VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELAGAVI, KARNATAKA

PROJECT WORK PHASE-2 REPORT
on

"AUTOMATED AGROBOT FOR SMART FARMING USING UBIQUITOUS COMPUTING"

A report submitted in the partial fulfillment of the requirements for the award of the degree of

Bachelor of Engineering
in
Information Science & Engineering

Submitted by

PRANAV N	**(1SG19IS069)**
ROHITH GANAPATHI BHAT	**(1SG19IS086)**
S KAUSHAL	**(1SG19IS087)**
NADEEM PASHA	**(1SG19IS126)**

Under the guidance of

Prof. SWETHA K B
Assistant Professor
Dept. of ISE, SCE

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

SAPTHAGIRI COLLEGE OF ENGINEERING

Bengaluru-57

2022-23

Department of Information Science & Engineering

CERTIFICATE

Certified that the **Project Work Phase-2 (18CSP83)** entitled **Automated Agrobot For Smart Farming Using Ubiquitous Computing** carried out by **Mr. Pranav N (1SG19IS069), Mr. Rohith Ganapathi Bhat (1SG19IS086), Mr. S Kaushal (1SG19IS087), Mr. Nadeem Pasha (1SG19IS126)** bonafide students of 8th semester, Department of Information Science & Engineering carried out at our college **Sapthagiri College of Engineering**, Bengaluru in partial fulfillment of the award of **Bachelor of Engineering** in **Information Science & Engineering** of the **Visvesvaraya Technological University,** Belagavi during the year 2022-23. It is certified that all corrections/suggestions indicated for Final Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work Phase-2 prescribed for the said Degree.

Signature of the Guide	Signature of the HOD	Signature of the Principal
Prof. Swetha K B Assistant Professor	Dr. H.R. Ranganatha Professor & Head	Dr. H Ramakrishna Principal

Name of the Examiners	Signature with date
1. ____________________	____________________
2. ____________________	____________________

ABSTRACT

The use of pesticides in agriculture plays a critical role in controlling pest populations and increasing crop yields. However, conventional methods of pesticide spraying can be inefficient and pose potential risks to human health and the environment. In this paper, we present a novel approach to pesticide spraying using an autonomous robot equipped with sensors to measure plant moisture, temperature, and humidity. The robot follows a predefined path, and the pesticide is sprayed when needed, based on the sensor data. The sensor data is uploaded to ThingSpeak, a cloud platform for the Internet of Things (IoT), We also present the design and implementation of the robot, including the hardware components, software architecture, communication with ThingSpeak, and 24/7 farmer helpdesk support through our chat-gpt enabled chatbot. Finally, we evaluate the performance of the robot in terms of pesticide efficiency and environmental impact. Our results show that the proposed approach significantly improves the efficiency of pesticide spraying and reduces the negative impact on the environment, making ita promising alternative to conventional methods.

ACKNOWLEDGEMENT

Any achievement doesn't depend solely on the individual efforts but on the guidance, encouragement and co-operation of intellectuals, elders and friends. A number of personalities have helped us. We would like to take this opportunity to thank them all especially the management of Sapthagiri Institutions.

We would like to express our heart-felt gratitude to **Dr. H Ramakrishna,** Principal, Sapthagiri College of Engineering, Bengaluru, for his help and inspiration during the tenure of the course.

It is great privilege to extend our deep sense of gratitude to **Dr. H.R. Ranganatha**, Head of the Department, Information Science and Engineering, Sapthagiri College of Engineering, Bengaluru, who patronized throughout our career, for his constant support and encouragement and for the facilities provided to carry out this work successfully.

We also extend our thanks to **Dr. Prerana Chaithra**, Project Coordinator, Dept. of ISE, S.C.E., Bengaluru for her kind cooperation.

With profound sense of gratitude, we acknowledge the guidance and support extended by **Prof. Swetha K B**, Assistant Professor, Department of Information Science & Engineering, S.C.E., Bengaluru. Her incessant encouragement and valuable technical support have been of immense help in realizing this project. Her guidance gave us the environment to enhance our knowledge, skills and to reach the pinnacle with sheer determination, dedication and hard work.

We also extend our sense of gratitude and sincere thanks to all faculty members and non-teaching staff members of Information Science and Engineering, Sapthagiri College of Engineering, Bengaluru for their views and encouraging ideas.

We are ever grateful to our family, teachers and friends for their constant love, guidance and support for helping us to get educated and complete our graduation.

PRANAV N
ROHITH GANAPATHI BHAT
S KAUSHAL
NADEEM PASHA

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 Overview

Agriculture is the heart of the world. In the world, agriculture is very important for the systemic needs of the human race in view of the rapid growth of the global population. Agriculture uses water for irrigation purposes. Water is essential for every plant, human and animal. Water wastage is one of the big complications in agriculture. Also, there are issues involved in huge manpower and also in irrigation systems. One of the solutions, for the above described problems, can be given by the Internet of Things.

The devices are getting smarter each day from smart TV to smart car to smart kitchen to Smartphone. Now everything is connected to the internet. IoT transforms the agricultural sector and empowers farmers to tackle the major difficulties they face. Adequate water supply is an important part of agriculture andcrops can be damaged by excessive water supply or water scarcity. IoT can significantly improve the utilization of water production.

IoT is concerned with connecting interconnected objects at different locations from each other. IoT is a type of network technology that senses information from various sensors and adds anything to the Internet for communication.

Traditional manual pesticide spraying operations is full of direct exposure to the pesticide liquid work environment, great harm to human body and when this pesticide may come into contact with the farmer during spraying, which may trigger skin cancer and asthma illnesses. Increased pesticide spraying can impact consumer health as it enters the food chain.

IoT technology is revolutionizing the way agriculture is practiced, by enabling farmers to optimize their operations and increase efficiency. One of the key applications of IoT in agriculture is smart irrigation. With the help of IoT sensors that can monitor soil moisture levels, temperature, humidity, and weather forecasts, farmers can determine the precise amount of water crops need. This helps farmers save water and reduce their environmental impact, while also increasing crop yields.

Another important application of IoT in agriculture is precision farming. This involves using sensors, drones, and other IoT devices to gather data about soil quality, plant health, and weather conditions, and then using this information to optimize crop growth and yield.

IoT technology also enables farmers to monitor their livestock more effectively. With the help of IoT sensors and GPS tracking devices, farmers can track the location, health, and behavior of their animals, and ensure that they are well-cared for. This can help improve animal welfare and productivity, while also reducing the risk of disease outbreaks. IoT plays a crucial role in smart farming by enabling the collection of data from various points in the farm through sensors and other devices.

Agriculture is a critical industry that is responsible for feeding the world's population. With the global population expected to reach 9.7 billion by 2050, there is a growing need for innovative approaches to increase agricultural production while reducing environmental impact. Smart farming and IoT offer solutions to address these challenges by helping farmers make data-driven decisions that lead to more sustainable farming practices.

Despite the fact that pesticide spraying is now required, farmers still find it to be a hazardous process. This project is based on the development of an agricultural robot vehicle that navigates between crops using an Android application based on the farmer's instructions. This truck has lower-cost components, making it more cost-effective. To move the robot in the field, the farmer can use any Android smart phone with this application. Through an IoT application, farmers can control pesticide sprinkling devices. This low-cost robotic vehicle would increase efficiency, safety, and meet labour demand in agricultural applications. The integration of smart farming, IoT, and agriculture has the potential to revolutionize the way we produce food.

Finally, sustainable farming practices are essential for the long-term viability of agriculture. By using IoT devices to monitor and control resource usage, farmers can reduce waste and minimize their environmental impact. For example, they can use precision application techniques to apply fertilizers and pesticides only where needed, reducing runoff and protecting water quality. They can also use crop rotation and cover cropping to build soil health and reduce erosion.

In conclusion, the integration of smart farming, IoT, and agriculture has the potential to revolutionize the way we produce food. By leveraging modern technologies to optimize agricultural production, we can improve food security, reduce waste, and promote sustainable farming practices for the benefit of both farmers and consumers. For example, IoT technology can help farmers determine the best time to plant and harvest crops. As these technologies continue to evolve, we can expect to see even greater benefits for the agriculture industry and the wider community.

1.2 Problem Statement

To develop a system which will be capable to perform automatic pesticide spraying in smart farms and toanalyze the data from agrobot which helps in better crops yielding's. The main functions of the proposed system is to spray pesticide effectively and transfer sensors data such as temperature, humidity, soil moisture over internet through WIFI module to cloud platform.

1.3 Objectives

The main objective of this project is

- Increase crop yields by monitoring and optimizing the growing conditions for different crops.
- Improve crop health by detecting pests and diseases early and applying targeted pesticide treatments.
- Reduce the use of chemicals by applying pesticides only when necessary and in a targeted manner.
- Save time and labor by automating tasks such as pesticide application and data collection.

1.4 Limitations

- High initial investment costs for purchasing and implementing agrobots and IoT devices.
- Dependence on reliable and fast internet connectivity, which may not be available in all rural areas.
- Limited compatibility between different types of agrobots and IoT devices from different manufacturers, which may make it difficult to integrate different technologies into a single system.
- Limited availability of trained personnel who are familiar with agrobotics and IoT technologies, which may require additional training or hiring of specialized staff.
- Maintenance and repair costs for agrobots and IoT devices can be significant, especially if they require specialized expertise or replacement parts.
- Challenges with data privacy and security, particularly in cases where sensitive or proprietary data is being collected and analyzed.
- Possible negative environmental impacts, such as increased energy use or the disposal of electronic waste generated by obsolete or broken devices.

1.5 Literature Survey

“IoT based Climate Monitoring System using Arduino” (Ms. Urmila A. Shinde, Ms. Vidya R. Patil, Ms. Vaishnavi R. Javeri, Ms. Mohua Biswas, IJARSCT 2022) [1] In summary, the system consists of sensors that measure temperature, humidity, and pressure, as well as a rain sensor.The data collected by these sensors is sent to an Arduino board, which processes the data and sends it to the ThingSpeak server using an ESP8266 Wi-Fi module. The ThingSpeak server acts as a front-end interface that allows users to view the collected data and perform analysis on it. The system is designed to monitor environmental conditions in real-time and store the data in a cloud database.

“Solar Powered Agribot for Farm Monitoring using Interent of Things(IOT)” (Sivaprasad Athikkal, Ambarish Pradhan, Abhilash Gade, A. Mahidhar Reddy, IJEET,2020) [2] This proposed Agribot consists of IR, moisture and temperature sensors. In order to make use of the naturally available sunlight they have used solar panels. The sensors check the temperature of the soil and irrigates the land depending on the temperature and then feeds the data to the cloud. this robot will change the path if an obstacle occurs. the main intention behind this project is to build a economical robot to help the farmers and to make use of the available natural resources.

"**Adaptive Planting Robot for Precision Agriculture**" (**J. Lin, L. Zhang, IEEE 2022**) **[3]** This paper presents a robot that can be used for tasks such as planting seeds and applying fertilizersin a precise and controlled manner. The robot includes a variety of sensors and other hardware that allow it to navigate around a field and avoid obstacles, as well as a control system that can be programmed to perform different tasks depending on the needs of the crops.

"Autonomous Navigation of an Agricultural Robot Based on Visual and Lidar Sensors" (A.J. Jiménez, M.A. Salama, and M.M.A. Salama,IEEE 2021) [4] This paper describes the design and implementation of an autonomous agricultural robot that uses a combination of visual and lidarsensors to navigate around a field and perform tasks such as mapping, localization, and object detection. The paper discusses how the robot was programmed to make decisions based on its environment, and presents some results from its use in a real-world agricultural setting.

"A Review of Autonomous Agricultural Robots: State of the Art and Future Trends" (M.M.A. Salama and M.A. Salama, IEEE 2021) [5] This paper provides a comprehensive review of the various types of autonomous agricultural robots that have been developed in recent years, including land rovers and other vehicle-based systems, as well as drones and other aerial systems. The paper discusses the various tasks that these robots can perform, as well as the challenges and opportunities associated with using them in agriculture. It also identifies some of the key trends and directions for future research in this field.

“The Smart Iot Based Automated Irrigation System Using Arduino UNO And Soil Moisture Sensor" by (Dr.S.Gnanavel, Mrs M.Sreekrishna Mr.N DuraiMurugan,Nashwan Mr. Loksharan S,IJRTE 2022) [6] Automating irrigation using the Internet of Things (IoT) technology can be a usefulway to increase the efficiency of agricultural water use and reduce the need for manual labor. By usingsensors to monitor soil moisture levels and water availability, an automated irrigation system can ensure that crops receive the optimal amount of water at the right times, leading to better crop yields and water conservation. Additionally, the use of an automated system can reduce the risk of human error and improve the overall safety of the irrigation process. It is important to carefully consider the specific needs of the crops being grown and the local climate when designing an automated irrigation system to ensure that it is effective and well-suited to the intended environment.

