOT Based smart crop-field monitoring and automation irrigation system” [2], System implemented on crop-field IOT based crop disease detection and pesticide recommendation Introduction Dept. of ISE, RVCE 2018-19 4 monitoring, was developed by smart phone operating by considering the sensors data via internet. Usage of ATMEL microcontrollers-based GSM operated sensors.

4. According to the authors of white published0paper “IOT Based crop-field monitoring and irrigation automation”, Distributed in field sensors-based irrigation system to support site specific irrigation management. Temperature sensor, pH sensors are connected to ATMEL, mobile communication model, stable remote access to field condition & real time control and monitoring of the variable rate irrigation controller.

5. According to the authors of the paper “IOT Based crop-field Monitoring and Irrigation Automation” [4], A system is developed to monitor the crop-field using sensors and automate the irrigation system. The notification is sent to farmers mobile periodically, the farmer can be able to monitor the field condition from anywhere. This system is 92% more efficient than the conventional approach.

PROJECT METHODOLOGY

Chapter 3

Project Methodology

3.1 System Architecture

The edge device which includes hardware and the sensors like color sensor, temperature sensor and humidity sensors. These sensors and the hardware are responsible for monitoring of the crop and sending the status of the crop to the cloud using the WiFi module. The architecture of this model is depicted in the figure 3.1 which shows how all the sub models of architecture are interconnected. In this model, the sensors like color sensor, temperature sensors and humidity sensors are connected to the Arduino Uno, which is intern connected to the ESP8255 WiFi module. WiFi module collects the data from the Arduino and sends it to the cloud for further operations. The algorithm at the cloud side downloads the data from the cloud. The data obtained from the cloud are analysed by the algorithm if disease exist the farmer will get an alert message and the pesticide suggestions.

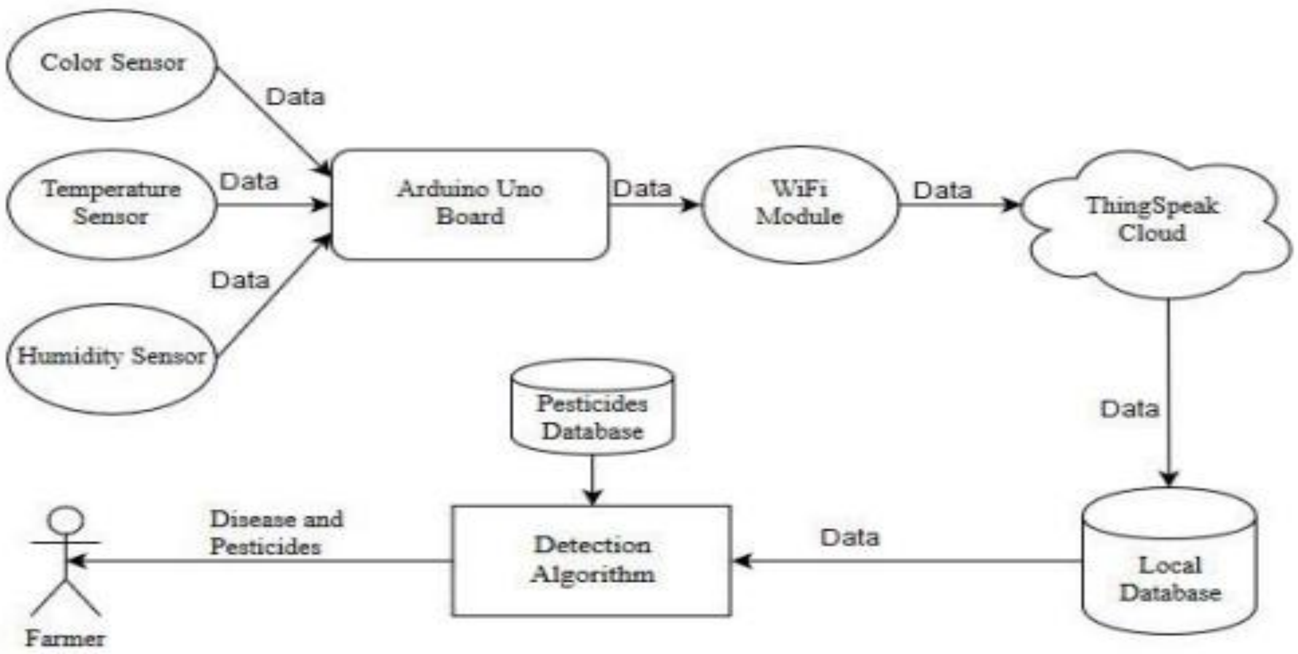

Figure 3.1 Architecture Diagram

3.2 Class Diagram

The diagram below represents the various classes and their methods for the application of crop-disease detection that uses our architecture. It identifies three distinct classes, Server, Sensors and Detection algorithm. Further the relationship between them are also understood by the diagram. Figure 3.5 below shows the class diagram for the leaf disease

