KYC – KNOW YOUR CROP

A PROJECT REPORT

Submitted by

RAKESH NARAYANAN C N [SCM22MCA-2021]

to

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in partial fulfillment of the requirements for the award of the Degree of

Master of Computer Application

Department of Computer Science and Engineering

SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY

(*Affiliated to APJ Abdul Kalam Technological University*)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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CERTIFICATE

This is to certify that the report entitled **'KYC – KNOW YOUR CROP'** submitted by **RAKESH NARAYANAN CN** to APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the Degree of Master of Computer Application is a bonafide record of the project work carried out by him under my guidance and supervision.

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ABSTRACT

KYC- Know Your Crop proposes an innovative IoT-based Crop Prediction System designed to optimize agricultural practices by leveraging real-time data from soil moisture, temperature, and humidity sensors. The integration of Internet of Things (IoT) technology with precision agriculture aims to empower farmers with accurate insights into environmental conditions, enabling informed decision-making and improving crop yield.

The system deploys a network of sensors strategically placed in the agricultural field to monitor key parameters critical for crop growth. Soil moisture sensors measure the water content in the soil, temperature sensors capture ambient temperature variations, and humidity sensors record the moisture content in the air. These sensors are connected to a central hub, which aggregates and processes the data to provide farmers with valuable information regarding the environmental factors influencing crop health.

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CHAPTER 1
INTRODUCTION

The IoT-based Crop Prediction System [1] using soil moisture, pH value, temperature, and humidity sensors represents a significant advancement in precision agriculture, where cutting-edge technologies converge to revolutionize traditional farming practices. In the face of climate change, resource scarcity, and a growing global population, there is an increasing need for innovative solutions that empower farmers with real-time insights for informed decision making. This project [2] proposes an integrated system that utilizes Internet of Things (IoT) devices, specifically soil moisture, temperature, and humidity sensors, to monitor and analyze crucial environmental parameters affecting crop health. By harnessing the power of data analytics and machine learning, this system aims to provide farmers with accurate predictions, enabling them to optimize irrigation, manage temperature-sensitive crops, and make informed choices for sustainable and efficient crop cultivation. The proposed IoT-based Crop Prediction System serves as a technological bridge between agriculture and data science, offering a user-friendly interface for farmers to access real-time information, predictive analytics, and actionable recommendations, ultimately contributing to the advancement of precision agriculture practices.

CHAPTER 2
PROOF OF CONCEPT

2.1 INTRODUCTION

The proof of concept for KYC, an IoT-based Crop Prediction System using soil moisture, temperature, humidity and ph sensors involves a systematic validation of the project's key components. We begin by configuring the necessary hardware, integrating soil moisture, temperature, and humidity sensors with a microcontroller to ensure accurate data collection. This hardware setup is then employed in a controlled agricultural setting, where the microcontroller is programmed to collect real-time data. Subsequently, a communication protocol is established for seamless data transmission from the microcontroller to a central processing unit (CPU). The CPU, hosted on a computer or cloud platform, is equipped with basic data processing capabilities to aggregate, and store incoming sensor data. Machine learning algorithms are then implemented for data analysis, leveraging historical data to predict crop growth stages, potential diseases, and yield estimates. A user-friendly interface, either web-based or mobile, is developed for farmers to access real-time information and predictions. Field tests are conducted to validate the system's performance in real-world conditions, with a focus on adaptability and prediction accuracy. Feedback from users is collected and incorporated into refinements, addressing any technical challenges, and optimizing the system for improved usability. The entire process is thoroughly documented, providing a comprehensive overview of the proof of concept and its successful validation.

2.2 OBJECTIVES

The Crop Prediction System using IoT [3] and sensors for soil moisture, pH, temperature, and humidity wants to change farming for the better. First off, it is all about keeping an eye on the environment in real-time. It is using fancy sensors to watch things like how wet the soil is, how hot or cold it is, how humid, and what the pH level is like. This helps farmers make smart decisions based on actual data. Another big goal is to help farmers use water wisely. By knowing exactly how damp the soil is, we can stop them from wasting water and make sure their crops are getting just the right amount. Here it is also paying attention to how temperature affects different crops. This way, farmers can adjust their plans depending on how hot or cold it gets outside.

One of the main things done in this project is using smart math to make predictions. By teaching computers to learn from the data, farmers can get hints about when their crops will grow and how much it will produce. This project is making it easy for farmers to understand all this info by designing a simple interface. And to make sure they do not miss anything important; we are setting up alerts and reminders. It is testing everything out in real fields and listening carefully to what farmers have to say. Our goal is to help farming become more sustainable, use resources better, and make farming even more precise.

CHAPTER 3
SYSTEM STUDY

3.1 EXISTING SYSTEM

Traditionally, farmers rely on manual observation and experience to make decisions about irrigation, crop management, and disease control. The existing system often lacks real-time data and predictive analytics, making it challenging for farmers to respond promptly to changing environmental conditions. Additionally, irrigation schedules are typically based on fixed timelines rather than dynamically adapting to soil moisture levels. Temperature-sensitive crops may face challenges as farmers may not have accurate and timely information about ambient temperature variations. Disease prevention measures often rely on visual inspection, and early detection is challenging without data-driven insights.

In the absence of IoT technology, farmers may not have access to automated systems that can continuously monitor environmental parameters and provide predictive analytics. The existing system may lack a centralized platform for data analysis, and decision- making might be more reactive than proactive. Overall, the conventional methods may lead to suboptimal resource utilization, lower crop yields, and increased vulnerability to environmental challenges.

The IoT-based Crop Prediction System aims to overcome these limitations by introducing a comprehensive, data-driven approach to precision agriculture, providing farmers with real-time insights and predictive analytics for more informed decision-making.

3.2 PROPOSED SYSTEM

The proposed IoT-based Crop Prediction System is introduced as a transformative solution for modern agriculture, addressing the limitations of traditional farming methods. By deploying a network of soil moisture, soil pH, temperature, and humidity sensors in the agricultural field, this system aims to provide farmers with a real- time, data-driven approach to crop management. The collected sensor data is transmitted to a centralized processing unit equipped with advanced analytics and machine learning algorithms [4]. Here, Random Forest Model is used for prediction of crop. This enables the generation of predictive insights into crucial aspects of crop cultivation.

The user-friendly interface, accessible through a web-based dashboard, empowers farmers to visualize the data effortlessly and receive actionable recommendations. The system incorporates optimized irrigation management based on soil moisture levels, and adaptive strategies for temperature-sensitive crops.

Automated alerts and notifications ensure timely responses to critical conditions, enhancing the overall resilience of the agricultural ecosystem. The proposed system represents a significant step towards precision agriculture, offering farmers a sophisticated toolset to make informed decisions, promote sustainable practices, and maximize crop yields in an ever-changing environment.

3.3 LITERATURE REVIEW

The literature review begins by exploring existing research and studies related to precision agriculture, IoT applications, and sensor technologies.

In the exploration of agricultural technological advancements, P. S. Vijayabaskar et al. [5] introduce a novel system integrating IoT and Machine Learning methodologies. This innovative framework harnesses IoT for sensor deployment and Machine Learning for data interpretation. Central to the architecture is the utilization of Raspberry Pi as a hub, facilitating the aggregation of data from various sensors. These sensors, ranging from temperature to moisture and PH levels, transmit their readings to the Raspberry Pi, which, in turn, communicates wirelessly via an adapter. The collected data is then transmitted to a server employing the MQTT protocol for storage and further analysis. Employing sophisticated data mining algorithms such as k-means clustering, KNN, and ARIMA models, this system extracts insights from the amassed data, aiding in the prediction of optimal crop types based on prevailing environmental conditions.