“Agricultural Pesticide Spraying Robot” (K. Sushma Priya, R. Praneetha Reddy, Y. Pradeep) [7] This is an android application that controls a spraying rover using a HC05 Bluetooth module. The rover has four brushless DC motors that are controlled by an Arduino Uno microcontroller and a L293D motor driver, and it is powered by a 12V battery. The rover also has servo motors that can move the sprayer, and it uses a 6V pump and a buck converter and relay module to control the high voltage needed to operate the pump. The rover has temperature and humidity sensors to predict weather conditions before spraying pesticides.

“Iot Based Weather Monitoring Using Arduino Uno” (Sanket Gosavi, Devraj Bhosale, Sourabh Bhide) [8] The Atmega328p microcontroller is used in an Internet of Things (IoT)-based weather monitoring system that measures and displays temperature, humidity, air quality, and light intensity using four sensors. The system sends this data to the internet using a Wi-Fi module and stores it on a cloud platform, allowing users to access live reports of local weather conditions. The system uses the Arduino IDE and various IoT platforms for programming and analysis, and it displays the sensor readings on a 16*2 LCD display. The data collected by the system can be used to track changes in local climate over time.

“Development of Smart Pesticide Spraying Robot” (Pvr Chaitanya, Dileep Kotte, A. Srinat B. Kalyan, IJRTE 2022) [9] This is a system for automatically detecting and spraying pesticides on crops that are affected by pests. The system uses scanners or cameras to take pictures of the affected crops and sends them to a processor, which compares the images and determines if the plants are contaminated. If contamination is detected, an automatic sprayer is used to inject the pesticide into the targeted area of the crops. The sprayer is controlled by a microcontroller and motor driver, and it has a float sensor to monitor the level of pesticide in the spraying bottle. If the pesticide level falls below a certain threshold, a buzzer alerts the farmer to refill the bottle. The system uses video processing techniques and morphological operations to analyze the images and determine the type and amount of pests present on the plants. The processor sends instructions to the microcontroller to control the movement and pesticide spraying of the robot.

“Automatic Multipurpose Agribot Using Arduino Mega and GPS Module Receiver” (Amol Gothankar,Vishal Soni, Avinash Vishwakarma ,Sagar Jankar,Satish Bhoyar, IJRTE 2021) [10] This is a remote-controlled farming robot that can perform various operations such as seeding, watering, and pesticide spraying. The robot has a transmitter and receiver section, and it can be controlled in either automatic or manual mode. In manual mode, the user can navigate the robot using buttons on a remote control, while in automatic mode the robot can navigate itself using a GPS receiver and magnometer. The robot has four motors for movement, and a motor driver IC controls a DC motor for seeding and awater pump for pesticide spraying. The robot also has a solenoid valve for watering and a L293D motor driver IC to control the movement of the motors. The Arduino microcontroller serves as the brain of the system and receives commands from the remote control through a decoder IC and RF receiver, and it sends these commands to the appropriate sections of the robot to perform the requestedoperations.

“Fully Automatic Robot Used For Spraying Medicines For Crops” (Santosh M, Yogitha Y, Lavanya G,Manjula, Manjunath K.B IJCESR 2020) [11] This is a method for guiding a robot througha field of crops using an open architecture design and real-time detection of the crops using sensors. The robot is designed to perform agricultural tasks such as pesticide spraying, and it uses an Arduino microcontroller as its heart to control its movements and other functions. The Arduino Uno is a microcontroller board based on the Atmel ATmega328 and it has 14 digital input/output pins and 6 analog inputs. It can be powered through a USB connection or with an external power supply and it is supported by the Arduino Integrated Development Environment (IDE) on various operating systems.

“Smart Irrigation System” (Shreyash, Srashti Sharma, Subhash Nagar, Shivani Priyadardshani, IJRTE 2021) [12] The proposed system is an automatic irrigation system that uses sensors and the Internet of Things (IoT) to detect soil moisture levels and control the watering of crops. The system consists of input and output sections, as well as an IoT section which includes a cloud server and communication modules. The input section includes a soil moisture sensor and a power supply unit, while the output section includes a relay module and a DC motor pump. When the soil moisture falls below a certain level (e.g. 60% for tomato plants), the pump is turned on to water the crops. The system also sends data to the ThingSpeak cloud server and can send alert messages to a mobile phone if the soil moisture falls below a certain level.

“Thingspeak Cloud Based Smart Irrigation System” (Rohan Darve, Ashish Singh, Gajesh Thakre, Kashinath Meshram, Ketan Nipane, Raksha Panore, Prof. N.L. Lanjewa IJCESR 2021) [13] The proposed system is an automatic irrigation system that uses sensors and the Internet of Things (IoT) to detect soil moisture levels and control the watering of crops. The system consists of input and output sections, as well as an IoT section which includes a cloud server and communication modules. The input section includes a soil moisture sensor and a power supply unit, while the output section includes a relay module and a DC motor pump. When the soil moisture falls below a certain level (e.g. 60% for tomato plants), the pump is turned on to water the crops. The system also sends data to the ThingSpeak cloud server and can send alert messages to a mobile phone if the soil moisture falls below a certain level. The system can be used to optimize irrigation and improve crop yield by avoiding under or over watering.

“Smart Farming Using IOT” (CH Nishanthi, Dekonda Naveen, Chiramdasu Sai Ram, Kommineni Divya, Rachuri Ajay Kumar, IJIRT 2021) [14] The infrared sensor is used to detect pests, birds, and humans in the farm. The sensor can detect the body temperature of these objects and sendan alert to the user through a message on their mobile phone. The LCD display is used to show the status of the different sensors in the system. The LDR sensor is used to detect the intensity of light in the farm and turns on a bulb when the intensity is low. The system can be monitored by the user through a mobile phone using the Wi-Fi module and an IoT mobile website. The soil sensor measures the water content in the soil and gives an output of the moisture level. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1.

“Smart Agriculture Management System Using Internet Of Things” (Kaushik Sekaran, Maytham N. Meqdad, Pardeep Kumar, Soundar Rajan, Seifedine Kadry) [15] The architecture for the smart agriculture system using IoT consists of three layers: the physical layer, the IoT layer, and the Com-op layer. The physical layer includes the automation process controller and the sensors and monitoring devices used in the field. The IoT layer includes the system controller, home-grown servers, and IoT devices that collect and send data to the controller. The proposed system aims to improve the efficiency and effectiveness of agriculture through real-time monitoring and control of various factors such as soil moisture, temperature, and pest presence, as well as energy management.

“Automation in Agriculture using AGROBOT” (Sindhu B R, Raghu, C Asha K, Chethan Shindhe R, Sahana PIJERT 2021) [16] The AGROBOT system is a robotic platform for performing various tasks in agriculture, such as planting seeds, harvesting crops, and ploughing fields. It is controlled using an Arduino microcontroller and is capable of moving through a field and performing its tasks while avoiding obstacles. The system can be used in different modes depending on the task being performed, and the speed and other characteristics of its DC motors can be adjusted using code. The AGROBOT system allows for automated agriculture tasks to be performed efficiently and with reduced waste.

“Smart Agriculture System using IoT Technology” (Adithya Vadapalli,Swapna Peravali, Venkata Rao Dadi, IJARSE 2020) [17] Smart irrigation systems using IoT technology can greatly benefit small farmers by automating the irrigation process and providing real-time information about the condition of their farms. By using sensors to monitor soil moisture and climate conditions, these systems can optimize irrigation schedules and reduce the risk of over or under irrigation, leading to higher crop yields and profits. In addition, the use of IoT-based systems can help small farmers access valuable information about their farms without the need to be physically present, allowing them to manage their farms more efficiently and effectively. Overall, the incorporation of smart irrigation systems using IoT technology can greatly benefit small farmers and help them stay competitive in the agriculture industry.

“IoT based Humidity, Temperature and Gas Monitoring using Arduino Uno” (S. A. S. Mohammeda, A. Aluri, K. K. Duru,V. Praneash,) [18] It is important to note that this system uses a number of sensors to gather data about the local weather conditions, including the DHT-11 sensor for measuring humidity and temperature, the MQ-6 sensor for measuring gas levels, and the ESP8266 WiFi module for transferring this data to the Thingspeak IoT platform. The Arduino Uno microcontroller is responsible for collecting data from these sensors, performing any necessary calculations, and then transmitting the data to the Thingspeak platform via the WiFi connection. Once the data has been transmitted, it can be accessed by the user by visiting the Thingspeak website. The system is designed to continuously gather and transmit weather data, allowing the user to view live updates on the weather conditions in their area.

“Real Time Environment Monitoring System using IOT” (Sonu Kumar, Rajnish Kumar, Ujjawal Maan, Ridhima Grover, IJERT 2020) [19] Smart agriculture is the use of modern technology and techniques to improve the efficiency and productivity of agriculture. This can include the use of sensors, drones, automation, and data analysis to optimize various aspects of farming such as irrigation, pest control, and crop selection. The use of IoT (Internet of Things) is particularly important in smart agriculture, as it allows for the real-time monitoring and control of various aspects of the farming process. Smart agriculture can provide numerous benefits such as increased yields, reduced costs, and improved resource management. It can also help to improve the lives of farmers by providing themwith more information and control over their operations.

"IOT Enabled pesticide Sprayer with security system by using solar energy" (Amaresh.A.M. Anagha G Rao, Fennaz Afreen, Moditha.N, IJERT,2020) [20] This paper brings froth the information about the implementation of agricultural robot through and android application. this robot is used for spraying of pesticides with the help of solar powered pumping system. The movement of the robot betwixt the crops is monitored by the farmer with the help of android application. If there's an invader in the field then the robot captures the image of the invader and sends it to the farmer. This robot can be used to during the COVID sanitization for spraying of sanitizer. The main agenda of this project is to build a nominal equipment which can be afforded by farmers, in order to increase the yield of the crops and reduce contact with the chemical pesticides.

" Design and Development of Autonomous Pesticide Sprayer Robot for Fertigation Farm" (A.M. Kassim, A. H. Azahar,S Sivarao, F. A. Jafar, H.I Jaafar, M. S. M. Aras IJACSA 2020) [21] The study presented the development of an autonomous pesticide sprayer robot for use in farming. The robot is equipped with sensors for obstacle detection and navigation. The ultrasonic sensors are used for obstacle detection, while the BLDC motors and gate drivers are used for movement and direction control. The robot was tested in a chili farm and was able to successfully navigate and avoid obstacles while spraying pesticides. The results of the experiment showed that the robot was able to detect obstacles at a distance of 150 cm and was able to turn left or right depending on the position of the obstacles. The robot was also able to stop and back up if an obstacle was detected too close. Overall, the autonomous pesticide sprayer robot demonstrated good performance and could potentially be a useful tool for farmers.

"Automatic Arduino Controlled Agribot For Multi-Purpose Cultivation" (G Vijaykumar, K Vijayalakshmi ,CH Pujitha, DN Sandhya Rani, ICARI-2020) [22] The Agribot uses this principle to detect obstacles in its path and navigate around them. The ultrasonic sensors are mounted on the front, left, and right sides of the robot and constantly measure the distance to any nearby objects The Agribot is also equipped with manual control capabilities, allowing the user to manually control its movement and functions using a Bluetooth connection.

1.6 Organization of report

CHAPTER 1 Introduction	Overview of the project along with the problem statement, objectives, limitations and literature survey are discussed.
CHAPTER 2 Analysis	It focuses on the existing system along with their drawbacks, proposed system and their advantages, it also gives an insight into the system requirements.
CHAPTER 3 Design	The architecture of the system are discussed here along with the use case diagram, class diagram, sequence diagram and activity diagram.
CHAPTER 4 Implementation	It provides the implementation details of the modules used and their algorithm. It also enlists the key user-defined functions of the main modules.
CHAPTER 5 Testing	It provides details about the unit testing, integration testing and system testing.
CHAPTER 6 Conclusion and Future Enhancements	The conclusion and the future enhancement of the project has been discussed in this section.