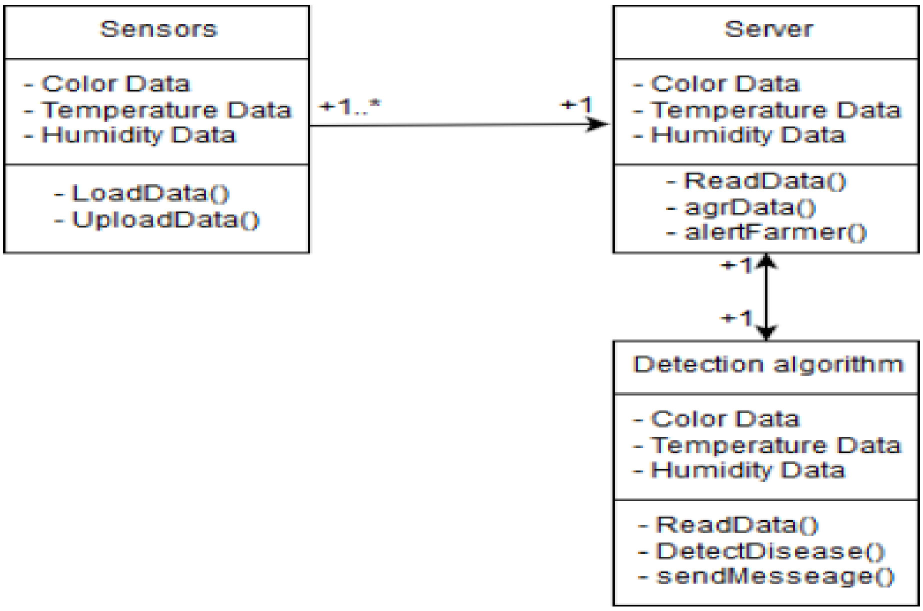

Figure 3.2 Class Diagram

3.3 Hardware Module

The hardware device, being responsible for continuous monitoring of the crop and collecting the data and sending them to the server. The data collected are color of leaf, temperature and humidity data of the crop. And another task is to send the data to the server by using the WiFi module. Arduino board is programmed in such a way that it collects all data from the sensors for every 30 min, and send these data to the cloud continuously. The time constant can be varied based on the requirement

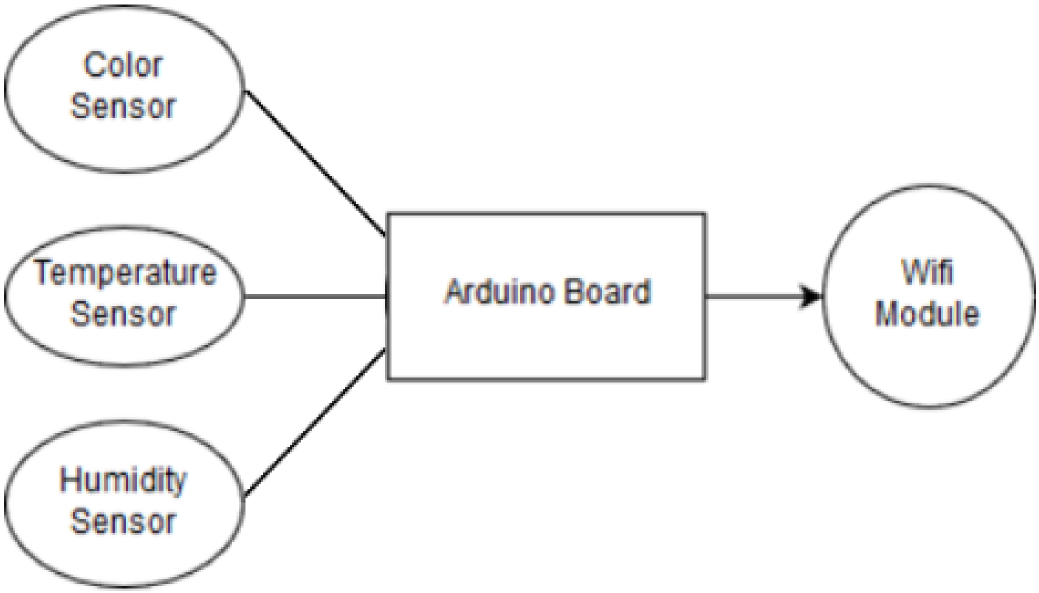

Fig:3.3 Hardware Module

Modules Description

Chapter 4

Modules Description

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4.1 Data Collection Module

Describe how the Data Collection Module gathers real-time sensor data from crop fields using IoT sensors. Explain the types of data collected and the sensors involved.Specify the types of IoT sensors used (e.g., humidity, temperature, image sensors).Mention how data is transmitted to the cloud (e.g., wireless protocols).

