An IoT Based ISM-Band Automated Irrigation System For Agriculture

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Abstract **- An IoT-based ISM-band automated irrigation system for agriculture is a smart solution that enables precision farming and water management. This system uses various sensors and actuators to monitor and control the irrigation process automatically, based on the soil moisture level and other environmental factors. The IoT technology enables remote monitoring and control of the irrigation system, which helps farmers to save water, reduce labor, and increase crop yield. The ISM-band wireless communication technology provides reliable and secure data transfer between the sensors, actuators, and the central control unit.**

Keywords:ESP8266,16*2LCD,DHT11,soil moisture sensor, Motor Driver, Water Pump.

I. INTRODUCTION

Agriculture has always been a critical sector for human survival and development, but it is facing unprecedented challenges in the 21st century. The world's population is expected to reach 9.7 billion by 2050, and food production must increase by at least 70% to meet the demand. At the same time, climate change, water scarcity, and unpredictable weather patterns are making agriculture more challenging than ever. To address these challenges, farmers are turning to innovative technologies such as IoT-based ISM-band automated irrigation systems. These systems use sensors and wireless communication to enable precision farming and water management. By monitoring environmental factors such as soil moisture, temperature, and humidity, these systems can provide the right amount of water to crops at the right time, reducing water wastage and optimizing crop yields. Moreover, these systems can be remotely monitored and controlled, reducing labor costs and improving the efficiency of farming operations. This technology has the potential to transform agriculture and make it more sustainable, efficient, and profitable in the long run.

II. OBJECTIVES

The objectives of an IoT-based ISM-band automated irrigation system is to provide sustainable and efficient water management solutions, reducing water wastage and optimizing crop yield. It also aims to reduce labor costs by enabling remote monitoring and control of the irrigation system.

III. MOTIVATION

An IoT-based ISM-band automated irrigation system for agriculture is motivated by the need to optimize water usage and increase crop yields in the face of climate change and water scarcity. This system provides precision irrigation and reduces labor costs, making farming more efficient and sustainable

IV. LITERATURE SURVEY

[1] Design and perpetration of IoT Based Smart Irrigation System Using jeer Pi" by J.J. Kulkarni and S.M. Jadhav. This paper presents a smart irrigation system using jeer Pi that provides an effective and robotic way to wash crops. It uses detectors to measure soil humidity, temperature, and moisture, and sends the data to the pall for analysis and decision timber.

[2] Design and perpetration of an IoT-Grounded Smart Irrigation System for Precision Agriculture" by M.U. Khan and M.A.U. Khan. This paper proposes an IoT-grounded smart irrigation system for perfection husbandry that utilizes colorful detectors and selectors to cover and control the irrigation process. The system uses a decision- making algorithm to determine the optimal irrigation quantum grounded on the crop type, soil type, and rainfall conditions.

[3] " An IoT- grounded Automated Irrigation System for Sustainable husbandry" by A.B. Patil and V.R. Shinde. This paper presents an IoT- grounded automated irrigation system that uses colorful detectors to cover soil humidity, temperature, and moisture, and a decision- making algorithm to control the irrigation process. The system also includes a mobile operation that allows growers to ever cover and control the irrigation process.

[4] "Design and perpetration of a Smart Irrigation System Using IoT for Agricultural Sustainability" by S. Singh and S. Kumar. This paper proposes a smart irrigation system that uses IoT technology to cover and control the irrigation process grounded on the real-time environmental data. The system includes detectors to measure soil humidity, temperature, and moisture, and a decision-making algorithm to determine the optimal irrigation quantum.

[5] " Development of IoT Based Smart Irrigation System for Agriculture" by S.B. Shinde and S.V. Ghadge. This paper presents an IoT- grounded smart irrigation system that uses colorful detectors to cover soil humidity, temperature, and moisture, and a decision-making algorithm to control the irrigation

process. The system also includes a mobile operation that allows growers to ever cover and control the irrigation process.