Chapter 2

ANALYSIS

CHAPTER 2

ANALYSIS

2.1 Existing System

2.1.1 Description

- **Manual way of spraying pesticide:** To manually spray pesticides, you will need a sprayer, protectiveclothing, and the pesticide product. Mix the pesticide according to the label instructions, put on protective clothing, and apply the pesticide to the affected area, making sure to cover it thoroughly butnot overspray. After applying the pesticide, clean the sprayer and protective clothing, and wash your hands and face.

- **Tractor or vehicle mounted sprayer:** Tractor or vehicle mounted sprayers are large, heavy-duty spraying systems that are attached to a tractor or other vehicle. They are typically used for agricultural purposes, such as spraying crops or pastures, but can also be used in large landscaping or pest control operations. These sprayers consist of a tank to hold the spray solution, a pump to pressurize the solution, and a series of nozzles or booms to apply the spray to the target area. The tractor or vehicle provides the power to move the sprayer and the operator controls the flow of the spray solution from the cab of the vehicle.

Drone based pesticide spraying: Drone-based pesticide spraying is a relatively new technology that utilizes unmanned aerial vehicles (UAVs) or drones to apply pesticides to crops or other target areas. This method has the potential to revolutionize the way pesticides are applied, offering numerous benefits over traditional methods. One major advantage of using drones for pesticide spraying is their ability to cover large areas quickly and efficiently. Drones can fly at low altitudes and maneuver around obstacles, allowing them to reach areas that may be difficult or impossible to access with traditional spraying equipment. They can also be equipped with sensors and cameras to map the target area and apply the spray in a precise, targeted manner, reducing the amount of pesticide used and the potential for overspray. In addition, drones can be equipped with advanced technology such as artificial intelligence, machine learning, and GPS mapping, which can optimize the spraying process by analyzing data and making real-time adjustments. This can result in more precise and effective pesticide application, reducing the amount of chemicals needed and minimizing the impact on the environment. Furthermore, drones equipped with GPS mapping technology can create precise maps of the target area, allowing for accurate and targeted spraying.

2.1.2 Drawbacks

- May be difficult to maneuver in tight or confined spaces. It is not precise and sometimes it is vagueand painful at times.
- Regulatory frameworks for drone-based spraying are still being established in many areas.
- May not be suitable for all types of pesticides or applications, and further research is needed todetermine their effectiveness and safety in different situations.
- May require the operator to come into contact with the spray solution, potentially increasing therisk of exposure to hazardous chemicals.
- Can be expensive to purchase and maintain.

2.2 Proposed System

2.2.1 Description

The agrobot would be equipped with sensors to measure temperature, humidity, soil moisture, and the presence of pests and diseases. These sensors would collect data on the conditions in which the crops are growing and the health of the plants. The data collected by the sensors would be transmitted to a cloud-based platform, where it could be analyzed and used to make informed decisions about the care and management of the crops. Farmers could use a smartphone or other device to access the data collected by the agrobot and monitor the health and growing conditions of their crops from anywhere. The agrobot could be programmed to automatically update its software and sensor configurations as new information becomes available, ensuring that it is always working with the most accurate and up-to-date data. By using sensors to optimize growing conditions and minimize the use of pesticides and water, the agrobot can help farmers to adopt more sustainable practices.

Additionally, the use of agrobots and IoT in smart farming can provide farmers with a more efficient and cost-effective approach to managing their crops. With the data collected by the agrobot's sensors, farmers can make informed decisions about when to irrigate their crops, when to apply fertilizers, and when to treat for pests and diseases. This can help reduce the amount of resources needed for these tasks, as they can be done only when necessary and in the appropriate amounts. Furthermore, the use of agrobots and IoT in smart farming can help reduce the risk of crop loss due to pests, diseases, and weather events. Another advantage of using agrobots and IoT in smart farming is that it can enable farmers to monitor their crops remotely, allowing them to make real-time decisions about their farming operations from anywhere with an internet connection.

2.2.2 Advantages

- Increase crop productivity.
- Reduce the cost of crop management.
- Improve the efficiency of irrigation.
- Enhance crop quality.
- Protect crops from pests and diseases.

2.3 Requirement Specification

2.3.1 Functional Requirements

Functional requirements in smart farming refer to the specific capabilities and features that a smart farming system must have in order to meet the needs and goals of the farmers and other stakeholders involved. These requirements typically cover a range of areas, including data collection, analysis, and visualization, automation of tasks and processes, and integration with other systems and platforms.

- Robot should spray pesticide effectively.
- Robot should be able to send the censored data to cloud.
- It uses object sensors to detect obstacle on the field path.
- Requirement data will be stored in Thingspeak.

2.3.2 Non Functional Requirements

Non-functional requirements in smart farming refer to the criteria that are not related to the specific functionalities of the system, but rather focus on the system's performance, usability, and other quality attributes.

- **Scalability:** The proposed system can handle growing amount of data by adding resources to the Thingspeak.
- **Flexibility:** It can be used in both smart farms as well as urban farm.
- **Reliability:** The proposed model must be reliable and strong in giving the functionalities.

2.3.3 Hardware Requirements

The selection of hardware equipment is very much important in proposed system and proper working of any software. In the selection of hardware, the size and the capacity of the requirements are also important. The following minimum hardware is necessary for the system

- Arduino
- Soil Moisture Sensor
- Humidity Sensor

- Temperature Sensor
- Wi-Fi
- Water Pump
- Relay
- L293D
- DC Motor

2.3.4 Software Requirements

Software requirements in smart farming include:

- Embedded C
- Arduino IDE
- Thingspeak
- React.js

Embedded C: Embedded C is a programming language commonly used in the development of embedded systems, which are computer systems designed to perform specific tasks with minimal resources. In smart farming, embedded C can be used to develop software for various types of embedded systems used in agriculture.

Arduino IDE: The Arduino Integrated Development Environment (IDE) is a software application used to write and upload code to Arduino microcontroller boards. Arduino boards are commonly used in smart farming applications because they are easy to use, low-cost, and have a wide range of compatible sensors and modules.

Thingspeak: It is an open-source IoT platform that allows developers to collect, analyze, and visualize data from sensors and other IoT devices. ThingSpeak is commonly used in smart farming applications because it is easy to use and can be integrated with a wide range of sensors and devices.

React.js: React.js is a powerful open-source JavaScript library that has gained widespread popularity for its ability to simplify the creation of complex user interfaces. Developed by Facebook, React.js enables the development of reusable UI components that can be easily combined to build highly scalable web applications. One of the key advantages of React.js is its use of a virtual DOM, which enables the library to efficiently update the UI in response to changes in data or user input.

Chapter 3

DESIGN

CHAPTER 3

DESIGN

3.1 System Design

System designs is the process of defining the architecture, Modules, Interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of the systems theory to product development. The figure. 3.1 shows a Agrobot System Architecture.

3.1.1 System Architecture

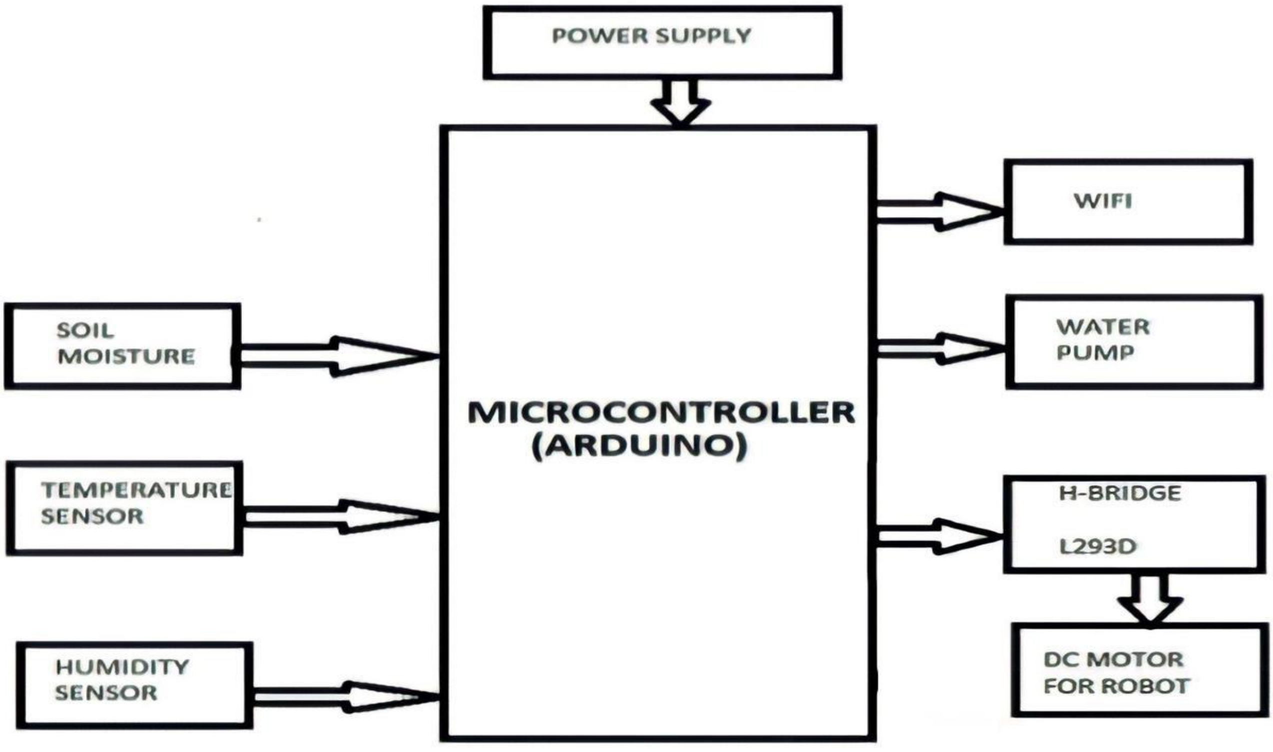

Figure 3.1 System Architecture of Agrobot

In this project, the Arduino microcontroller is used to control the various hardware components of the agrobot, such as the motors that power the wheels, the sensors that collect data on temperature, humidity, and soil moisture, and any other devices that are needed to operate the agrobot. The Arduino is programmed using a variety of control algorithms and other software that allow it to collect sensor data, make decisions based on that data, and execute actions (such as moving the agrobot or spraying pesticides) in response. By using the Arduino as the central "brain" of the agrobot, you can create a highly flexible and customizable system that can be programmed to performa wide range of tasks. Sending sensor data to a cloud-based platform such as ThingSpeak for analysis would be an important component of a smart agrobot with temperature, humidity, soil moisture, and pesticide/water spray sensors.

By sending the data to the cloud, farmers could access it from anywhere and use it to make more informed decisions about the care andmanagement of their crops. For example, farmers could use the data to track the growing conditionsand the health of their crops over time, identifying trends and patterns that could be used to optimizethe growing conditions. They could also use the data to identify problems such as pests or diseases before they become severe, allowing them to take preventative measures to protect their crops. Additionally, farmers could use the data to evaluate the effectiveness of different pesticide treatmentsor irrigation strategies, helping them to make more informed decisions about how to manage their crops.

Overall, sending sensor data to a cloud-based platform like ThingSpeak can be a valuable tool for improving the efficiency and productivity of agricultural operations. One of the key features of our agrobot is the ability to collect and transmit data on factors such as temperature, humidity, and soil moisture. We are using ThingSpeak, a cloud- based Internet of Things (IoT) platform, to store and manage this data. Using MATLAB, we are able to access and analyze the data in real-time, allowing us to visualize trends and patterns that may be important for optimizing farming practices. For example, we can plot temperature and humidity over time to understand how these factors vary across a field, or create maps showing the distribution of soil moisture to identify areas that may be in need of irrigation. By using ThingSpeak and MATLAB together, we are able to turn the sensor data collected by the agrobot into valuable insights that can help farmers make informed decisions.