4.2 Disease Detection Module

Discuss how the Disease Detection Module analyzes the collected data using machine learning techniques to identify crop diseases. Highlight the importance of early disease detection. Share any specific accuracy rates or success stories related to disease identification. Emphasize the role of rapid disease detection in minimizing crop losses.

4.3 Alert and Notification Module

Explain how the Alert and Notification Module triggers alerts when diseases are detected. Mention the communication channels used for notifications. Detail the criteria for triggering alerts (e.g., disease severity thresholds). Discuss the various notification methods used to alert users. Highlight the importance of timely alerts for proactive action.

4.4 Remote Monitoring Module

Discuss the capabilities of the Remote Monitoring Module for real-time data access and decision-making. Explain how remote monitoring benefits crop producers. Provide examples of how remote monitoring has benefited crop producers (e.g., case studies). Discuss the significance of real-time data access for making informed decisions. Mention any remote control features, if applicable.

4.5 User Interface Module

The User Interface Module in our project, "Leaf Disease Detection Using Cropcare++," provides a user-friendly way for farmers to interact with the system. It's like the control center where farmers can access real-time data about their crops, receive alerts about diseases, and get recommendations on what to do. This simple and intuitive interface empowers farmers to make informed decisions easily, ensuring their crops stay healthy and productive.

RESULTS AND DISCUSSION

Chapter 5

Results and Discussion

The primary objective to design the architecture was successfully completed. In order to demonstrate the working model, several use-case were examined, implemented and tested. The server was a HP laptop with 8GB of RAM. But the Server can be hosted in lesser specification also depending of the number of client's model connected to the server. The device with light computational capabilities is been chosen, because it is cost-effective and easier for implementation for many applications. It has been decided to implement the architecture to detect these diseases.

1. Powdery mildew
2. Anthracnose
3. Die back
4. Phoma blight
5. Bacterial canker
6. Red rust

the snapshot of database which stores the pesticides to be suggested. The disease mentioned above and their pesticides are stored into the MySQL database. The indexing of the disease is as followed as the numbering of the disease list above. These pesticides are further used by the algorithm to give the appropriate pesticides to the farmer. In the server side to verify the result of detecting the disease and to suggest the pesticide. The server program will also display the result values to the terminal with alerting the farmer. The result value, that is the disease name and pesticides are suggested to the farmer using the farmer email ID. The figure 6.3 shows the screenshots of how the result message looks like. After getting this message the farmer can further proceeds to apply the suggested pesticides in order to avoid the disease caused loss.

