Smart Agriculture: Soil Detection and Crop Prediction with Machine Learning

Mr.B.N.bansode, Raut Atharv Ketan, Divate Tejas Manoj, Mungase Vaishnavi Prafull,

Professor, Department of Electronics Engineering, AVCOE, Sangamner, Maharashtra, India.
Students, AVCOE, Sangamner, Maharashtra, India

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Abstract –

The aim of this project is to design and construct a versatile wireless multi-functional Automated tailored for Agriculture applications. Leveraging the capabilities of Raspberry Pi, this Automation will be equipped with a range of functionalities crucial for various farming tasks, such as reconnaissance, surveillance, communication, and support operations in challenging terrains and environments.

Key Words: Radio Communication, IoT, Digital Farming, Literate India, Smart Farming, LoRa.

1. INTRODUCTION

In this project, we're using Arduino, which is like a tiny computer, to help us with farming. We've also got special sensors that can tell us about the nutrients in the soil (NPK), as well as the temperature and humidity in the air. These sensors are like little detectives collecting important information. The first step is all about gathering data. Think of it as taking notes about what's happening in the soil and around the plants. The sensors tell us if the soil has enough of the right nutrients, and if the weather is good for the plants. The second step is where the magic happens. We have a smart computer program called a machine learning model. This clever program looks at all the information the sensors collected. It's like a plant doctor that checks how healthy the plants are going to be. So, the big idea is that we use technology to keep an eye on the soil and weather, and this helps us figure out if the plants will grow strong and healthy. This is super important because healthy plants mean better crops, less waste, and a happier planet. In the rest of the project, we'll explain how we set up all the gadgets, how we gather data, how the smart program works, and what we hope to achieve. By the end, we aim to make farming smarter and better for everyone.

The significance of this project lies in its potential to revolutionize the way we approach agriculture. By intelligently monitoring and assessing the vital parameters that influence plant growth, we can make informed decisions and take proactive measures to ensure optimal conditions for plant development. This not only has the potential to boost crop yields but also reduces resource wastage, making it a sustainable and environmentally friendly approach to agriculture.

2. Need and Necessity

2.1 Problems Faced by

2.1.1 Smart farming

2.1.2 Smart Computer Program

2.2 Hurdlers to Develop the System

2.2.1 Reducing complexity

A versatile wireless multifunctional tailored for agriculture applications.

More Devices

This is another challenge to interface more devices with the microcontroller i.e. Atmega-328P, DHT11 sensor, NPK sensor, raspberry pi 4b, lcd16*2 display.

2.2.2Softwares

1.Apache HTTP Server:

It is used to host web pages. In our case, it is hosting the User Interface and Live Stream Local HTML Website.

2.Node.js:

The JavaScript program is executed on this Platform. The JavaScript code is executed on the Server, which is in our case Raspberry Pi.

3.JavaScript:

The Application that controls the sensor is written in JavaScript and works together with the HTML Webpage that is hosted by Apache Server. Any Activity on the Screen is captured by JavaScript and it takes respective control on sensors.

4.HTM:

HTML is used to create the webpage that is being hosted on Apache Server in Raspberry Pi to view the user interface and data feed. HTML is connected to JavaScript code running on the server.

3. Literature Review

As of my last knowledge update in January 2022, I don't have access to specific real-time databases, so I can't provide the latest surveys or research smart agricultural projects . However, you can find relevant information by searching academic databases, journals, and conference proceedings.

IEEE Xplore, ScienceDirect, and Google Scholar are good starting points for such research.

Look for keywords like "Interfacing with Arduino with NPK sensor," "Smart Agriculture using raspberry pi" or similar terms in your search. Additionally, conference proceedings from robotics conferences often feature the latest developments in this field.