3.1.2 Use Case Diagram

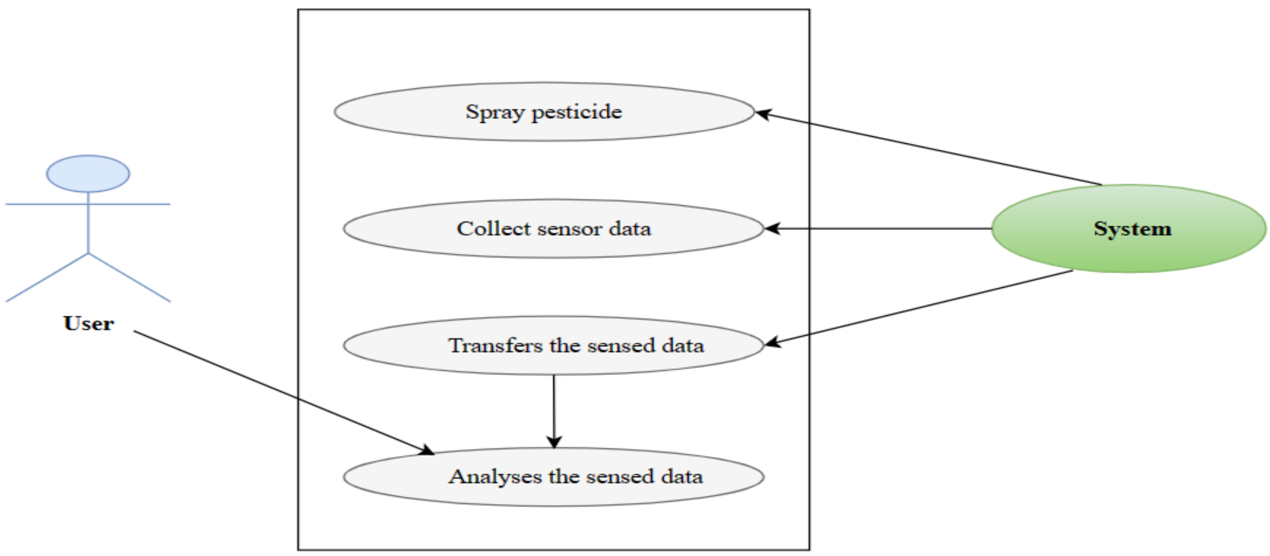

Figure 3.2 Use case diagram of Agrobot

A use case diagram is a dynamic or behavior diagram in UML. Use case diagrams model the functionality of a system using actors and use cases. Use cases are a set of actions, services, and functions that the system needs to perform. In this context, a "system" is something being developed or operated, such as a web site. The "actors" are people or entities operating under defined roles within the system. Use case diagrams are valuable for visualizing the functional requirements of a system that will translate into design choices and development priorities.

Figure 3.2 shows use case diagram, which explains the following steps:

- Initially the system will start spraying the pesticide.
- Sensors will collect the sensor data.
- Sensor data will be transferred to cloud with the help of wifi module.
- User will perform analysis on the sensed data on cloud.

3.2 Detailed design

3.2.1 Class Diagram

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application. Class diagram describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modelling of object-oriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages. Class diagram shows a collection of classes, interfaces, associations, collaborations, and constraints. It is also known as a structural diagram. Class diagrams are the only diagrams which can be directly mapped with object-oriented languages and thus widely used at the time of construction. Figure 3.3 shows a class diagram of the processing steps.

- The Agrobot class represents the robot that moves through the field and sprays pesticides and water. It has attributes such as location and methods like move() and stop().
- The Pesticide class represents the types of pesticides available to the system. It has attributes like amount and methods like spray() to apply the pesticide to the crops.
- The SensorData class represents the data collected by the sensors, including temperature, humidity, and soil moisture. It has attributes to store this data and can be used by the system to optimize pesticide use.
- The WiFiModule class represents the module used to transfer the sensor data over the internet to the cloud platform. It has a method called sendData() to send the data.
- The database used to store the sensor data. It is connected to the Cloud class and represents the storage location of the data.

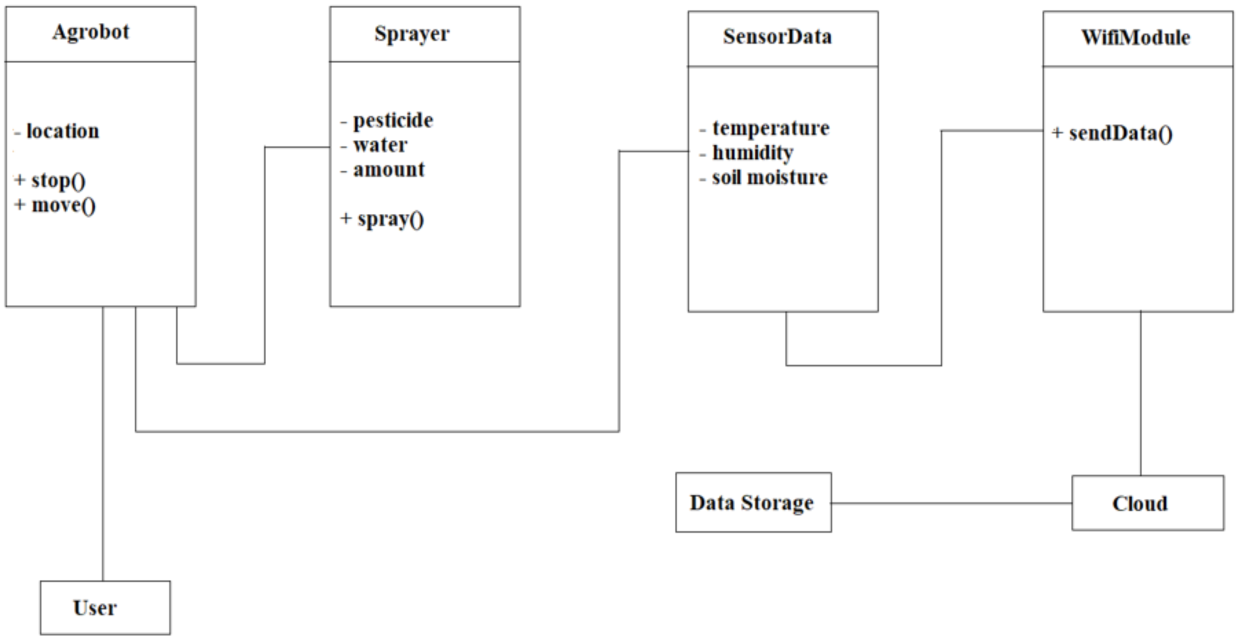

Figure 3.3 Class Diagram of Agrobot

3.2.2 Sequence Diagram

A sequence diagram shows object interaction arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the object needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realization in the logical view of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios. Sequence Diagrams are interaction diagrams that detail how operations are carried out. They capture the interaction between objects in the context of collaboration.

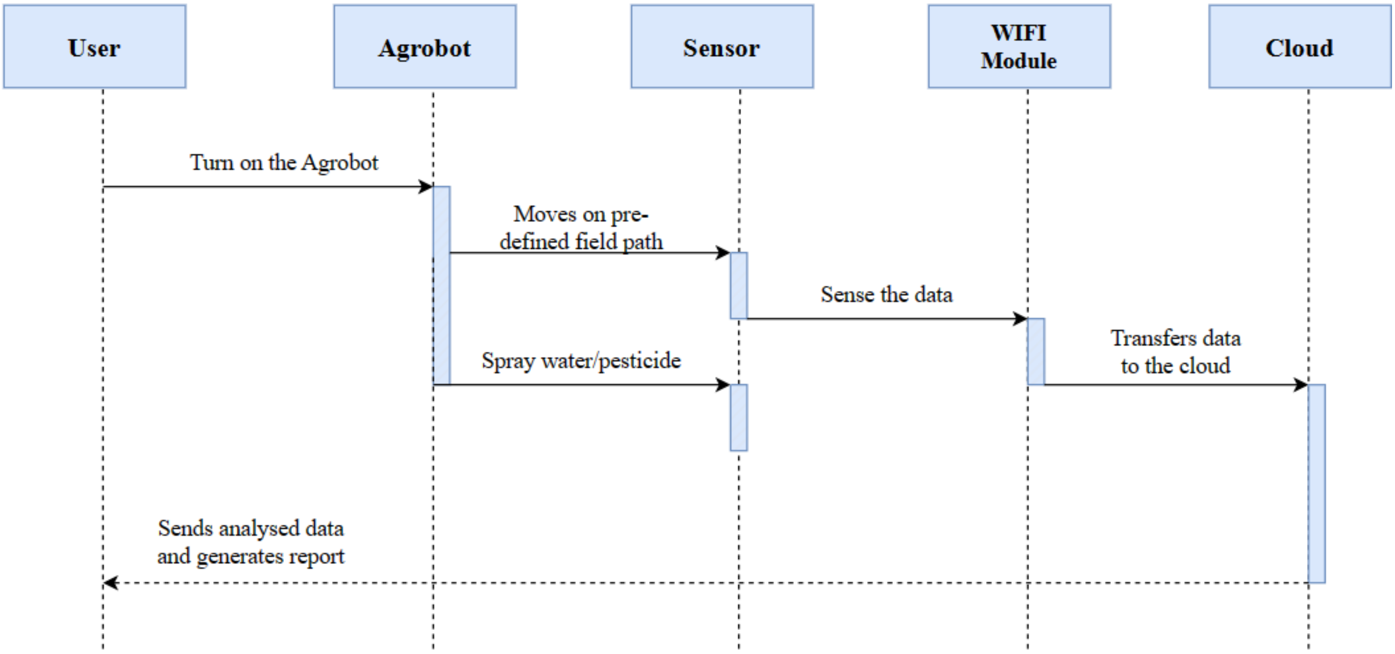

Figure 3.4 Sequence Diagram of Agrobot

The sequence diagram depicts the flow of actions and messages between the User, Agrobot, Sensors, WiFi, and Cloud in a proposed system for automatic pesticide spraying and data analysis in smart farms. The diagram illustrates that the system begins with the user turning on the Agrobot, which then moves to the field. The sensors on the Agrobot collect data on temperature, humidity, and soil moisture, which is then transmitted through the WiFi module to the cloud platform for storage and analysis.

The cloud platform receives the data and performs analysis on it, optimizing the pesticide use to improve crop yield. The cloud platform generates a report which is then sent back to the user for further action. The proposed system is aimed at simplifying the process of pesticide spraying in smart farms by automating the process and providing valuable insights to optimize pesticide use. The sequence diagram effectively communicates the flow of messages and actions in the proposed system, highlighting the role of each component and their interactions.

3.2.3 Activity Diagram

Activity diagram is another important diagram in UML to describe the dynamic aspects of the system. Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent. Activity diagrams deal with all type of flow control by using different elements such as fork, join, etc. The basic purposes of activity diagrams are similar to other four diagrams. It captures the dynamic behavior of the system. Other four diagrams are used to show the message flow from one object to another but activity diagram is used to show message flow from one activity to another. Activity is a particular operation of the system.

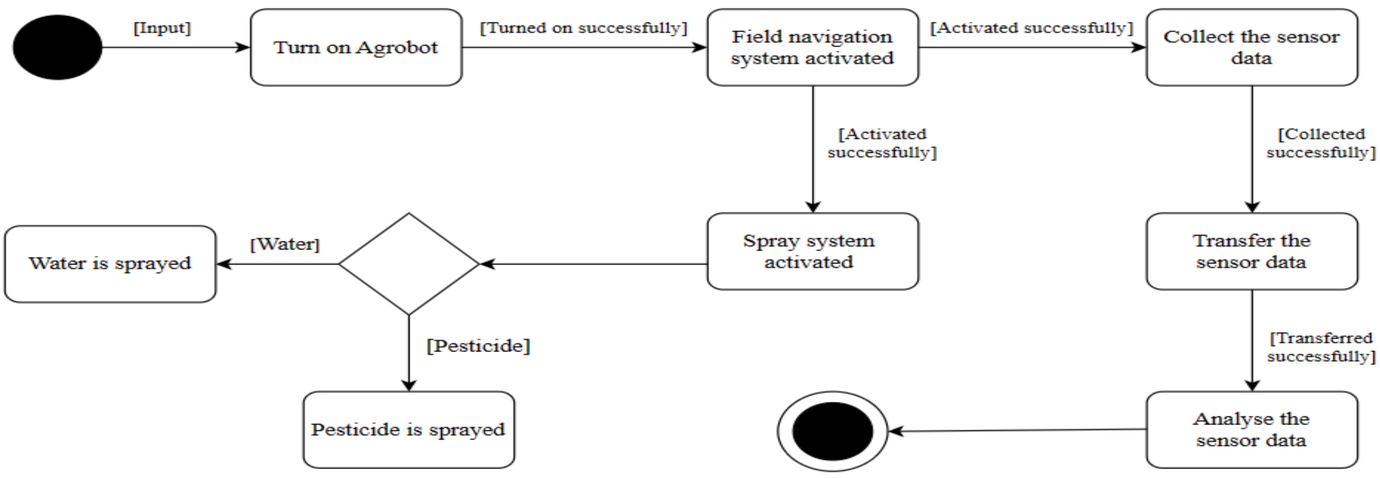

Figure 3.5 Activity diagram of Agrobot

Figure 3.5 shows the activity diagram showing the flow of the process.