Prof. D.S. Zingade, et.al [6] proposed an android based application which can precisely predict the most suitable crop to the farmer. This application takes the user location as the input with the help of GPS. Basic weather forecast data about the location, such as temperature, rainfall, the moisture level in the soil and soil nutrients are obtained from IMD (Indian Meteorological Department). By considering the previous productions of the crops the obtained data is analysed at the server-side and the most profitable crop is sent to the user’s android application as the result.

Reference Paper [7] determines real time sampling of soil properties using MODIFIED SUPPORT VECTOR REGRESSION, a popular machine learning algorithm and four modules. The Modules include Sensor interfaced to IoT device, Agri cloud, Analyzing the real time sensor data and Agri user interface (AUI). The first module is portable IoT device (NodeMCU) with soil moisture sensor and pH sensor, environmental sensors. Agri cloud module consists of storage. Analyzing the real time data module is processing of types of crops and small plants suggested using modified support vector machine algorithm. Agri-user interface is a basic web interface. Thus, with the help of soil properties farmer will be able to get types of crops and small plants is grown in farmland with help of Modified support vector machine algorithm.
Prachi Sharma et al. [8] introduced a novel system designed to streamline crop prediction processes with minimal user input. Central to their approach is the development of a portable system, featuring a handheld device capable of seamlessly gathering data from various sensors and processing it to generate crop predictions. The system operates on a microcontroller platform, with essential components including EC, pH, and color sensors, all interfaced with an LCD display. Utilizing Bluetooth technology, the microcontroller communicates soil characteristics, such as color texture, electrical conductivity, and pH value, to an accompanying Android application. This application then uploads the collected data to a central server for analysis. Upon analysis, the server determines the most suitable crop for the soil conditions and relays this information back to the LCD display for user retrieval.
Moreover, the study conducted by Li et al. (2020) on machine learning applications in agriculture demonstrates the effectiveness of predictive analytics for crop yield estimation. This research provides a foundation for the proposed project's objective of implementing machine learning algorithms [9] to predict crop growth stages and yield estimates based on historical and real-time data. In a similar vein, the work of Agrawal and Singh (2017) discusses the challenges in traditional agriculture practices and the potential benefits of adopting smart farming solutions. This research underscores the need for innovative systems like the proposed IoT- based Crop Prediction System to overcome limitations in conventional approaches.

The literature review concludes by identifying the gaps in current research, emphasizing the need for a comprehensive system that integrates soil moisture, temperature, and humidity sensors with IoT technology and predictive analytics. By building on the insights and limitations identified in these studies, the proposed research aims to contribute to the field of precision agriculture by offering a holistic solution for data-driven and sustainable crop management.

CHAPTER 4
SYSTEM DESIGN

4.1 ARCHITECTURE

The architecture of the Crop Prediction System using soil moisture, pH sensors, temperature, and humidity sensors involves several interconnected components that collaborate to collect, process, analyze data, and provide actionable insights.

Sensor Network: Soil moisture sensors, soil pH sensors, temperature sensors, and humidity sensors are strategically deployed in the agricultural field. These sensors continuously measure environmental parameters and send data to the microcontroller.

Microcontroller: The microcontroller (e.g., Arduino or Raspberry Pi) serves as the data aggregation point, collecting real-time sensor data from the field. It is responsible for preprocessing data and transmitting it to the Centralized Processing Unit (CPU).

Communication Module: A communication module, often implemented using wireless communication protocols like Wi-Fi or LoRa, facilitates the transmission of sensor data from the microcontroller to the Centralized Processing Unit (CPU).

Centralized Processing Unit (CPU): The CPU, hosted on a cloud platform or a local server, receives and manages the incoming sensor data. It is responsible for data storage, processing, and analysis. Cloud platform called Thingspeak may be utilized for scalable and efficient processing.

Monitoring and Maintenance: Continuous monitoring tools are implemented to track the system's performance, detect anomalies, and ensure that sensors are functioning correctly. Maintenance procedures are established to address hardware failures, software bugs, or system optimization.

This comprehensive architecture ensures a holistic approach to precision agriculture, leveraging advanced technologies to provide farmers with accurate and actionable insights for enhanced crop management.

4.2 BLOCK DIAGRAM

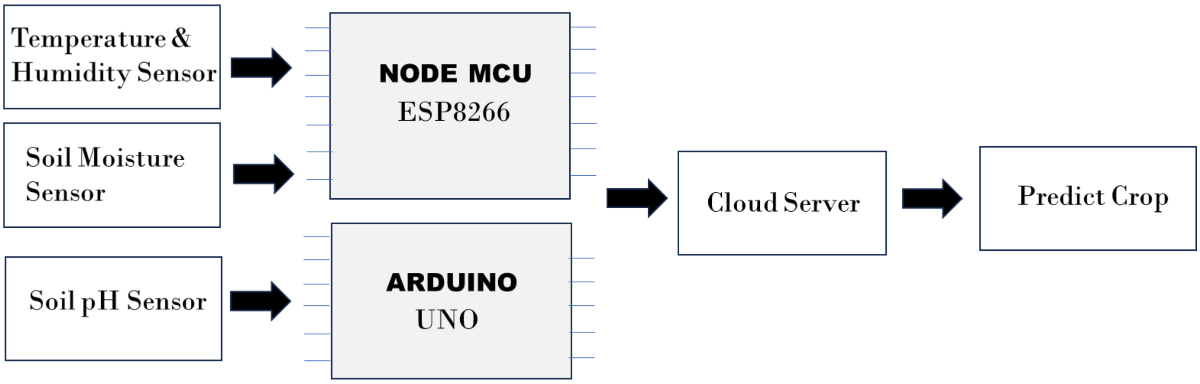

Figure 4.1 : Block Diagram

4.3 HARDWARE CONNECTIONS

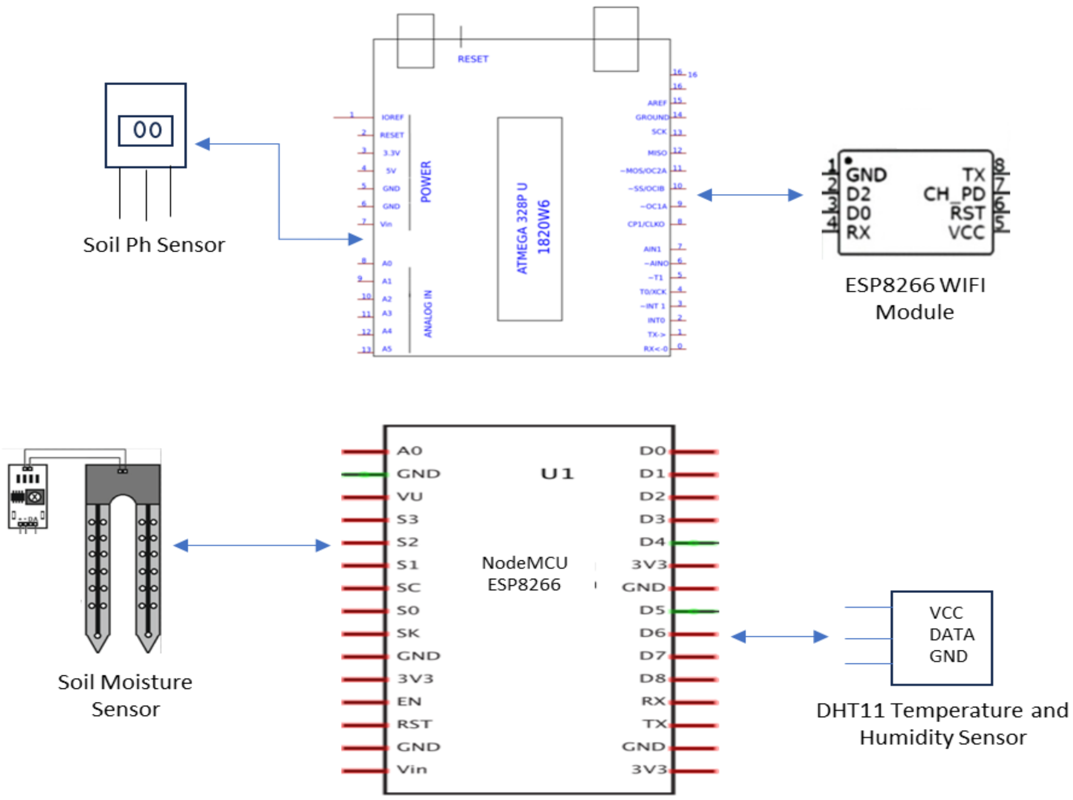

Figure 4.2 : Hardware Architecture

4.4 MACHINE LEARNING ALGORTHM

Crop prediction using soil analysis [13] involves the application of various algorithms and techniques to make accurate predictions about which crops are best suited for a particular area or field based on the soil's characteristics.