5.1 Arduino Uno Board

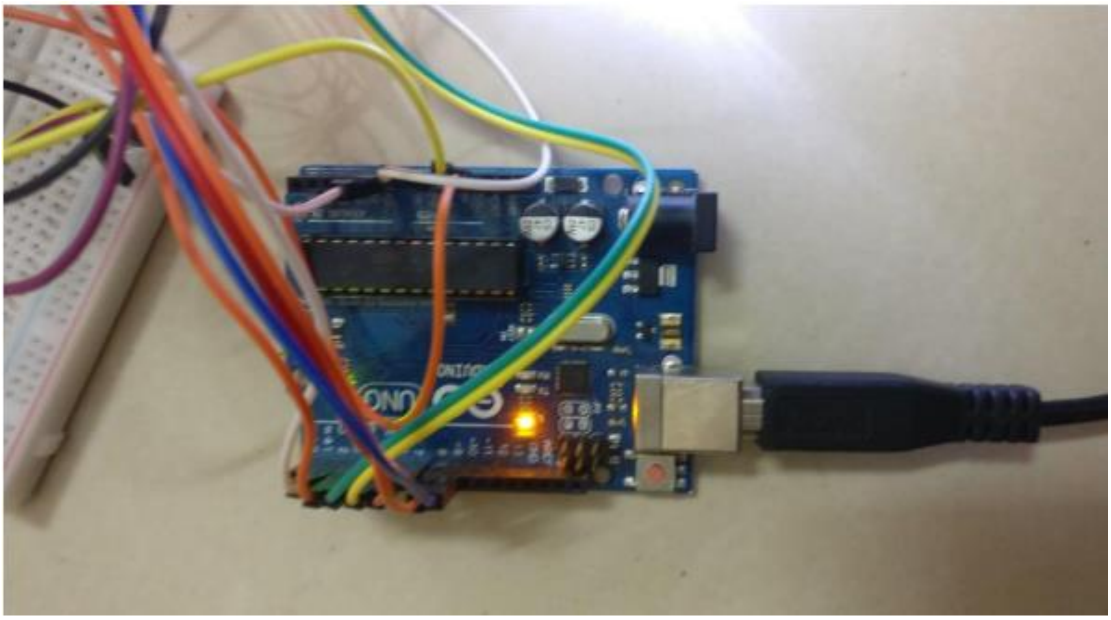

Figure 5.1 Arduino Uno Board

5.2 Color Sensor Sensing Leaf color

Figure 5.2 Color Sensor Sensing Leaf color

5.3 Alert Message to the Farmer

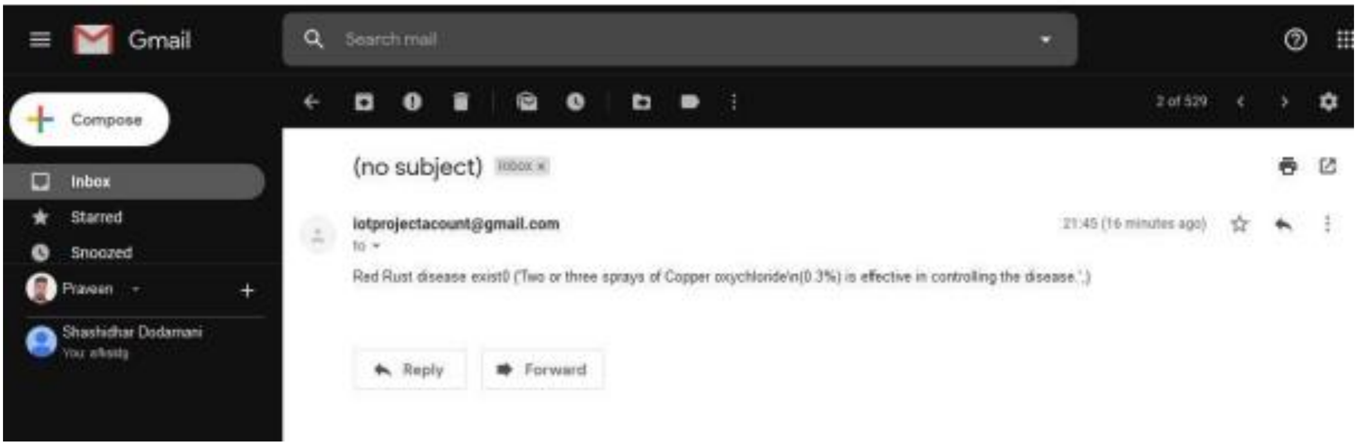

Figure 5.3 Alert Message to the Farmer

5.4 Server Detecting the disease

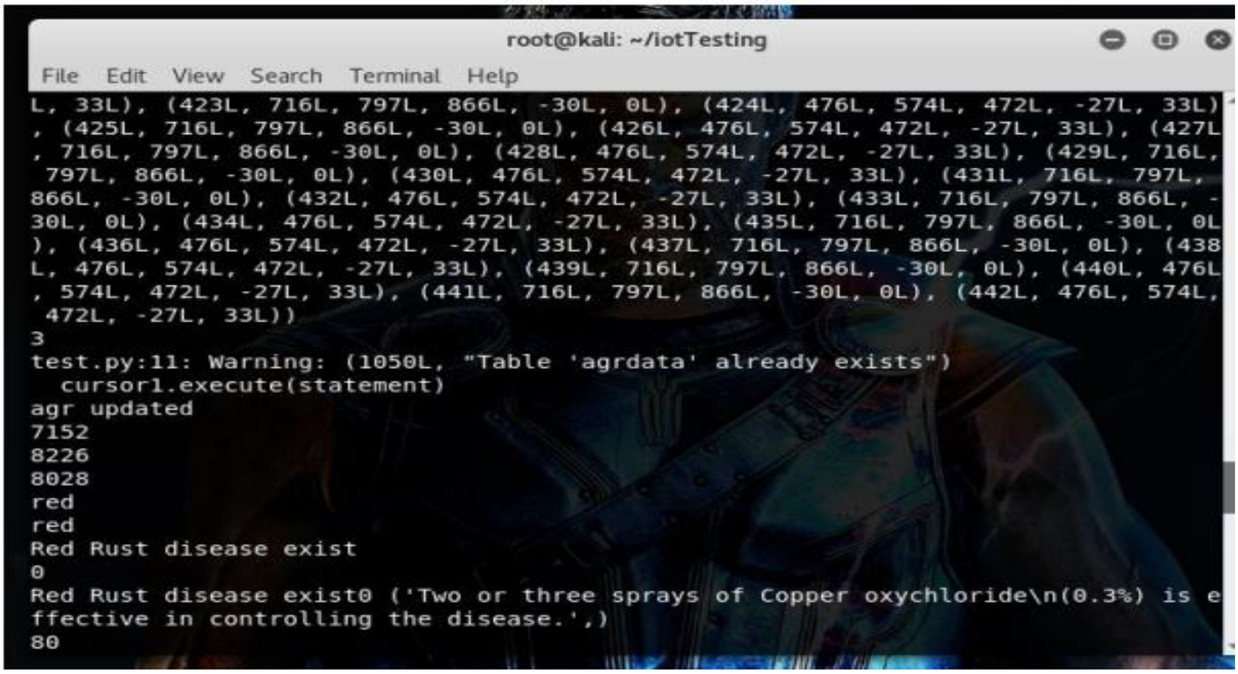

Figure 5.4 Server Detecting the disease

Sample Codes

Chapter 6

Sample Codes

Hardware code:

Reading sensor data Arduino:

```
void readSensors(void)
{
 temperature = DHT.humidity;
 temperature = (temperature-491.67)*5/9;
 humidity = DHT.temperature;
 digitalWrite(S2,LOW);
 digitalWrite(S3,LOW);
 colorRed = pulseIn(sensorOut, LOW);
 digitalWrite(S2,HIGH);
 digitalWrite(S3,HIGH);
 colorGreen = pulseIn(sensorOut, LOW);
 digitalWrite(S2, LOW);
 digitalWrite(S3, HIGH);
 colorBlue = pulseIn(sensorOut, LOW);
}
```

Sending data to cloud:

```
void GetThingspeakcmd(String getStr)
{
String cmd = "AT+CIPSEND=";
cmd += String(getStr.length());
 ESP8266.println(cmd);
Serial.println(cmd);
 if(ESP8266.find(">"))
 {
```

```
ESP8266.print(getStr);
Serial.println(getStr);
delay(500);
String messageBody = "";
while (ESP8266.available())
{
String line = ESP8266.readStringUntil('\n');
if (line.length() == 1)
```

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```
{
messageBody = ESP8266.readStringUntil('\n');
}
}
Serial.print("MessageBody received: ");
Serial.println(messageBody);
return messageBody;
}
else
{
ESP8266.println("AT+CIPCLOSE");
Serial.println("AT+CIPCLOSE");
}
```

Server code:

```
def check():
connection=MySQLdb.connect("localhost","root","root","IOT")
cursorX=connection.cursor()
statementX="SELECT * FROM agrdata ORDER BY id DESC LIMIT 1;"
cursorX.execute(statementX)
checkforcolor()
avgResult=cursorX.fetchall()
for row in avgResult:
```

```
colorR=row[1]
colorG=row[2]