- The activity diagram of this project starts from user turning on the agrobot.
- Once the agrobot turned on successfully field navigation system will be activated successfully.
- Once the field navigation system is activated two activities like collection of sensor data and spray system will be simultaneously performed.
- Once the spray system is activated based on the needs either water or pesticide will be sprayed.
- Wifi module will send the sensed sensor data to the cloud and then user can analyse the data.

Chapter 4

IMPLEMENTATION

CHAPTER 4

IMPLEMENTATION

4.1 Main Package

The installed packages are:

1. LiquidCrystal

The LiquidCrystal library is a widely used package in embedded C programming for interfacing with character LCD displays. The key feature of the LiquidCrystal library is its support for different interface modes. It can interface with LCD displays using either a 4-bit or 8-bit parallel interface, or a 2-wire I2C interface. This makes it flexible and compatible with a wide range of microcontrollers and LCD displays.

2. Stdio.h

stdio.h is a standard header file in the C programming language that provides input and output functionality. It stands for "standard input/output header." This header file declares a set of functions, macros, and types that are used to handle input and output operations, such as reading from or writing to files or the console.

3. Stdlib.h

stdlib.h is a standard header file in the C programming language that provides functions for performing general utility tasks. It stands for "standard library header." This header file declares a set of functions, macros, and types that are used to manage memory, convert strings to numeric values, generate random numbers, and perform other general tasks.

4. String.h

string.h is a standard header file in the C programming language that provides functions for manipulating strings. It stands for "string header." This header file declares a set of functions, macros, and types that are used to handle character strings.

5. DHT.h

dht.h is a header file that is often used in conjunction with the DHT series of temperature and humidity sensors. DHT sensors are low-cost, digital sensors that can measure temperature and relative humidity with high accuracy and reliability. These functions allow a programmer to read data from a DHT sensor and retrieve the temperature and humidity values in either integer or floating-point format.

6. Timer.h

Timer.h is a header file used in microcontroller programming to manage timers and timer interrupts. A timer is a hardware device that can be programmed to generate an interrupt at regular intervals, which can be used to trigger certain actions in a program or to keep track of time.

7. SoftwareSerial.h

SoftwareSerial.h is a header file used in microcontroller programming to emulate serial communication between two devices using software. Serial communication is a method of transmitting data between two devices over a single communication line. It also defines data types for storing serial communication settings, such as the baud rate, and for storing incoming and outgoing serial data.

4.2 Main User Defined Function

There are 3 modules in the architecture of the system. They are:

1. Agrobot
2. ThingSpeak Analysis
3. Software Module

1. Module 1

Module Name: Agrobot

Functionality: This module is responsible for spraying pesticides and transferring the sensed data to cloud.

Input: The user turn on the power supply.

Output: The data will be transferred to the cloud.

2. Module 2

Module Name: ThingSpeak Analysis

Functionality: This module is responsible for analysis of the sensed data.

Input: Values of temperature sensor, humidity sensor,

Output: The data will be transferred to the cloud.

3. Module 3

Module Name: Agrobot Software

Functionality: This module is responsible for dashboards, agro chatbot and latest scheme.

Input: Select the scheme state wise also can ask question related to agriculture.

Output: Dashboards and answers to our queries.

The User Defined Functions are:

1. Serial_read

The Serial.read() function is used to read incoming serial data in Arduino. It returns the first byte of incoming serial data available or -1 if no data is available. If the data is not immediately available, the function will wait until it is. The function reads the data in the order it is received, i.e., first in first out (FIFO).

2. Humidity_measurement

This function reads humidity and temperature values from a DHT sensor connected to a specific pin. The function prints the humidity and temperature values on the serial monitor using the "Serial.print" function. There is also a delay of 500 milliseconds after each print statement.

3. Moisture_monitor

This function reads the analog value from a moisture sensor connected to pin 0 of the Arduino. It then subtracts the read value from 1024 to get the correct moisture value. Finally, it uses the sprintf function to format the moisture value as a string and prints it to the serial monitor. The function is delayed by 1 second using the delay function before it runs again.

4. send2server

This function sends data to a server using the HTTP GET method. It formats the data into a URL string containing an API key, temperature, humidity, and moisture values. The function then sends the URL to the server using the httpGet function.

5. connect_wifi

This is a function named "connect_wifi" that takes two parameters: a string named "cmd" and an integer named "t". The function has a loop that sends the "cmd" string to a Serial1 port and waits for a response. If the response contains the string "OK", the loop exits and the function prints "OK" to the Serial port. If the loop runs more than five times without finding "OK", it exits and prints "Error" to the Serial port. This function is likely used to connect to a WiFi network.

4.3 Algorithm of Main module

Pseudocode for Path

Step 1: The function initiates by moving the robot forward for 4 seconds, stopping for 1 second, and then moving forward again for 4 seconds before stopping for another second.

Step 2: The robot then turns left for 10 seconds before stopping for another second.

Step 3: After that, the robot moves forward again for 4 seconds before stopping for another second and then turns right for 10 seconds before stopping for another second.

Step 4: Finally, the function calls the MOISTURE_MONITOR() and HUMIDITY_MEASUREMENT() functions to measure the moisture and humidity levels, respectively, and then updates the time using the t.update() function.

4.4 Sample code of Application

```
#include <LiquidCrystal.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include<dht.h>
#include<Timer.h>
Timer t;
#include <SoftwareSerial.h>
SoftwareSerial Serial1(8, 9);

#define heart 13

char *api_key="NY999BRWTZK1EA7U";
static char postUrl[150];
void httpGet(String ip, String path, int port=80);



#define dht_dpin 2
int Relay=3;

int IN1=4;
int IN2=5;

int IN3=6;
int IN4=7;

int IN5=10;
int IN6=11;
```

```
dht DHT;
char MOISTURE_buff[20];
int MOISTURE_Value;

void setup()
{
    Serial.begin(9600);

    Serial.println("AGRIBOT WITH PESTICIDE ROBOT....");

    Serial1.begin(9600);
   Serial.begin(9600);



   Serial.println("Connecting Wifi....");
   connect_wifi("AT",1000);
   connect_wifi("AT+CWMODE=1",1000);
   connect_wifi("AT+CWQAP",1000);
   connect_wifi("AT+RST",5000);
   connect_wifi("AT+CWJAP=\"pranav77\",\"123456789\"",10000);
   Serial.println("Wifi Connected");

   pinMode(heart, OUTPUT);
   delay(2000);
   t.oscillate(heart, 1000, LOW);
   t.every(20000, send2server);

}

void loop()
{
  FORWARD();
  delay(4000);
  STOP();
```

```
  delay(1000);
  FORWARD();
  delay(4000);
  STOP();
  delay(1000);
  LEFT();
  delay(10000);
  STOP();
  delay(1000);
  FORWARD();
  delay(4000);
  STOP();
  delay(1000);
  RIGHT();
  delay(10000);
  STOP();
  delay(1000);
  MOISTURE_MONITOR();
  delay(1000);
  HUMIDITY_MEASUREMENT();

  t.update();

}
void FORWARD()
{
  Serial.println("Forward...");
  digitalWrite(IN1,HIGH);
  digitalWrite(IN2,LOW);
  digitalWrite(IN3,HIGH);
  digitalWrite(IN4,LOW);
}
void STOP()
{
  Serial.println("Stop...");
  digitalWrite(IN1,LOW);
  digitalWrite(IN2,LOW);
```

```
  digitalWrite(IN3,LOW);
  digitalWrite(IN4,LOW);
  SPRAY();
}
void SPRAY()
{
  Serial.println("Spraying...");
  digitalWrite(Relay,HIGH);
  digitalWrite(IN5,HIGH);
  digitalWrite(IN6,LOW);
  delay(1000);
  digitalWrite(IN5,LOW);
  digitalWrite(IN6,LOW);
  delay(1000);
  digitalWrite(IN5,LOW);
  digitalWrite(IN6,HIGH);
  delay(1000);
  digitalWrite(IN5,LOW);
  digitalWrite(IN6,LOW);
  delay(1000);
digitalWrite(Relay,LOW);
}
void LEFT()
{
  Serial.println("Left...");
  digitalWrite(IN1,LOW);
  digitalWrite(IN2,HIGH);
  digitalWrite(IN3,HIGH);
  digitalWrite(IN4,LOW);

}
void RIGHT()
{
  Serial.println("Right...");
  digitalWrite(IN1,HIGH);
  digitalWrite(IN2,LOW);
  digitalWrite(IN3,LOW);
```

```
  digitalWrite(IN4,HIGH);



}
char Serial_read(void)
{
      char ch;
      while(Serial.available() == 0);
      ch = Serial.read();
      return ch;
}

void HUMIDITY_MEASUREMENT(void)
{
    DHT.read11(dht_dpin);
    Serial.print("Humidity: ");
    Serial.print(DHT.humidity);
    Serial.print(" %");
    Serial.print("  ");

    delay(500);

    Serial.print("Temperature:");
    Serial.print(DHT.temperature);
    Serial.print(" C");
    Serial.println("  ");

  delay(500);

 }
void MOISTURE_MONITOR()
{
  MOISTURE_Value=analogRead(0);
  MOISTURE_Value=1024-MOISTURE_Value;
  sprintf(MOISTURE_buff,"MOISTURE:%d",MOISTURE_Value);
  Serial.println(MOISTURE_buff);
```

```
  delay(1000);

}

void send2server()
{
  char humidityStr[8];
  char tempStr[8];
  char moistureStr[8];



  dtostrf(DHT.temperature, 5, 3, tempStr);
  dtostrf(DHT.humidity, 5, 3, humidityStr);
  dtostrf(MOISTURE_Value, 5, 3, moistureStr);


  sprintf(postUrl,
"update?api_key=%s&field1=%s&field2=%s&field3=%s",api_key,humidityStr,tempStr,moistureStr);
  httpGet("api.thingspeak.com", postUrl, 80);
}

//GET https://api.thingspeak.com/update?api_key=SIWOYBX26OXQ1WMS&field1=0

void httpGet(String ip, String path, int port)
{
  int resp;
  String atHttpGetCmd = "GET /"+path+" HTTP/1.0\r\n\r\n";
  //AT+CIPSTART="TCP","192.168.20.200",80
  String atTcpPortConnectCmd = "AT+CIPSTART=\"TCP\",\""+ip+"\","+port+"";
  connect_wifi(atTcpPortConnectCmd,1000);
  int len = atHttpGetCmd.length();
  String atSendCmd = "AT+CIPSEND=";
  atSendCmd+=len;
  connect_wifi(atSendCmd,1000);
  connect_wifi(atHttpGetCmd,1000);
}
```

```
void connect_wifi(String cmd, int t)
{
  int temp=0,i=0;
  while(1)
  {
//    lcd.clear();
//    lcd.print(cmd);
    Serial.println(cmd);
    Serial1.println(cmd);
    while(Serial1.available())
    {
      if(Serial1.find("OK"))

      i=8;
    }
    delay(t);
    if(i>5)
    break;
    i++;
  }
  if(i==8)
  {
   Serial.println("OK");

  }
  else
  {
   Serial.println("Error");

  }
}
```

Chapter 5

TESTING

CHAPTER 5

TESTING

Testing is the process of evaluating a system or its component(s) with the intent to find whether it satisfies the specified requirements or not. Testing is executing a system in order to identify any gaps, errors,or missing requirements in contrary to the actual requirements. Before applying methods to design effective test cases, a software engineer must understand the basic principle that guides software testing. All the tests should be traceable to customer requirements.

5.1 Unit Testing

Unit testing is a software development process in which the smallest testable parts of an application, called units, are individually and independently scrutinized for proper operation. Unit testing is often automated but it can also be done manually. The goal of unit testing is to isolate each partof the program and show that individual parts are correct in terms of requirements and functionality. Test cases and results are shown in the Tables.

Unit Testing Benefits:

- Unit testing increases confidence in changing/ maintaining code.
- Codes are more reusable.
- Development is faster.
- The cost of fixing a defect detected during unit testing is lesser in comparison to that of defects detected at higher levels.
- Debugging is easy.
- Codes are more reliable.

Unit testing is a crucial part of software development that helps ensure the reliability and effectiveness of a system. In this case, there are four specific unit tests that are necessary for testing the Agrobot system. The first test will focus on the water spraying functionality. The second test will verify the activation of the pesticide sprayer. The third test will examine the accuracy of sensor data collection and analysis, verifying that the system correctly collects and analyzes data related to temperature, humidity, and soil moisture. The final test will assess the navigation functionality, verifying that the robot is able to successfully navigate to the field location without any errors. By conducting these four unit tests, developers can ensure that the Agrobot system is reliable and meets the necessary requirements for optimal performance.