As Compared to Other Models [15] like SVM (96.6%), KNN (97.4%) , Decision trees with accuracy 98.6% re used to create models that can predict the best crop based on soil characteristics. They can be interpretable and easy to understand for farmers. This Project uses Random Forest Model with accuracy of 99.32%, which is a combination of many decision trees for predicting accurate crops suited for soil factors.

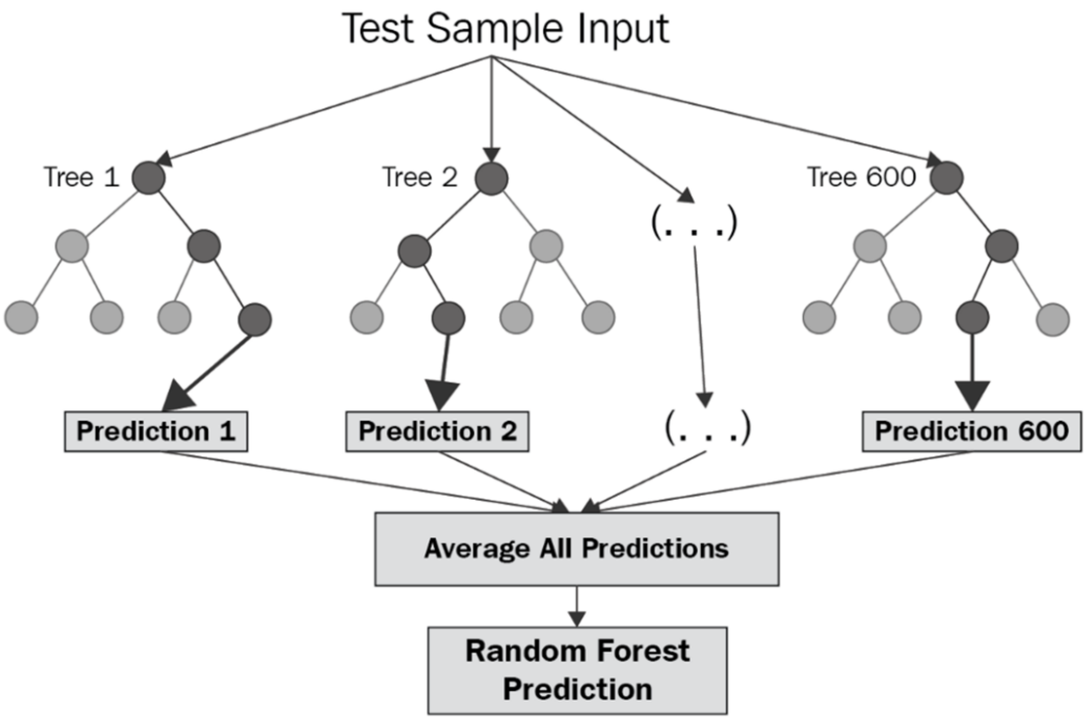

Figure 4.3 : Random Forest Algorithm Architecture

CHAPTER 5
HARDWARE AND SOFTWARE

5.1 HARDWARE REQUIREMENTS

5.1.1 Node MCU ESP8266

Figure 5.1 : Node MCU

Node MCU is an open-source firmware and development kit that enables rapid prototyping of IoT (Internet of Things) projects. It is based on the ESP8266 microcontroller, which features built-in Wi-Fi connectivity and can be programmed using the Lua programming language. The Node MCU development board provides an easy-to- use platform for building IoT devices with minimal hardware and software setup. It includes a USB-to-serial converter for programming and debugging, as well as GPIO pins for connecting sensors, actuators, and other components. The NodeMCU ESP8266 typically has about 10 GPIO (General Purpose Input Output) pins that can be used for digital input/output or to connect to various sensors and actuators.It also has one analog input pins for reading analog sensor values.

The firmware includes a variety of libraries and modules that simplify the development of IoT applications. These include libraries for Wi-Fi connectivity, MQTT messaging, and JSON parsing, among others. The firmware also provides an interactive shell that allows developers to test and debug code on the device itself. One of the main advantages of Node MCU is its ease of use. Developers can quickly prototype and test IoT applications using the Lua scripting language, which is easy to learn and provides a high level of abstraction.

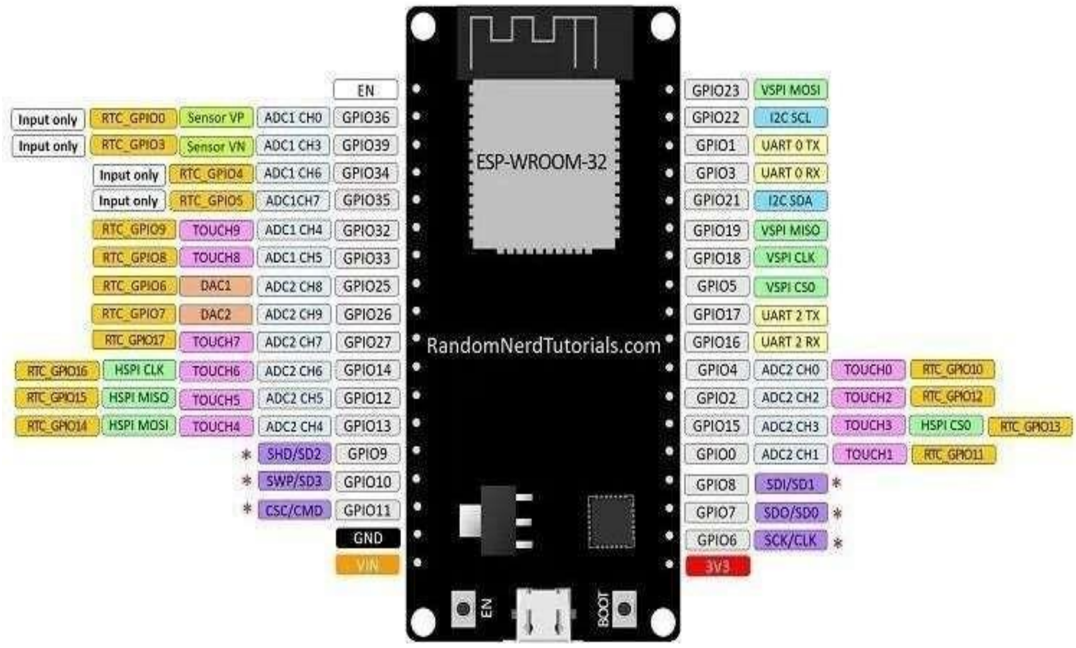

Figure 5.2 : Node MCU Architecture

5.1.2 Arduino UNO

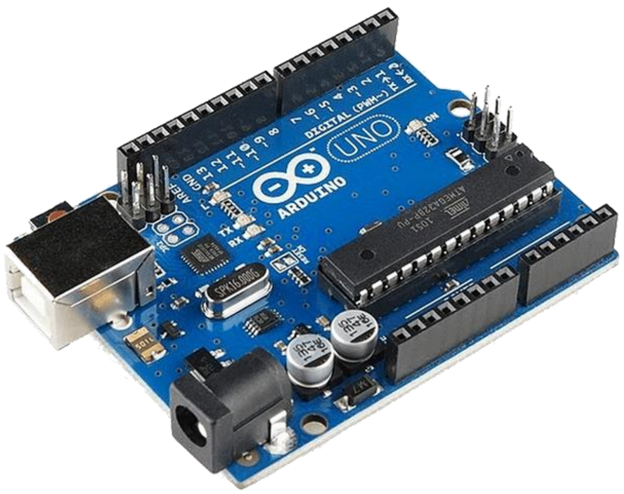

Figure 5.3 : Arduino UNO

The Arduino Uno [10] is like the brains of a small electronic project. It is built around a chip called the ATmega328P, which is like its main processor. The Uno has a bunch of pins that you can use to connect things to it. It has 14 digital input/output, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. Some of these pins can be used to control things that need varying amounts of power, like lights that you want