4. Methodology

4.1 Block Diagram

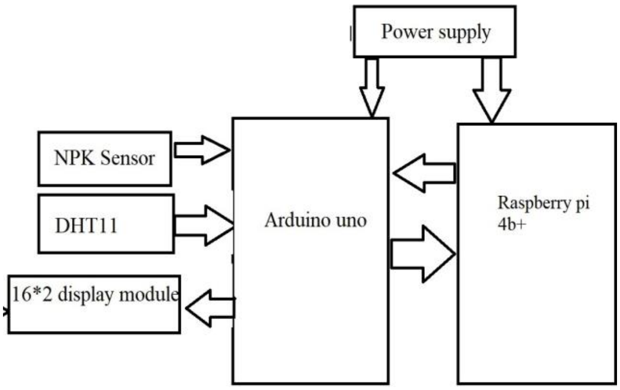

Figure 3.1 System Block Digarm

4.1.1 Essential System Components

4.1.1.1NPK Sensor

The soil npk sensor is suitable for detecting the content of nitrogen, phosphorus, and potassium in the soil, and judging the fertility of the soil. There by facilitating the systematic evaluation of the soil condition. Can be buried in the soil for a long time, resistant to long- term electrolysis, corrosion resistance, vacuum potting, and completely waterproof. Soil npk sensors are widely used in soil nitrogen, phosphorus and potassium detection, precision agriculture, forestry.

Fig 4.1 NPK Sensor

4.1.1.2Arduino Uno

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

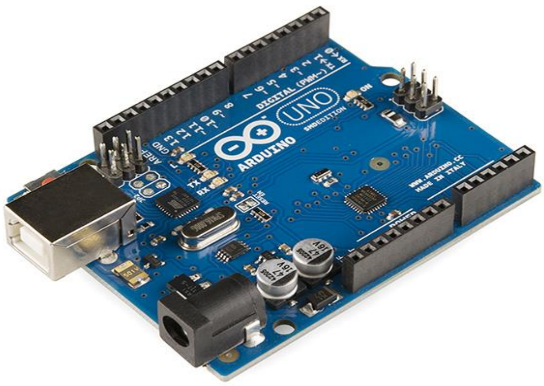

Figure 4.2 Arduino Uno

4.1.1.3 16*2 LCD Display

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two re gisters, namely, Command and Data.

Figure 4.3 LCD 16*2 Display

4.1.1.4 DHT11 Sensor

The DHT11 sensor can either be purchased as a sensor or as a module. Either way, the performance of the sensor is same. The sensor will come as a 4-pin package out of which only three pins will be used whereas the module will come with three pins as shown above.

The only difference between the sensor and module is that the module will have a filtering capacitor and pull-up resistor inbuilt, and for the sensor, you have to use them externally if required.

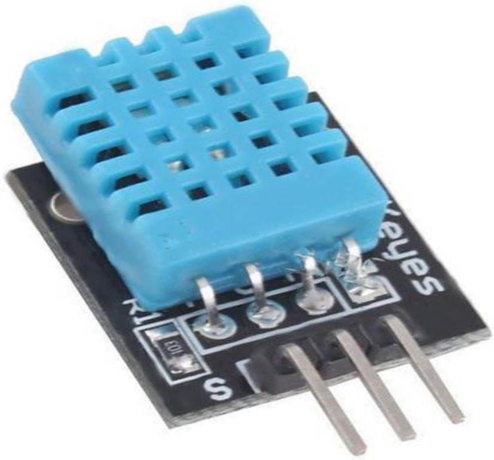

Figure 4.4 DHT11 Sensor

4.1.2 Working Principle

The aim of this project is to design and construct a versatile wireless multi-functional automated tailored for Agriculture applications. Leveraging the capabilities of Raspberry Pi, this automation will be equipped with a range of functionalities crucial for various military tasks, such as reconnaissance, surveillance, communication, and support operations in challenging terrains and environments.