Test cases and results are shown in the table 5.1:

Test Case	Name of Test	Test Input	Expected Output	Actual Output	Remarks
UTC-1	Test water spraying functionality	Activate water sprayer	Water sprayed successfully	Water sprayed successfully	Pass
UTC-2	Test pesticide spraying functionality	Activate pesticide sprayer	Pesticide sprayed successfully	Pesticide sprayed successfully	Pass
UTC-3	Test sensor data collection and analysis functionality	Collect sensor data and analyze it	Sensor data collected and analyzed successfully	Sensor data collected and analyzed successfully	Pass
UTC-4	Test navigation functionality	Define field location and navigate to it	Successfully arrived at location and successfully returned to home base	Successfully arrived at location and successfully returned to home base	Pass

Table 5.1: Unit Testing of Agrobot

5.2 Integration Testing

Integration testing is a level of software testing where individual units are combined and testedas a group. The purpose of this level of testing is to expose faults in the interaction between integrated units. Test drivers and test stubs are used to assist in Integration Testing. Integration testing is defined asthe testing of combined parts of an application to determine if they function correctly. It occurs after unit testing and before validation testing. Integration testing can be done in two ways: Bottom-up integration testing and Top-down integration testing.

- Bottom-up Integration - This testing begins with unit testing, followed by tests of progressively higher-level combinations of units called modules or builds.
- Top-down Integration - In this testing, the highest-level modules are tested first and progressively, lower-level modules are tested thereafter.

In a comprehensive software development environment, bottom-up testing is usually done first, followed by top-down testing. The process concludes with multiple tests of the complete application, preferably in scenarios designed to mimic actual situations. Table 5.2 shows the test cases for integration testing and their results.

Test Case	Name of Test	Test Input	Expected Output	Actual Output	Remarks
ITC-1	Water and Pesticide Spraying with Sensor Data Collection	Trigger water sprayer and collect sensor data	Water is sprayed successfully. Sensor data is collected successfully.	Water is sprayed successfully. Sensor data is collected successfully.	Pass
ITC-2	Navigation and Sensor Data Collection with Water Spraying	Define field location and navigate to it, collect sensor data	Successfully arrived at location and Sensor data collected and analyzed successfully	Displays status along with remedies	Pass

Table 5.2: Integration Testing of Agrobot

5.3 System Testing

System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black-box testing, and as such, should require no knowledge of the inner design of the code or logic. System testing is important because of the following reasons:

- System testing is the first step in the Software Development Life Cycle, where the application is tested as a whole.
- The application is tested thoroughly to verify that it meets the functional and technical specifications.
- The application is tested in an environment that is very close to the production environment where the application will be deployed.
- System testing enables us to test, verify, and validate both the business requirements as well as the application architecture.

Test Case	Name of Test	Test Input	Expected Output	Actual Output	Remarks
STC-1	System testing	Field location and sensor data of agrobot	All system functionalities work seamlessly.	All system functionalities work seamlessly.	Pass

Table 5.3: System Testing of Agrobot

Chapter 6

CONCLUSION AND FUTURE ENHANCEMENTS

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENTS

6.1 Conclusion

A smart agrobot with temperature, humidity, soil moisture, and pesticide/water spray sensors has the potential to revolutionize the way that crops are grown and managed. By automating tasks such as data collection and pesticide application, the agrobot can help farmers to save time, labor, and resources, while also improving the health and productivity of their crops. By using sensors to optimize the growing conditions and detect pests and diseases early, the agrobot can also help farmers to reduce their reliance on chemical pesticides and promote more sustainable practices. This can include information on the optimal time for harvesting, as well as identifying potential issues before they become major problems. By providing farmers with more accurate and timely information, a smart agrobot can help them to be more proactive and responsive in their management of crops.

Overall, a smart agrobot has the potential to greatly improve the efficiency and sustainability of agriculture, making it a valuable tool for farmers around the world a smart agrobot can also contribute to more sustainable agriculture practices. By reducing the use of chemical pesticides and promoting more precise and targeted application, the agrobot can help to minimize the impact of agriculture on the environment. This can lead to benefits such as improved soil health, reduced water pollution, and greater biodiversity.

In addition to the benefits mentioned above, a smart agrobot with temperature, humidity, soil moisture, and pesticide/water spray sensors could also provide a number of other advantages. For example, the agrobot could be used to monitor and control the growing conditions in greenhouses or other controlled environments, allowing farmers to grow crops year-round. Another potential benefit of a smart agrobot is its ability to reduce human error and increase consistency in crop management. Unlike humans, who may miss subtle changes in crop health or apply pesticides unevenly, a smart agrobot can monitor crops continuously and apply pesticides precisely and consistently.

The agrobot could also be used to collect data on the health and growth of crops, which could be used to develop new strategies for improving crop yields and quality. Additionally, the agrobot could be used to monitor and control irrigation systems, helping farmers to conserve water and reduce the risk of over-irrigation. Overall, the potential applications for a smart agrobot in agriculture are vast, making it a valuable tool for farmers and agribusinesses around the world.

6.2 Future Enhancements

In future smart farms involves several possibilities, Integrating additional sensors such as pH sensors, light sensors, and air quality sensors could provide more comprehensive data for analysis and better insights into optimizing pesticide use. This would lead to more efficient and accurate crop management. Incorporating machine learning algorithms into the cloud platform could significantly improve the efficiency and accuracy of the system. These algorithms can analyze the data collected by the sensors and predict future crop health and pesticide requirements, leading to better decision-making and increased cost savings.

Implementing precision spraying technology in the Agrobot could allow for targeted spraying of specific areas of the crop based on the data collected by the sensors. This would reduce pesticide waste and improve the overall effectiveness of the system, providing a more sustainable and environmentally friendly solution. Lastly, integrating the proposed system with other smart farm technologies such as automated irrigation systems would provide a more holistic approach to crop management. This would create a more comprehensive and integrated solution for smart farming and could lead to greater efficiencies and cost savings. Overall, these enhancements would create a more effective and efficient solution for crop management in smart farms, providing better crop yields and sustainability.

SNAPSHOTS

SNAPSHOTS

Agrobot Model

Figure 7.1: Agrobot model

The agrobot model is used to navigate the field and spray pesticide.

Hardware Components of Agrobot

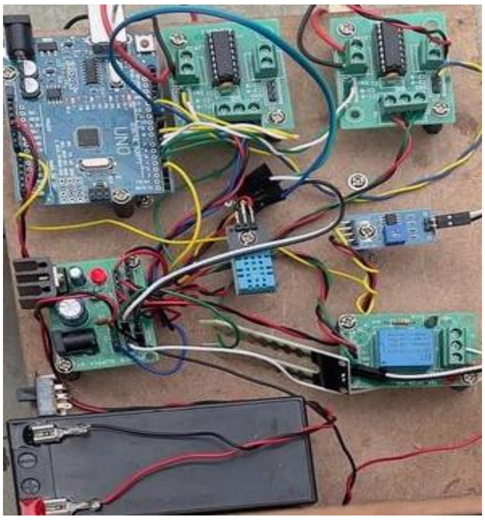

Figure 7.2 Circuit of Agrobot

Hardware components of the agrobot which consist of multiple sensors.

Humidity and Soil moisture Sensor

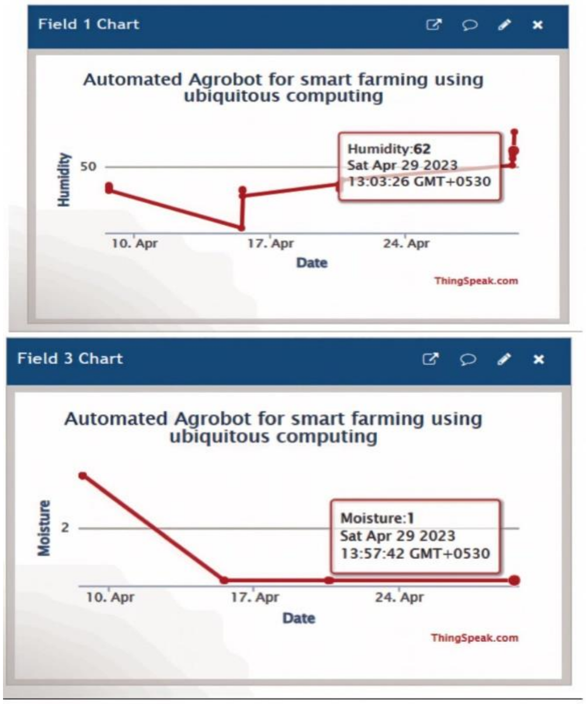

Figure 7.3 Humidity and Soil Moisture Sensor

This graph indicates humidity and soil moisture data points with respect to date and time.

Temperature Sensor

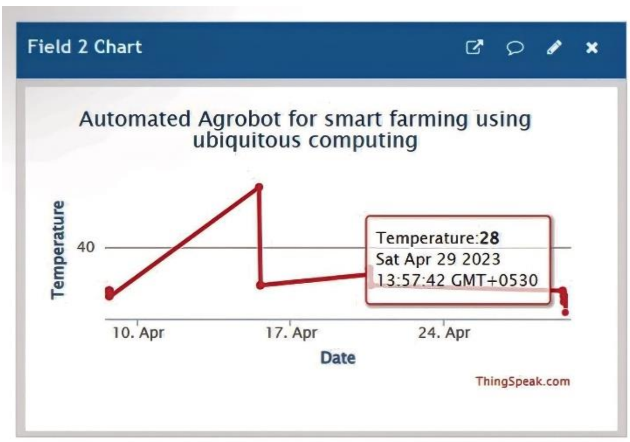

Figure 7.4 Temperature Sensor

This graph indicates temperature data points with respect to date and time.

Homepage of Website

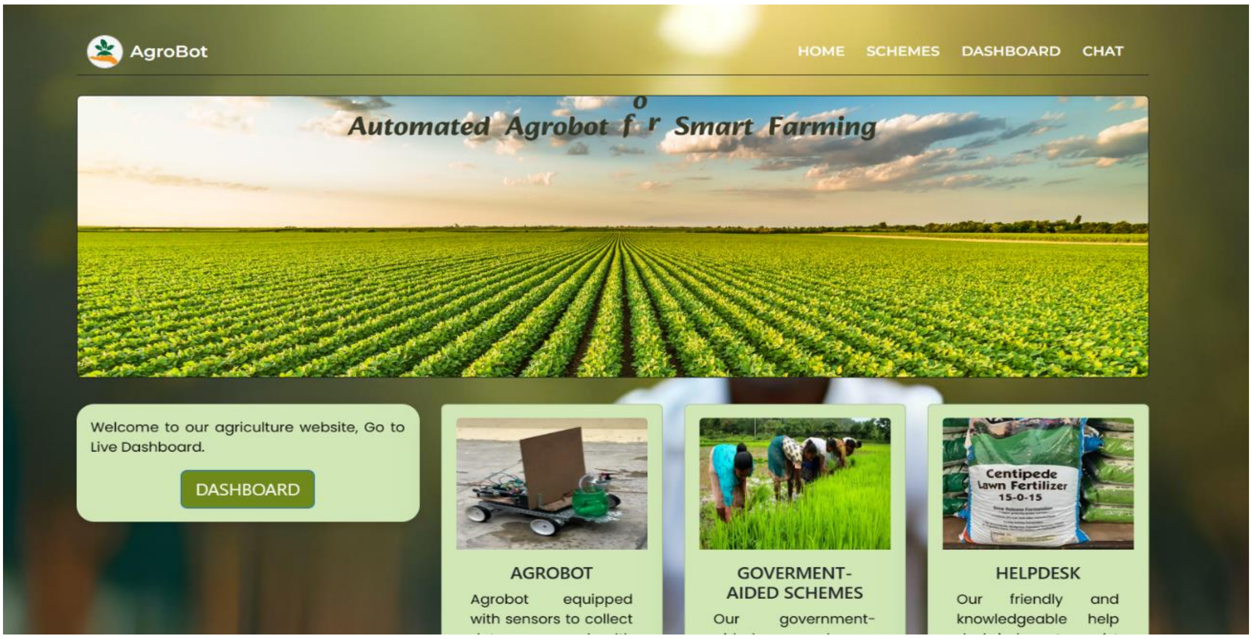

Figure 7.5 Home page

Home page of our Agrobot website where all our services listed.