to dim or motors that you want to speed up or slow down. It also has slots where you can plug in sensors or other devices to measure things like temperature or light levels.
The Uno can be connected to the computer with a USB cable to program it and make it do whatever you want. Or can power it with a special adapter that plugs into a wall socket, or even with batteries if you are making something portable. And if it goes mess something up while experimenting, it can be fixed easily, and if worst comes to worst, can be replaced the chip inside the Uno without spending too much money, to start over again.

5.1.3 Soil Moisture Sensor

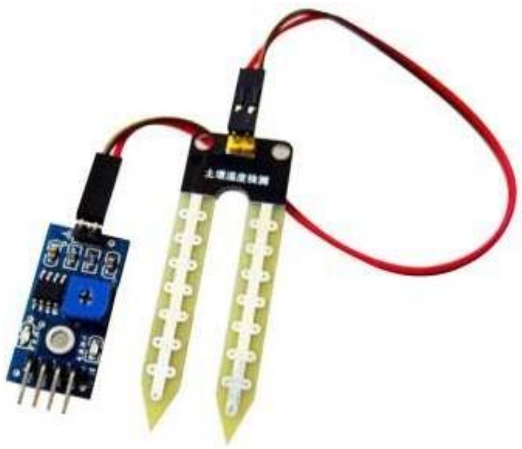

Figure 5.4 : Soil Moisture Sensor

A soil moisture sensor is a device designed to measure the volumetric water content in soil. It plays a crucial role in precision agriculture by providing real-time information about the moisture levels in the soil, which is essential for optimizing irrigation and ensuring proper plant hydration. The sensor typically consists of two electrodes that are inserted into the soil. As the soil moisture changes, the electrical conductivity between the electrodes also changes. This variation in conductivity is then correlated to the soil moisture content. Soil moisture sensors can be either resistive or capacitive in design.
Key features and considerations for soil moisture sensors include their accuracy, response time, calibration requirements, and compatibility with different soil types. Soil moisture data collected by these sensors is valuable for precision irrigation, enabling farmers to optimize water usage, prevent over-watering or under-watering, and enhance overall crop health and yield.

5.1.4 DHT11 Temperature and Humidity Sensor

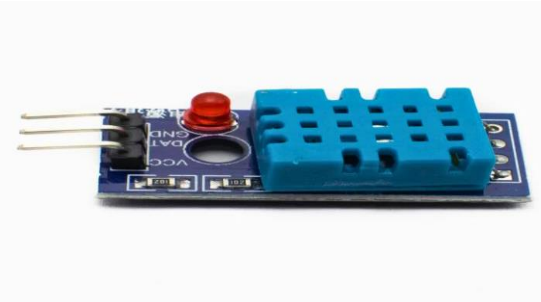

Figure 5.5 : DHT11 Temperature and Humidity Sensor

The DHT11 is a low-cost digital temperature and humidity sensor widely used in various applications, including environmental monitoring and home automation. This sensor is compact, easy to use, and provides reliable readings of both temperature and humidity.
The DHT11 temperature humidity sensor is suitable for a range of applications where moderate accuracy is acceptable, and cost is a primary consideration. It is commonly utilized in weather stations, home automation systems, and DIY projects for monitoring environmental conditions.

5.1.5 Soil pH Sensor

Figure 5.6 : Soil pH Sensor

The PH0-14 Value Detect Sensor Module with a PH Electrode Probe BNC is like a tool for measuring how acidic or alkaline something is, with a range from 0 to 14. It has a BNC connector to make sure it stays connected well. You can use it with both Arduino and Raspberry Pi, making it useful for lots of different projects. The PH Sensor UNO is probably a special sensor just for Arduino Uno boards, so it fits perfectly with Arduino projects. There's also a PH Sensor Arduino Kit that comes with everything you need, like solutions to calibrate the sensor, wires, and a breadboard. Similarly, there is a PH Sensor Raspberry Pi Kit for Raspberry Pi projects. It is important to calibrate the sensor using solutions with known pH values and to read the instructions carefully to make sure you get accurate measurements.

5.1.6 ESP8266 WIFI Module

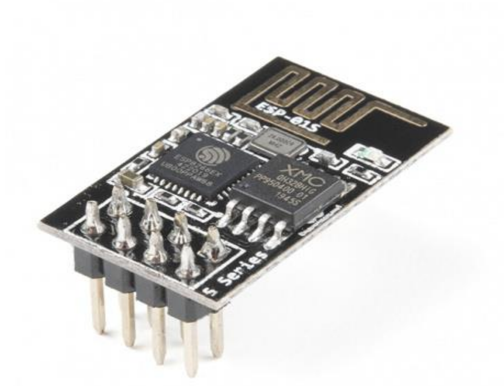

Figure 5.7 : ESP8266 WIFI Module

The ESP8266 WiFi Module is like a little brain with built-in internet powers. It's got everything it needs to connect to WiFi networks all on its own, so you can hook it up to your other gadgets and give them WiFi too. Think of it as a super handy helper for your Arduino – it's ready to go right out of the box, no complicated setup required! Plus, it's really affordable and there's a big community of people who use it and share ideas.

This module is smart too – it can handle a lot of tasks without needing extra help. You can connect sensors and other gadgets to it easily, and it does not need much extra hardware to work its magic. So, it's perfect for all sorts of projects where you need to get things online without a fuss.

5.1.7 Jumper Cables

Figure 5.8 : Jumper Cables

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools to make it easy to change a circuit as needed.

5.1.8 Bread Board

Figure 5.9 : Bread Board

A breadboard is an essential tool in electronics prototyping, providing a platform for building and testing circuits without the need for soldering. It consists of a plastic board with numerous interconnected metal clips that allow users to easily connect and disconnect electronic components such as resistors, capacitors, and integrated circuits. The board's grid layout helps organize components and facilitates the creation of temporary circuits for experimentation. Breadboards are widely used by electronics enthusiasts, hobbyists, and professionals to quickly iterate and test circuit designs before moving to a more permanent setup.

5.2 SOFTWARE REQUIREMENTS

5.2.1 ARDIUNO IDE

The Arduino Integrated Development Environment (IDE) is an application [10] that works on different operating systems like Windows, macOS, and Linux. It's written in Java and lets you write and upload programs to Arduino-compatible boards, and even some other vendor development boards with the help of additional cores. The IDE's source code is released under the GNU General Public License, version 2. It supports the programming languages C and C++, following special rules for code structuring.

It includes a software library from the Wiring project, offering many common input and output procedures. When you write your code, you only need two basic functions: one for starting the sketch and the other for the main program loop. These are compiled and linked with a program stub main() into an executable cyclic executive program using the GNU tool chain provided with the IDE.