The significance of this project lies in its potential to revolutionize the way we approach agriculture. By intelligently monitoring and assessing the vital parameters that influence plant growth, we can make informed decisions and take proactive measures to ensure optimal conditions for plant development. This not only has the potential to boost crop yields but also reduces resource wastage, making it a sustainable and environmentally friendly approach to agriculture

4.2 Circuit Diagram

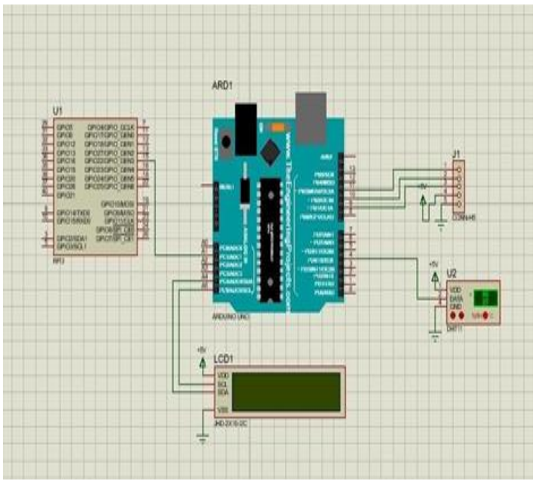

Figure 4.4 Schematic diagram

5. Model Views(Actual)

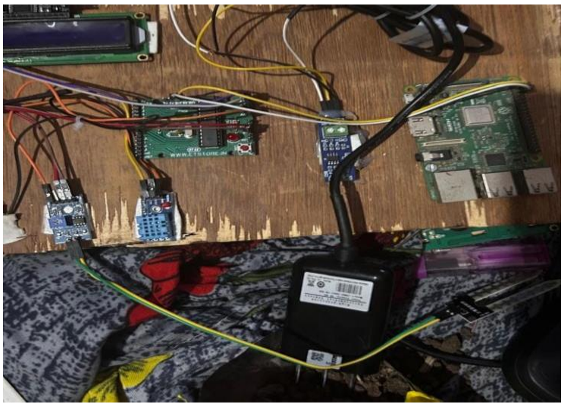

Figure 4.5 Actual diagram

6. Conclusion

1. Enhanced Crop Management and Efficiency:

Precision Farming: Smart agriculture enables precise monitoring and management of crop health parameters, optimizing irrigation, fertilization, and pest control practices. This leads to increased crop yield and improved resource efficiency.

Data-Driven Decisions: Leveraging machine learning for predictive analytics and decision support allows farmers to make informed decisions based on real-time and historical data, contributing to improved crop management strategies.

2. Sustainable Agriculture Practices:

Resource Conservation: Smart agriculture technologies promote sustainable practices by minimizing resource wastage, reducing the environmental impact of farming operations through optimized resource usage, and promoting soil and water conservation.

Reduced Chemical Usage: Targeted application of fertilizers and pesticides based on sensor data and predictive analytics reduces the dependency on agrochemicals, promoting environmentally friendly farming practices.

3. Improved Crop Health Monitoring and Disease Management:

Early Detection: Utilizing machine learning and image analysis helps in the early detection of crop diseases and pest infestations, allowing for timely interventions and minimizing crop losses.

The final product developed is found helpful for the farmers. This system is consumes low power and can measure various parameters like Temperature, Humidity , Moisture and others.

The farmers are feels relaxed and their stress is reduced in some bit. Farmers did not required to visit the farm for small cases he can monitor the farm also he can monitor the wind speed which will help while spreading the pesticides.

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ACKNOWLEDGEMENT

We would like to take this opportunity to express our respect and deep gratitude to our guide Dr. B.N. Bansode , for giving us all necessary guidance required, for this project, apart for being constant source of inspiration and motivation. It was our privilege to have worked under him.

We are thankful to H.O.D. Dr. S. B. Rahane & Principal Dr. M. A. Venkatesh for the regular guidance, co-operation, encouragement and kind help. We are also thankful to all the faculty members and staff of the department for their kind support and cooperation during the project work.

We are highly obligated to our entire friends, whose contribution intellectually and materially in the words and deeds for preparation of this Seminar report. We are also thankful to all our teaching and non-teaching staff for their enormous support.

ABOUT THE AUTHOR

Mr. B.N.Bansode(Asst. Prof. Electronics Engineering Dept. AVCOE)

Mr. Raut Atharv Ketan
(B.E. Electronics , AVCOE)

Mr. Divate Tejas Manoj
(B.E. Electronics, AVCOE)

Miss. Mungase Vaishnavi Prafull
(B.E. Electronics, AVCOE)