Live Dashboard

Figure 7.6 Dashboard of sensor values.

This page is about visualization of live sensor values.

Schemes Page

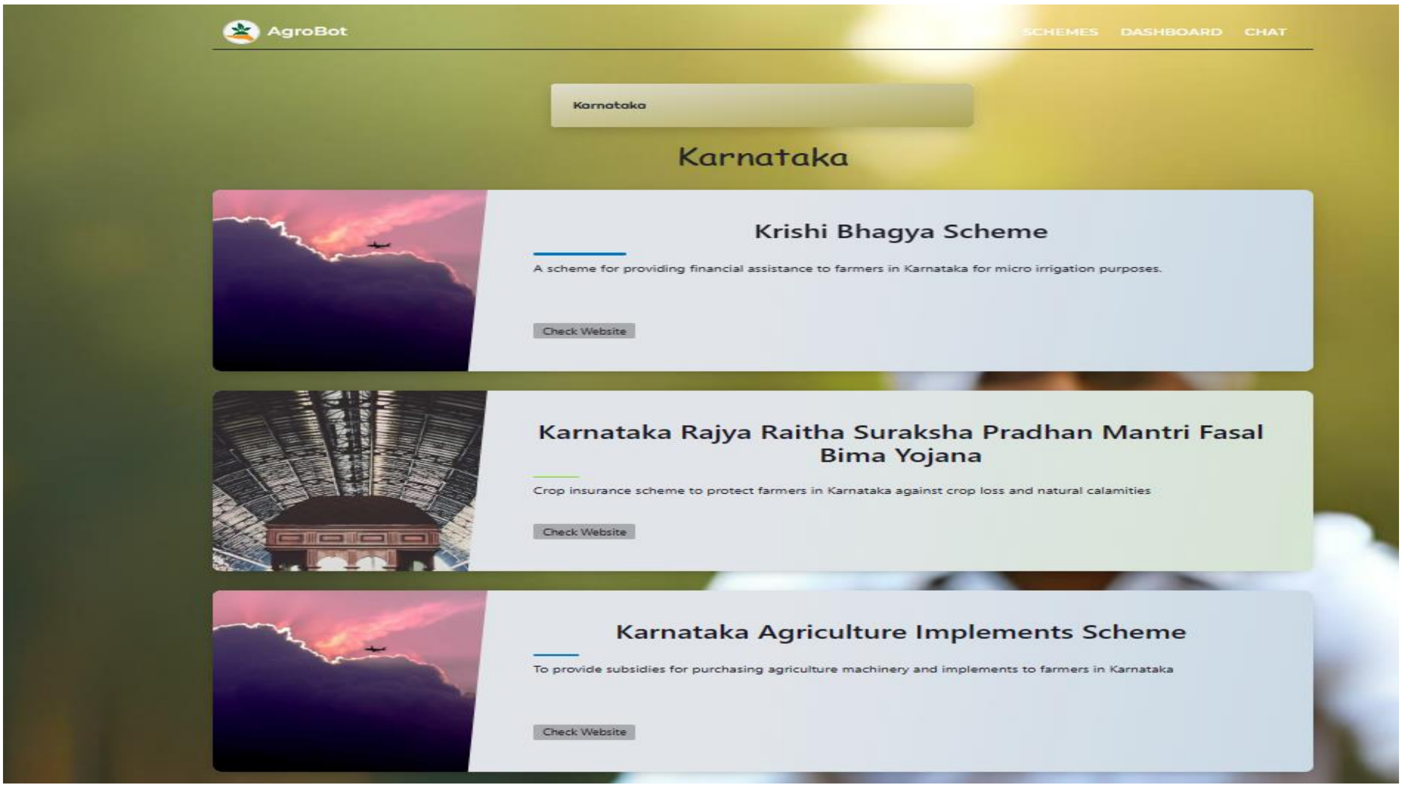

Figure 7.7 Schemes Page.

This page will displays the different schemes related to agriculture based upon states.

Chat Page

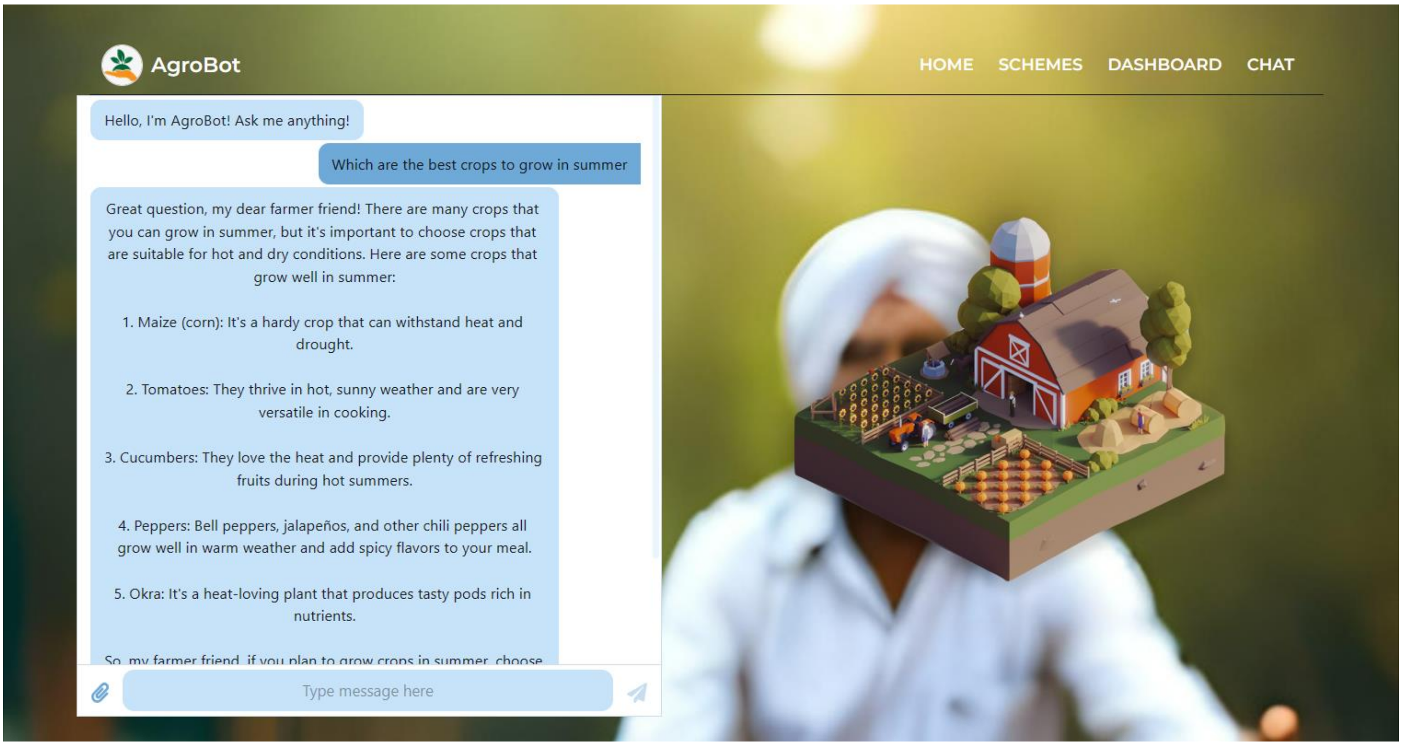

Figure 7.8 Chat Page.

This page contains chat-gpt enabled chat bot.

ANNEXURE A

GLOSSARY

Automatic pesticide spraying system

A system that automatically sprays pesticides on crops based on data collected by sensors.

Cloud platform

A platform that stores and analyzes data collected by the sensors in the automatic pesticide spraying system.

Precision spraying technology

Technology used in the automatic pesticide spraying system to enable targeted spraying of specific areas of the crop based on the data collected by sensors.

Sensors

Devices used in the automatic pesticide spraying system to collect data on temperature, humidity, soil moisture, pH levels, light intensity, and air quality.

Smart farms

Farms that utilize technology such as the automatic pesticide spraying system to increase efficiency and sustainability in crop management.

Sustainability

The ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Targeted spraying

Spraying of specific areas of the crop based on data collected by sensors in the automatic pesticide spraying system to reduce pesticide waste and improve effectiveness.

Integrated solution

A comprehensive solution that combines different technologies to provide a more effective and efficient solution for crop management.

Sustainability

The ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Targeted spraying

Spraying of specific areas of the crop based on data collected by sensors in the automatic pesticide spraying system to reduce pesticide waste and improve effectiveness.

Annexure - B

ACRONYMS

ANNEXURE B

ACRONYMS

IOT	**Internet of Things**
UI	**User Interface**
DC	**Direct Current**
LED	**Light Emitting Diode**
WIFI	**Wireless Fidelity**
IDE	**Integrated Development Environment**

Annexure - C

LANGUAGE DESCRIPTION

ANNEXURE C

LANGUAGE DESCRIPTION-EMBEDDED C

Overview:

Embedded C is a programming language used to develop software for embedded systems, which are computer systems that are designed to perform specific functions within a larger system. Unlike general-purpose computers, which are designed to perform a wide range of tasks, embedded systems are typically designed for a single purpose or a narrow range of purposes, such as controlling a car's engine or operating a medical device. Embedded C was developed specifically for these types of systems, and is designed to be lightweight, efficient, and easy to use.

Today, Embedded C is used in a wide range of industries, including automotive, aerospace, consumer electronics, and medical devices. It has become an essential tool for developers who are designing and programming embedded systems, and has helped to drive innovation and advances in a wide range of fields. With the increasing demand for smart, connected devices, the use of Embedded C is expected to continue to grow in the years ahead, as developers seek to create ever-more sophisticated and efficient embedded systems.

History:

The history of Embedded C dates back to the early 1980s, when the first microcontrollers were being developed. At that time, assembly language was the primary language used for programming embedded systems. However, assembly language programming was time-consuming and error-prone. As a result, programming in C became popular due to its high-level language constructs and portability.

The first version of Embedded C was developed by Michael Barr in the early 1990s. He developed a subset of the C programming language that was optimized for embedded systems. This subset of C included specific features such as memory mapping and bit manipulation. These features allowed for more efficient use of memory and increased performance in embedded systems.

Over time, Embedded C has evolved to include new features and optimizations for the needs of the embedded systems industry. Today, Embedded C is widely used in various industries, including automotive, aerospace, consumer electronics, and medical devices. It continues to be a critical tool for developing software for embedded systems and plays an essential role in advancing technology and innovation.

Design and Features:

Embedded C is a high-level programming language used to develop software for embedded systems, which are computer systems designed to perform specific functions within larger electronic devices. It is an extension of the C programming language and has many features that make it well-suited for embedded systems development.

One of the key features of Embedded C is its ability to interact directly with the hardware of an embedded system, such as microcontrollers, sensors, and other peripherals. This allows developers to write code that is highly optimized for a specific hardware platform, resulting in faster and more efficient operation. Additionally, Embedded C provides a rich set of data types and functions that are well-suited for real-time processing and control applications.

The development of Embedded C is closely tied to the history of embedded systems, which have been used in a wide range of applications since the 1960s. Over time, as the capabilities of embedded systems have grown, so too have the demands placed on the software that powers them. As a result, there has been a growing need for programming languages and development tools that are tailored specifically to the needs of embedded systems development.

Development Environment:

In terms of development environment, Embedded C can be used with a wide range of integrated development environments (IDEs) and compilers, including popular options such as Keil µVision, IAR Embedded Workbench, and GCC. These tools provide developers with a range of features to support the development process, including debugging, code analysis, and optimization. Overall, the combination of Embedded C and these development tools makes it possible to create highly efficient and reliable software for embedded systems.

Applications:

Embedded C is used in a wide range of applications, particularly in the field of embedded systems. It is often used in microcontroller-based applications such as robotics, consumer electronics, automotive systems, and medical devices. In robotics, for example, Embedded C can be used to control motors, sensors, and other actuators. In consumer electronics, it can be used to develop firmware for devices such as smartphones, cameras, and home appliances. In automotive systems, it can be used to develop firmware for electronic control units (ECUs) that control various functions such as the engine, transmission, and braking systems. In medical devices, it can be used to develop firmware for devices such as pacemakers and insulin pumps. In short, Embedded C is a versatile programming language that is widely used in various industries and applications.

BIBLIOGRAPHY

BIBILOGRAPHY

[1] Ms. Urmila A. Shinde, Ms. Vidya R. Patil, Ms. Vaishnavi R. Javeri, Ms. Mohua Biswas “IoT based Climate Monitoring System using Arduino”, IJARSCT 2022.