colorB=row[3]
avgTemp=row[4]
avgHumidity=avgResult[5]
connection.commit()
connection.close()
checkForColor()
checkForTemperature()
checkForHumidity()
checkfordisease()
```

CONCLUSION

Chapter 8

CONCLUSION AND FUTURE SCOPE

The concept of leaf disease detection using IOT is still young and the research to explore this domain is evolving exponentially. Our project proposes a solution to solve problems related to farmer. Continues monitoring of the crop field by the farmer and providing the appropriate pesticides to them is been automated using the IOT in this project. As per the results obtained, the number of diseases to the crop can be identified by the sensors like color sensor, humidity sensor and temperature sensor. The proposed method which incorporates a machine learning model not only improves the scalability but also increases adaptability and maintenance. The objective of the project was fulfilled by developing the architecture that automates the detection of the disease of a crop and suggest the suitable pesticide to the farmer. The crop status is monitored continuously by the sensors of hardware module and are sent to the server. In the server side the data collected are analyzed and detect the disease to the leaf. The number of identification of disease using the apparatus can be increased by more number of parameters. This architecture can also be developed to wide variety of crops. The number of parameters we considering can also be increased to get the accurate results. The integration of server and the sensors paradigms can be improved with respect to data transfer and the security of the data. For applications involving sensitive data, data encryption can also be incorporated for privacy-preservation and security.

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Chapter 9

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