To load your code onto the Arduino board, the IDE uses a program called avrdude to convert it into a text file in hexadecimal encoding. Then, a loader program in the board's firmware loads this file onto the board. Your programs written using Arduino Software (IDE) are called sketches, saved with the file extension .ino. The editor includes features for cutting/pasting and searching/replacing text. It also gives feedback on saving and exporting, and displays errors in the message area. The console shows text output by the IDE, including error messages and other information, while the bottom right corner shows the configured board and serial port.

Features of Arduino IDE:

1. Works Across Platforms: Arduino IDE works on Windows, Mac OS, and Linux, and can also be accessed from the cloud. This flexibility allows programmers to create and save their sketches either locally or on the cloud and upload them directly to the board.
2. Board Management: The IDE includes a board management module, allowing users to easily select the board they want to work with from a drop-down menu. Changing the board selection automatically updates the PORT information related to the new board.
3. Easy Sketching: With Arduino IDE, creating programs (sketches) is straightforward using the built-in text editor. Although it has several features, the process is simple.

4. Flexible Board Selection: The IDE's board management module allows users to choose the board they want to use and seamlessly switch to another option if needed. PORT data is updated automatically when making modifications to the board selection.

5.2.2 C Programming Language

The Arduino software, which is like a digital workshop for creating programs, uses languages called C and C++. These languages help people write instructions for Arduino microcontroller boards, which are small computers that can control different electronic devices. Although Arduino programming is like regular computer programming, it has made easier in many ways, especially for beginners.

When you are writing code for Arduino, you usually work with two main parts: setup() and loop(). The setup() part gets things ready when you start the program, like setting up tools and materials before building something. The loop() part is where the main action happens, like following instructions step by step.

Arduino comes with lots of pre-made tools to help with different tasks, like measuring things or controlling lights. These tools are like having a box of handy gadgets that you can use without needing to know exactly how they work. They take care of the tricky parts in order to focus on what you want to do.

There are a lot of familiar stuff from regular programming in Arduino, like using numbers and letters to represent things, following instructions in order, and organizing information in lists. Even though Arduino hides some of the technical stuff, it is still important to understand the basics of how things work to make your projects really shine.

All in all, Arduino's use of the C programming language makes it easier to build all sorts of cool stuff, whether it is just starting out or a pro looking for new challenges.

CHAPTER 6
SYSTEM IMPLEMENTATION

6.1 WORKING

The IoT-based Crop Prediction System using soil moisture, pH value, temperature, and humidity sensors aims to revolutionize modern agriculture by addressing key objectives. Firstly, the project seeks to establish a robust framework for real-time environmental monitoring, employing advanced sensors to continuously track crucial parameters like soil moisture, temperature, humidity, and pH Value. The sensors like DHT11, Soil moisture sensor, Soil pH Sensor are used to collect the data with the help of ESP8266 NodeMCU and arduino UNO microcontrollers. These values that are sensed are then sent to Thingspeak cloud server from where these data are fetched by the webpage. Thingspeak Server [14] is used to visualize the data and notice the frequent changes in the data. The data that is fetched is produced to the trained Random Forest model with accuracy 99% for predicting the crop that is suitable for the given conditions.

6.2 INTERFACING SENSORS

6.2.1 Interfacing DHT11 sensors with Node MCU

Connecting a DHT11 sensor to an ESP8266 is easy [11]. Begin by placing the ESP8266 on your breadboard, making sure that each side of the board is on a different side of the breadboard.

Place the sensor on your breadboard next to the ESP8266. Connect the sensor's VCC pin to the ESP8266's 3.3V pin and ground to ground. Connect the sensor's Data pin to the ESP8266's D8 pin. Finally, add a 10KΩ pull-up resistor between VCC and the data line to keep it HIGH for proper communication between the sensor and the ESP8266. To begin reading sensor data, you will need to install the DHT sensor library.

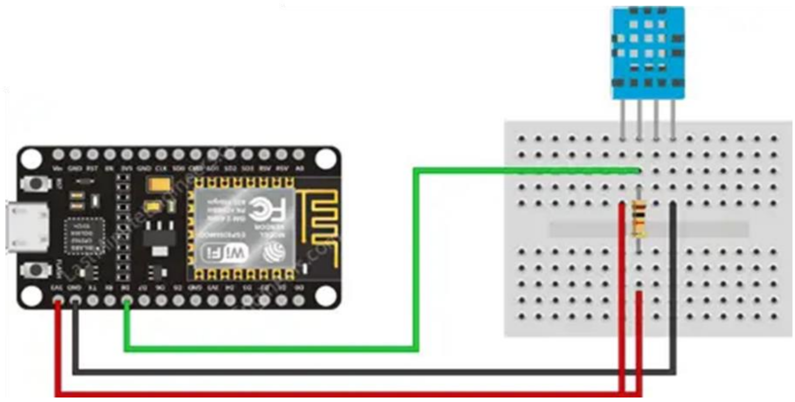

Figure 6.1 : Interfacing DHT11 with Node MCU

6.2.2 Interfacing Moisture sensor with Node MCU

The soil moisture sensor works simply. It has a fork-shaped probe with two exposed conductors. Think of it like a knob that turns, but instead of turning, it changes its resistance depending on how wet the soil is. When the soil has more water, it conducts electricity better, so the resistance is lower. And when there is less water, it conducts electricity less, so the resistance goes up. The sensor gives out a voltage based on this resistance, and by measuring that voltage, we can figure out how moist the soil is. To get it going, just hook up the VCC pin to a 3.3V pin on whatever is controlling it. Now, these sensors don't last forever because they're always in contact with moisture. Plus, leaving them powered up while they're in the soil speeds up corrosion.

To keep them going longer, it is best to only turn them on when you're actually using them. One way to do this is by connecting the sensor's power pin to a digital pin on something like an Arduino and then controlling that pin to turn the sensor on and off as needed. Finally, connect the A0 pin to the MCU’s A0 pin for data.

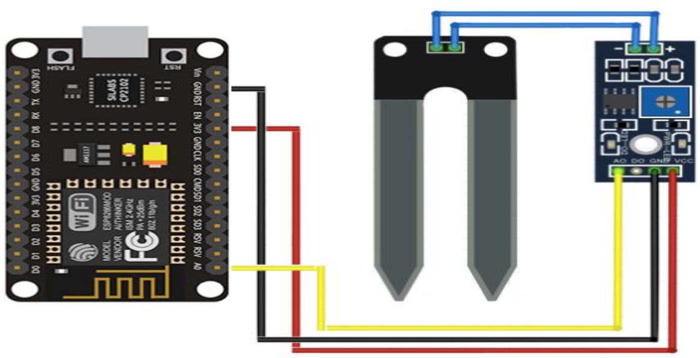

Figure 6.2 : Interfacing Moisture Sensor with Node MCU

6.2.3 Interfacing pH sensor with Arduino

The analog pH sensor kit from the DIY MORE can measure pH values of different liquids with a good precision. The board contains a pair of trimmers through which you can adjust the Analog reading offset. Calibrate [12] the pH sensor without using any liquid or substance and then later measure the pH value of substances. It has two LEDs which work as the Power Indicator, a pH sensor, a BNC connector. This board is also known as the sensor interface circuit.

This pH Sensor Kit has an on-board voltage regulator chip due to which it can be easily powered up using 3.3 to 5.5Vdc.

The pH Sensor interface circuit is also provided with 6 male headers which are clearly labelled as V+, this is where to connect the 3.3V from the Arduino

The next two pins are the ground pins, connect any of these two pins with the Ground pin of the Arduino. Po is the Analog output pin, which should relate to the analog pin of the Arduino.

Sensor Calibration: To calibrate this sensor, requires a wire to short the external part and the center of the probe connector. This causes a 2.5 volts tension on the Po analog output pin. Connect the external part of the BNC connector with the center of the BNC probe connector. Now connect the V+ pin with the Arduino's 5v. Connect the ground pin of the interface circuit with the ground pin of the Arduino, and finally connect the analog output pin Po with the A0 pin of the Arduino. Connect Arduino with the laptop to calibrate the pH sensor .