[2] Sivaprasad Athikkal, Ambarish Pradhan, Abhilash Gade, A. Mahidhar Reddy “Solar Powered Agribot for Farm Monitoring using Interent of Things(IOT)”, IJEET,2020.

[3]J. Lin, L. Zhang, and Y. Zhang ,IEEE 2022 “ Adaptive Planting Robot for Precision Agriculture”,IEEE 2022.

[4] A.J. Jiménez, M.A. Salama, and M.M.A. Salama “Autonomous Navigation of an Agricultural Robot Based on Visual and Lidar Sensors”, IEEE 2021.

[5] M.M.A. Salama and M.A. Salama, IEEE 2021 “A Review of Autonomous Agricultural Robots: State of the Art and Future Trends, IEEE 2021.

[6] Dr.S.Gnanavel, Mrs M.Sreekrishna Mr.N DuraiMurugan,Nashwan Mr. Loksharan “The Smart Iot Based Automated Irrigation System Using Arduino UNO And Soil Moisture Sensor”, IJRTE 2022

[7] Sanket Gosavi, Devraj Bhosale, Sourabh Bhide “Agricultural Pesticide Spraying Robot”.

[8] Mahek Jain, Bhavya Bhagerathi, Sowmyarani C N “Iot Based Weather Monitoring Using Arduino Uno”.

[9] Pvr Chaitanya, Dileep Kotte, A. Srinath, K. B. Kalyan “Development of Smart Pesticide Spraying Robot”, IJRTE 2022.

[10] Amol Gothankar,Vishal Soni, Avinash Vishwakarma ,Sagar Jankar,Satish Bhoyar “Automatic Multipurpose Agribot Using Arduino Mega and GPS Module Receiver”, IJRTE 2021.

[11] Santosh M, Yogitha Y, Lavanya G,Manjula, Manjunath K.B “Fully Automatic Robot Used For Spraying Medicines For Crops”, IJCESR 2020.

[12] Shreyash, Srashti Sharma, Subhash Nagar, Shivani Priyadardshani "Smart Irrigation System", IJRTE2021.

[13] Rohan Darve, Ashish Singh, Gajesh Thakre, Kashinath Meshram, Ketan Nipane, Raksha Panore, Prof. N.L. Lanjewa "Thingspeak Cloud Based Smart Irrigation System", IJCESR 2021.

[14] CH Nishanthi, Dekonda Naveen, Chiramdasu Sai Ram, Kommineni Divya, Rachuri Ajay Kumar "Smart Farming Using IOT ", IJIRT 2021.

[15] Kaushik Sekaran, Maytham N. Meqdad, Pardeep Kumar, Soundar Rajan, Seifedine Kadry "Smart Agriculture Management System Using Internet Of Things".

[16] Sindhu B R, Raghu, C Asha K, Chethan Shindhe R, Sahana "Automation in Agriculture using AGROBOT", PIJERT 2021.

[17] Adithya Vadapalli,Swapna Peravali, Venkata Rao Dadi "Smart Agriculture System using IoT Technology", IJARSE 2020.

[18] S. A. S. Mohammeda, A. Aluri, K. K. Duru,V. Praneash "IoT based Humidity, Temperature and Gas Monitoring using Arduino Uno".

[19] Sonu Kumar, Rajnish Kumar, Ujjawal Maan, Ridhima Grover "Real Time Environment MonitoringSystem using IOT", IJERT 2020.

[20] Amaresh.A.M. Anagha G Rao, Fennaz Afreen, Moditha.N, IJERT,2020 "IOT Enabled pesticide Sprayer with security system by using solar energy", IJERT 2020.

[21] A.M. Kassim, A. H. Azahar,S Sivarao, F. A. Jafar, H.I Jaafar, M. S. M. Aras, " Design and Development of Autonomous Pesticide Sprayer Robot for Fertigation Farm", IJACSA 2020

[22] G Vijaykumar, K Vijayalakshmi ,CH Pujitha, DN Sandhya Rani, "Automatic Arduino Controlled Agribot For Multi-Purpose Cultivation", ICARI-2020

SAPTHAGIRI
College of Engineering
Creating Tomorrow

SAPTHAGIRI COLLEGE OF ENGINEERING

Accredited by NBA (CSE,ECE,EEE,ISE & ME)
Accredited by NAAC with 'A' Grade
An ISO 9001:2015 and 14001:2015 Certified Institution

INTERNATIONAL CONFERENCE

on

Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices: **ICGCP-2023**

5 – 7 May, 2023

ISBN: 9798392733033

In association with

SCE IQAC

INVEST

INSTITUTION'S INNOVATION COUNCIL

CERTIFICATE

This certificate acknowledges and honors

PRANAV N

of

Information Science & Engineering, SCE

for participating and presenting a paper titled

Automated agrobot for smart farming using ubiquitous computing

In International Conference on ***Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices, ICGCP-2023*** organized by Sapthagiri College of Engineering, Bengaluru during 5–7 May, 2023.

Dr. R.G.Deshpande	**Dr. Harish.R**	**Dr. H Ramakrishna**
Conference Co-ordinator Associate Professor, Dept of Mechanical Engg, SCE	Conference Co-Chair Prof & Head, Dept of Physics, SCE	Conference Chair Principal, SCE

SAPTHAGIRI
College of Engineering
Creating Tomorrow

SAPTHAGIRI COLLEGE OF ENGINEERING

Accredited by NBA (CSE,ECE,EEE,ISE & ME)
Accredited by NAAC with 'A' Grade
An ISO 9001:2015 and 14001:2015 Certified Institution

INTERNATIONAL CONFERENCE

on

Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices: **ICGCP-2023**

5 – 7 May, 2023

ISBN: 9798392733033

In association with

INSTITUTION'S INNOVATION COUNCIL
(Ministry of Education Initiative)

CERTIFICATE

This certificate acknowledges and honors

ROHITH GANAPATHI BHAT

of

Information Science & Engineering, SCE

for participating and presenting a paper titled

Automated agrobot for smart farming using ubiquitous computing

In International Conference on ***Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices, ICGCP-2023*** organized by Sapthagiri College of Engineering, Bengaluru during 5–7 May, 2023.

Dr. R.G.Deshpande
Conference Co-ordinator
Associate Professor,
Dept of Mechanical Engg, SCE

Dr. Harish.R
Conference Co-Chair
Prof & Head, Dept of Physics, SCE

Dr. H Ramakrishna
Conference Chair
Principal, SCE

SAPTHAGIRI
College of Engineering
Creating Tomorrow

SAPTHAGIRI COLLEGE OF ENGINEERING

Accredited by NBA (CSE,ECE,EEE,ISE & ME)
Accredited by NAAC with 'A' Grade
An ISO 9001:2015 and 14001:2015 Certified Institution

INTERNATIONAL CONFERENCE

on

Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices: **ICGCP-2023**

5 – 7 May, 2023

ISBN: 9798392733033

In association with

SCE IQAC

INSTITUTION'S INNOVATION COUNCIL
(Ministry of Education Initiative)

CERTIFICATE

This certificate acknowledges and honors

S KAUSHAL

of

Information Science & Engineering, SCE

for participating and presenting a paper titled

Automated agrobot for smart farming using ubiquitous computing

In International Conference on ***Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices, ICGCP-2023*** organized by Sapthagiri College of Engineering, Bengaluru during 5–7 May, 2023.

Dr. R.G.Deshpande	**Dr. Harish.R**	**Dr. H Ramakrishna**
Conference Co-ordinator	Conference Co-Chair	Conference Chair
Associate Professor, Dept of Mechanical Engg, SCE	Prof & Head, Dept of Physics, SCE	Principal, SCE

SAPTHAGIRI College of Engineering
Creating Tomorrow

SAPTHAGIRI COLLEGE OF ENGINEERING

Accredited by NBA (CSE,ECE,EEE,ISE & ME)
Accredited by NAAC with 'A' Grade
An ISO 9001:2015 and 14001:2015 Certified Institution

INTERNATIONAL CONFERENCE

on

Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices: **ICGCP-2023**

5 – 7 May, 2023

ISBN: 9798392733033

In association with

INSTITUTION'S INNOVATION COUNCIL
(Ministry of Education Initiative)

CERTIFICATE

This certificate acknowledges and honors

NADEEM PASHA

of

Information Science & Engineering, SCE

for participating and presenting a paper titled

Automated agrobot for smart farming using ubiquitous computing

In International Conference on ***Global Convergence in Technology, Entrepreneurship, Computing & Value Engineering: Principles and Practices, ICGCP-2023*** organized by Sapthagiri College of Engineering, Bengaluru during 5–7 May, 2023.

Dr. R.G.Deshpande
Conference Co-ordinator
Associate Professor,
Dept of Mechanical Engg, SCE

Dr. Harish.R
Conference Co-Chair
Prof & Head, Dept of Physics, SCE

Dr. H Ramakrishna
Conference Chair
Principal, SCE

IFERP
connecting engineers...developing research

CERTIFICATE
OF APPRECIATION

SRM RAMAPURAM

CHANDIGARH GROUP OF COLLEGES

IFERP – PROJECT COMPETITION, 2023

This is to certify that Mr/Ms .... Pranav N ....of

.... B.Tech, Information Science & Engineering, Sapthagiri College Of Engineering ....Presented his/her

worthy project titled .... *Automated Agrobot For Smart Farming Using Ubiquitous Computing* ....

....

In the idea phase of the "IFERP-Project Competition, 2023"

A. Siddth

Mr. Siddth Kumar Chhajer
MD & Founder, IFERP
Technoarete Group

Mr. Rudra Bhanu Satpathy
CEO & Founder, IFERP
Technoarete Group

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION
IFERP

IFERP
connecting engineers...developing research

CERTIFICATE
OF APPRECIATION

SRM RAMAPURAM

CHANDIGARH GROUP OF COLLEGES

IFERP – PROJECT COMPETITION, 2023

This is to certify that Mr/Ms .... Rohith Ganapathi Bhat ....of

.... B.Tech, Information Science & Engineering, Sapthagiri College Of Engineering ....Presented his/her

worthy project titled .... *Automated Agrobot For Smart Farming Using Ubiquitous Computing* ....

....

In the idea phase of the "IFERP-Project Competition, 2023"

A. Siddth

Mr. Siddth Kumar Chhajer
MD & Founder, IFERP
Technoarete Group

Mr. Rudra Bhanu Satpathy
CEO & Founder, IFERP
Technoarete Group

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION
IFERP

IFERP
connecting engineers...developing research

SRM RAMAPURAM

CHANDIGARH GROUP OF COLLEGES

CERTIFICATE
OF APPRECIATION

IFERP – PROJECT COMPETITION, 2023

This is to certify that Mr/Ms S Kaushal of B.Tech, Information Science & Engineering, Sapthagiri College Of Engineering Presented his/her worthy project titled *Automated Agrobot For Smart Farming Using Ubiquitous Computing*

In the idea phase of the "IFERP-Project Competition, 2023"

Mr. Siddth Kumar Chhajer
MD & Founder, IFERP
Technoarete Group

Mr. Rudra Bhanu Satpathy
CEO & Founder, IFERP
Technoarete Group

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION IFERP

IFERP
connecting engineers...developing research

SRM RAMAPURAM

CHANDIGARH GROUP OF COLLEGES

CERTIFICATE
OF APPRECIATION

IFERP – PROJECT COMPETITION, 2023

This is to certify that Mr/Ms Nadeem Pasha of B.Tech, Information Science & Engineering, Sapthagiri College Of Engineering Presented his/her worthy project titled *Automated Agrobot For Smart Farming Using Ubiquitous Computing*

In the idea phase of the "IFERP-Project Competition, 2023"

Mr. Siddth Kumar Chhajer
MD & Founder, IFERP
Technoarete Group

Mr. Rudra Bhanu Satpathy
CEO & Founder, IFERP
Technoarete Group

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION IFERP

DETAILS OF THE PROJECT TEAM

Name : PRANAV N

USN : 1SG19IS069

E-mail : pranavbharadwaj142@gmail.com

Phone Number : 9353489676

Name :ROHITH GANAPATHI BHAT

USN : 1SG19IS086

E-mail : rohithbhat198@gmail.com

Phone Number : 7349131343

Name : S KAUSHAL

USN : 1SG19IS087

E-mail : kaushal.shivaprakashan@gmail.com

Phone Number : 9632434634

Name : NADEEM PASHA

USN : 1SG19IS126

E-mail : nadeempasha2001@gmail.com

Phone Number : 8310917579