Disconnect the Arduino board and remove the wire. Then connect the pH sensor with the interface board.

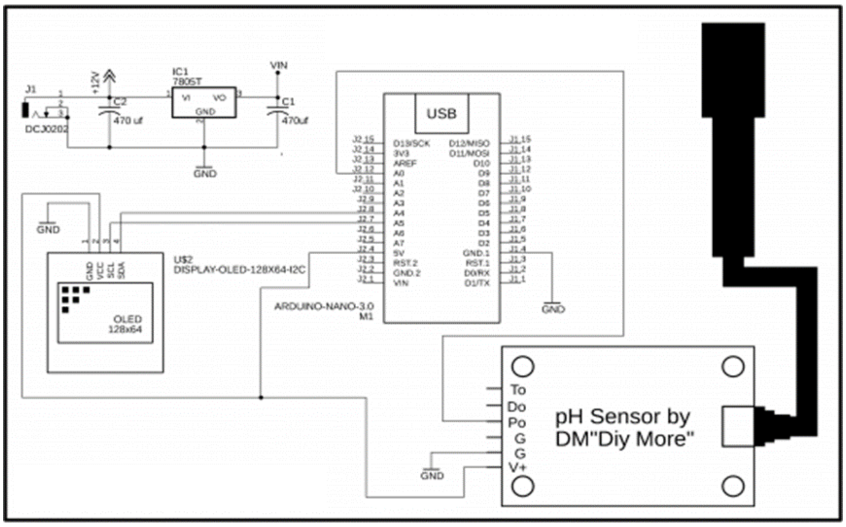

Figure 6.3 : Interfacing pH Sensor with UNO

CHAPTER 7
RESULT ANALYSIS

7.1 RESULT

The IoT-based Crop Prediction System using soil moisture, pH value, temperature, and humidity sensors aims to revolutionize modern agriculture by addressing key objectives.

- Accurate predictions of which crops are most suitable for a given area or field based on given characteristics.
- Continuous monitoring of soil conditions and adjustments to crop recommendations based on real-time data.

7.2 SCREENSHOTS

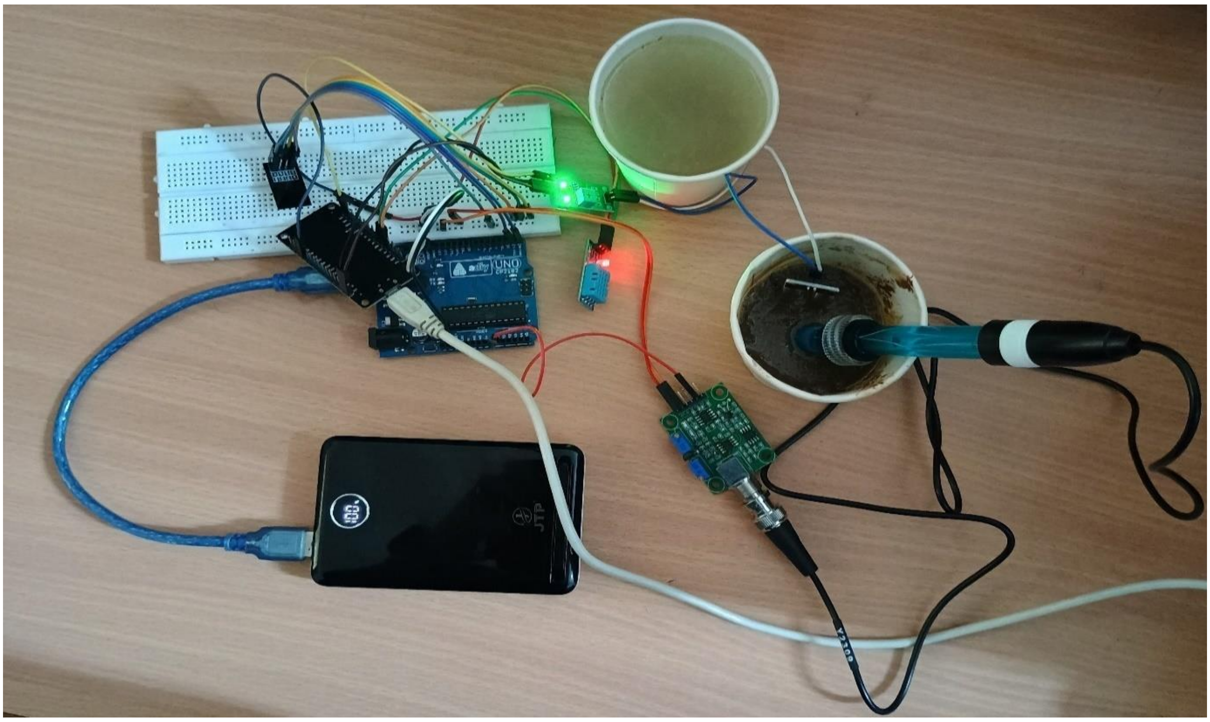

Figure 7.1 : Hardware Connections - Collecting data from Soil Using different Sensors.

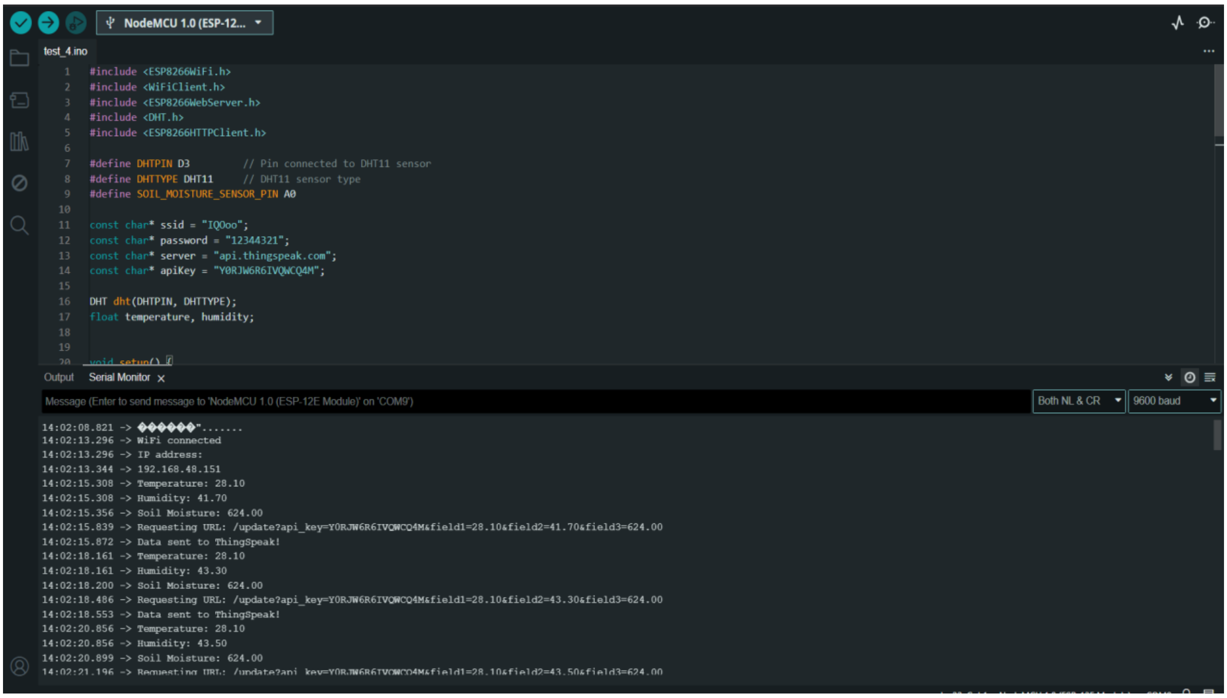

Figure 7.2 : Serial Monitor Output

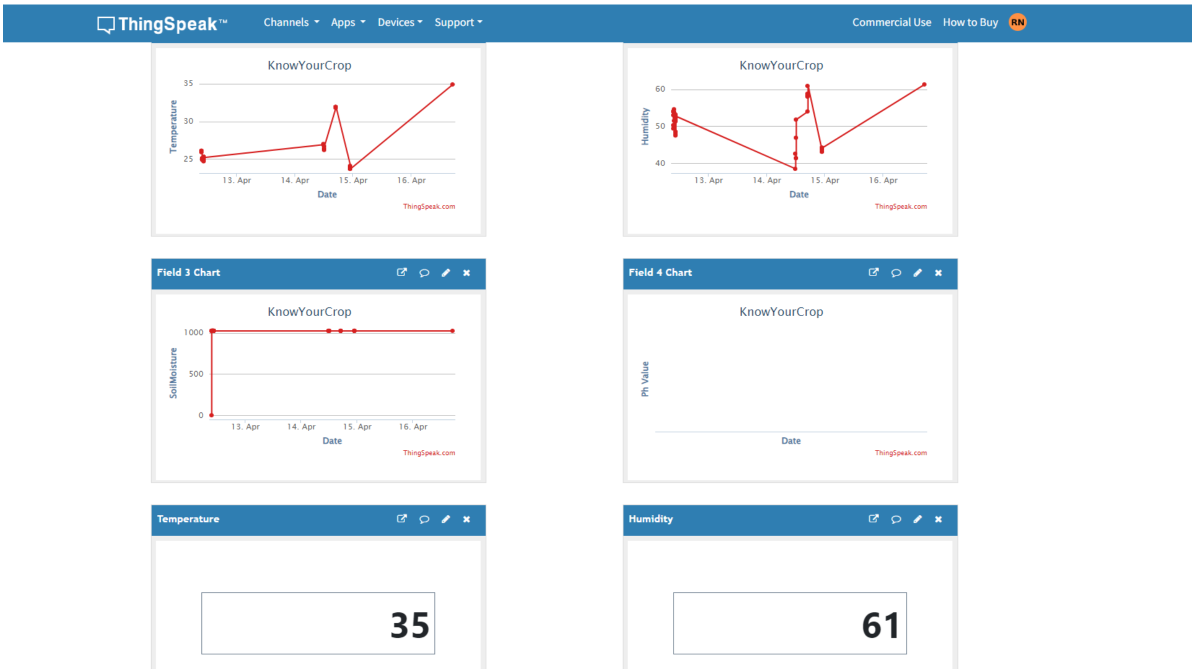

Figure 7.3 : Thingspeak Server Data Visualization

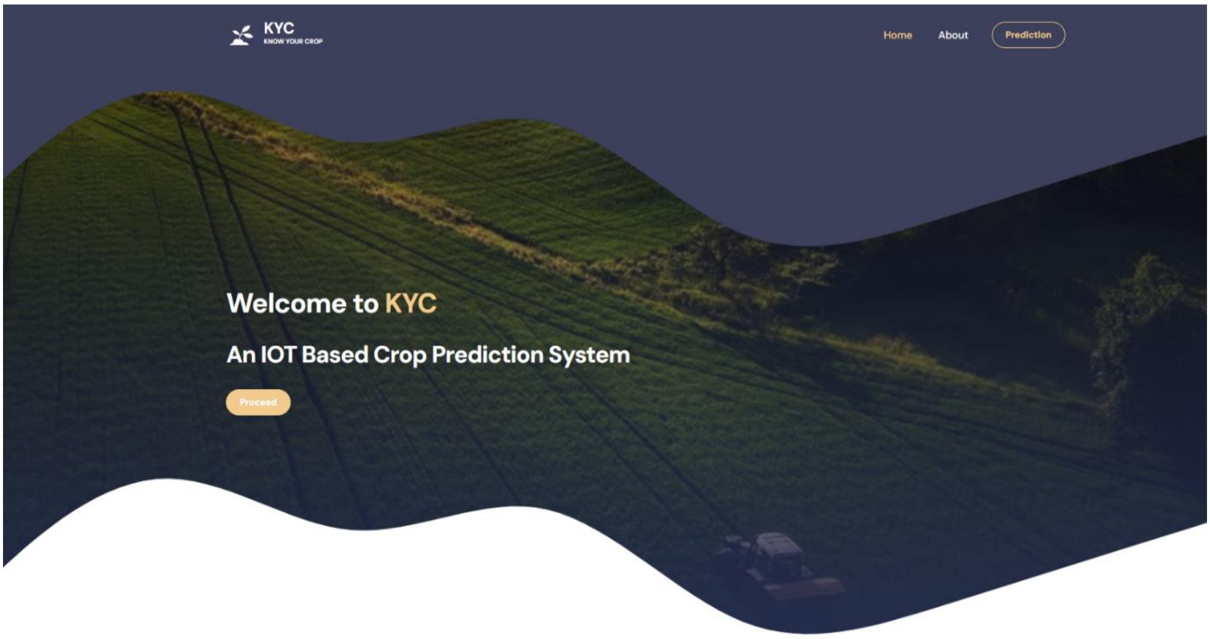

Figure 7.4 : Home Page

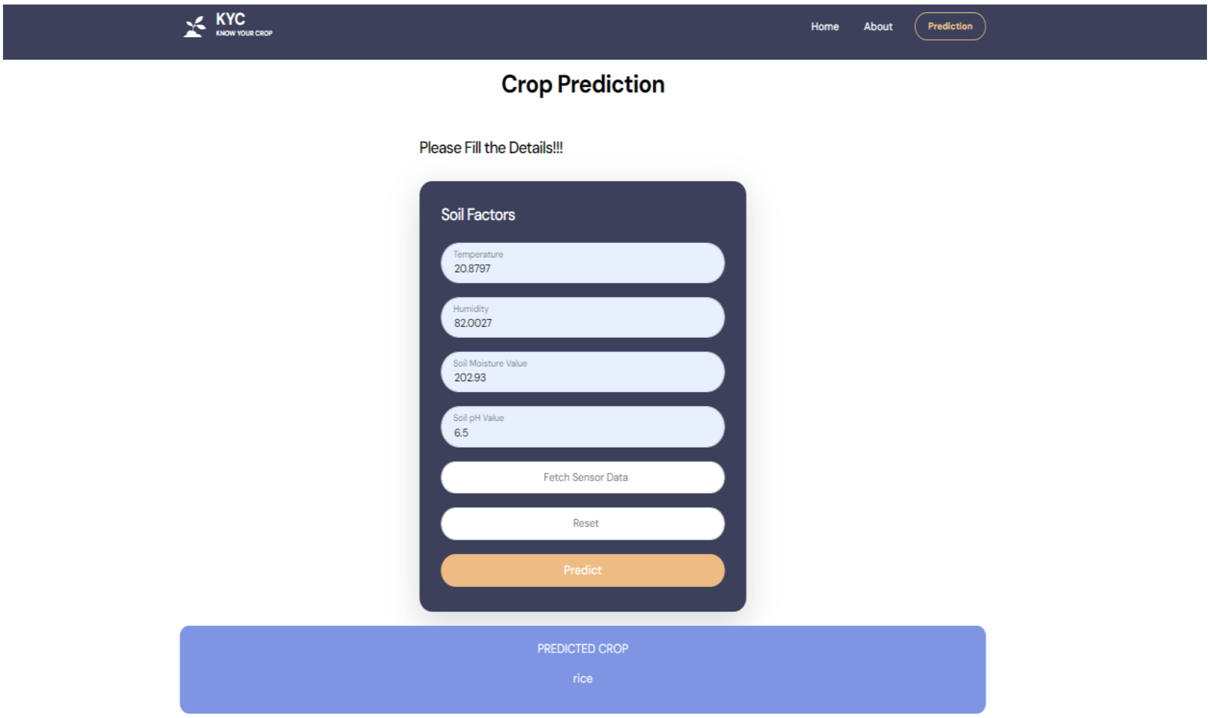

Figure 7.5 : Prediction 1

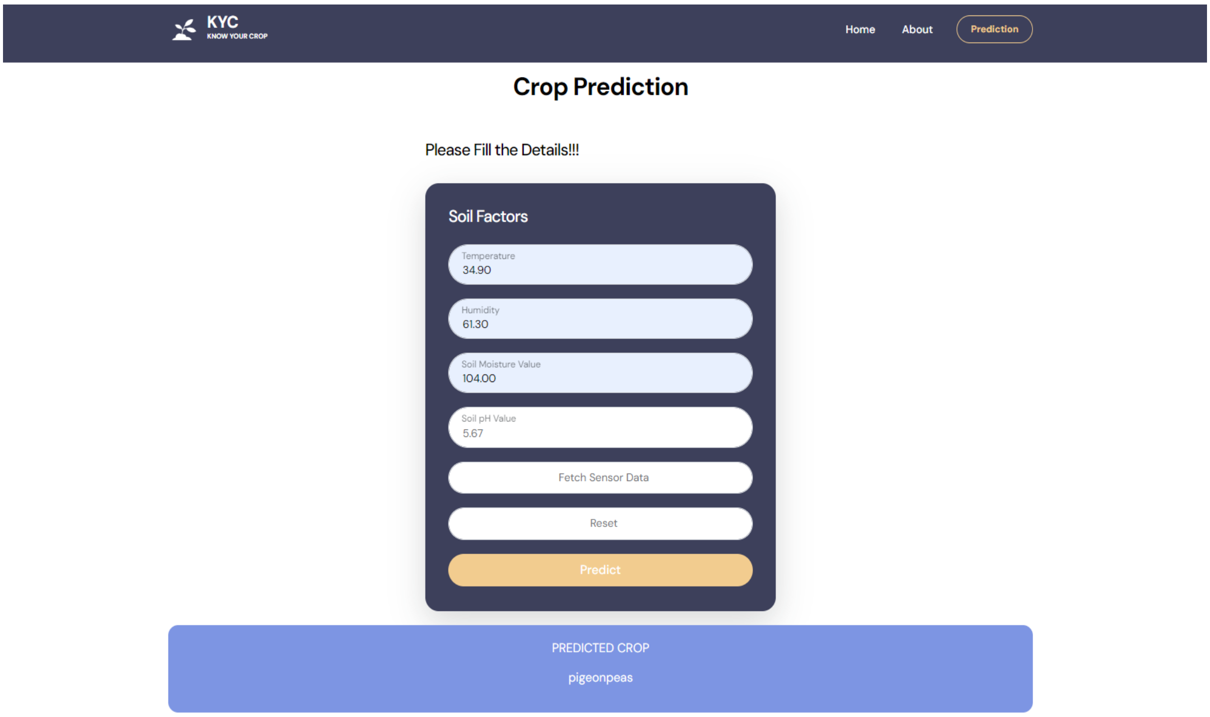

Figure 7.6 : Prediction 2

CHAPTER 8
CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

KYC - Know Your Crop an IoT-based Crop Prediction System employing soil moisture, temperature, humidity, and pH sensors represents a significant stride towards modernizing and optimizing agricultural practices. This system uses these sensors to gather information about soil moisture, temperature, humidity and ph value of soil in farming areas, which helps farmers make better decisions. By analysing this data in real-time and using advanced technology like machine learning, it predicts the crop yield according to soil factors. Farmers can access this information easily through the website. Looking ahead, there is a lot of potential to expand this system by adding more sensors like NPK sensors [16], using even more advanced technology, and integrating new ideas like blockchain and edge computing. It is designed to be flexible and grow as the needs of agriculture change.

Basically, this project is about moving from traditional farming methods to more high-tech and sustainable ones. By Integrating both IoT and data analysis, it helps farmers manage resources better, be more efficient, and grow healthier crops. Ultimately, the goal is to give farmers the tools they need to succeed in modern agriculture and build a better future for farming.

8.2 FUTURE SCOPE

The IoT-based Crop Prediction System, using sensors for soil moisture, temperature, ph, and humidity, sets the stage for a host of exciting future improvements and expansions. By adding more sensors like NPK sensors, light sensors, nutrient sensors, or disease detection sensors, we can gather a wider range of data inputs, offering deeper insights into the health and environmental conditions of crops. We can also incorporate drone technology and remote sensing techniques to capture high-resolution images of the crops. By analysing these images alongside sensor data, we can gain a complete understanding of the field's health, enabling more precise decision-making. To ensure the security and integrity of data, can implement blockchain technology. This is crucial for maintaining trust in the information provide to farmers and stakeholders.

REFERENCES

[1] Gupta, Archana, et al. "Smart crop prediction using IoT and machine learning." *International Journal of Engineering Research & Technology (IJERT)* 9.3 (2021): 18-21.

[2] Pravallika, G. Sai, et al. "Proficient smart soil based IoT system for crop prediction." *2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA)*. IEEE, 2020.

[3] Nagaraja, G. S., et al. "IoT based smart agriculture management system." *2019 4th International Conference on Computational Systems and Information Technology for Sustainable Solution (CSITSS)*. IEEE, 2019.

[4] Patil, Pavan, Virendra Panpatil, and Shrikant Kokate. "Crop prediction system using machine learning algorithms." *Int. Res. J. Eng. Technol.(IRJET)* 7.02 (2020).

[5] P. S. Vijayabaskar, Sreemathi.R, Keertanaa.E, “Crop Prediction Using Predictive Analytics”, IEEE International Conference on Computation of Power, Energy, Information and Communication,2017.

[6] Prof. D.S. Zingade, OmkarBuchade, Nilesh Mehta, ShubhamGhodekar, Chandan Mehta, “Crop Prediction System using Machine Learning”, International Journal of Advance Engineering and Research Development, Vol. 4,No.5,Dec.-2017.

[7] Radhika, Narendiran, “Kind of Crops and Small Plants Prediction using IoT with Machine Learning,” International Journal of Computer & Mathematical Sciences April 2018, pp. 93-97

[8] Prachi Sharma, Dr.D.V.Padole, ”Design and Implementation Soil Analyser Using IoT”, International Conference on Innovation in information, Embedded and Communication Systems,2017

[9] Rao, Madhuri Shripathi, et al. "Crop prediction using machine learning." *Journal of Physics: Conference Series*. Vol. 2161. No. 1. IOP Publishing, 2022.

[10] https://www.arduino.cc/en/software

[11] https://lastminuteengineers.com/esp8266-dht11-dht22-web-server-tutorial/

[12] https://www.electroniclinic.com/ph-meter-arduino-ph-meter-calibration-diymore-ph-sensor-arduino-code/

[13] Nischitha, K., et al. "Crop prediction using machine learning approaches." *International Journal of Engineering Research & Technology (IJERT)* 9.08 (2020): 23-26.

[14] https://thingspeak.com/channels/2491321

[15] Manishkumar Dholu, Mrs. K. A. Ghodinde, “Internet of Things (IoT) for Precision Agriculture Application”, Proceedings of the 2nd International Conference on Trends in Electronics and Informatics (ICOTEI), Mumbai, pp. 339-342, 2018.

[16] Lokesh.K , Shakti.J , Sneha Wilson , Tharini.M.S , T N Nagabhushan , Anand Raj S Ulle and ShivaPrakash S P, “Automated crop prediction based on efficient soil nutrient Estimation using sensor network”, National Conference on Product Design,2016