V. BLOCK DIAGRAMS

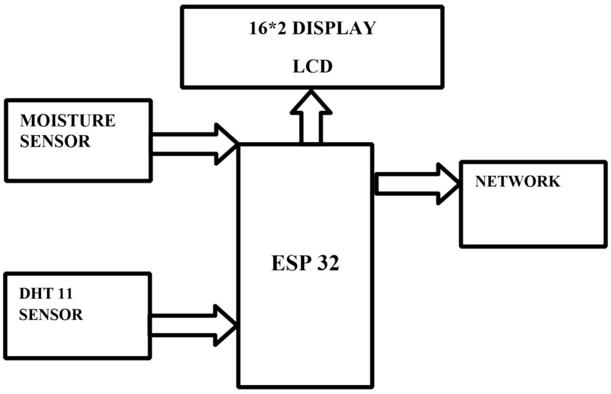


Fig 1: SLAVE NODE

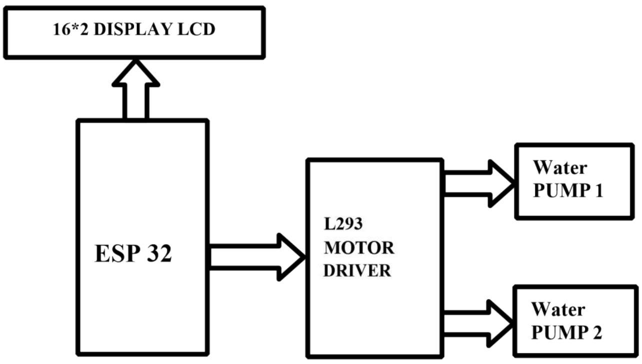


Fig 2: MASTER NODE

we have used two slave node and one master node ,here both the slave nodes and a master node communicate with each other by creating local server and communicating between slave master node. The slave node consists of sensors which collect the data and sends the information to the master node. The sensors are DHT11 and SOIL MOISTURE sensors. In DHT11 there is an inbuilt thermistor, here the temperature is converted into resistance value and then to the electrical signals by using 8-bit microcontroller is inbuilt. Another sensor that we have used is SOIL MOISTURE SENSOR, when it is dipped into the soil with moisture the resistance value is changed, when water is absorbed the resistance value decreases, based on this resistance value we need to create electrical signal. the sensors present in the slave node senses the humidity, temperature and soil moisture, in terms of percentage and degrees. These values are then sent to the master node through WIFI communication, based on this master node decide which water pump to be on and off. Here in the master node a 16*2 LCD is connected in order to display the value sent by the slave node.

VI. HARDWARE REQUIREMENTS:

DHT11 Sensor.

ESP8266.

16*2 LCD.

Soil Moisture Sensor.

Motor Driver.

Water Pump.

VII.SOFTWARE REQUIREMENTS:

Arduino Ide.

VIII.RESULTS AND DISCUSSION:

Fig **3.**

Slave node 1

Fig 4: Slave node 2

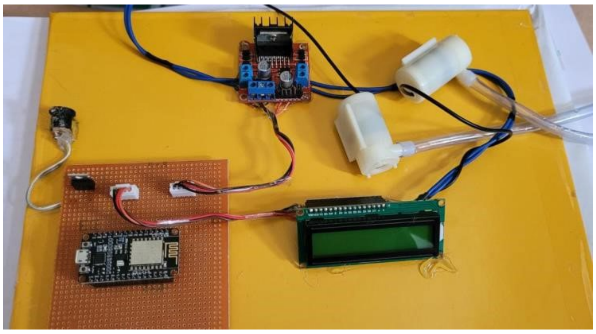


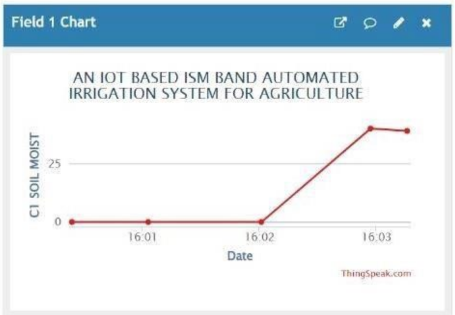
Fig.5. Master node

Here we used 2 slave nodes and 1 master node. The master node has sensors, LCD and water pumps to supply water to the agricultural field.

RESULTS

Fig 6: RESULTS OF SOIL MOISTURE AND DHT11 SENSOR OF SLAVE NODE 1

Here we took C1 and C2 as example, In the LCD we will get the Soil moisture, Temperature, Humidity value in the percentage form. DHT11 and Soil moisture will sense and give the output.



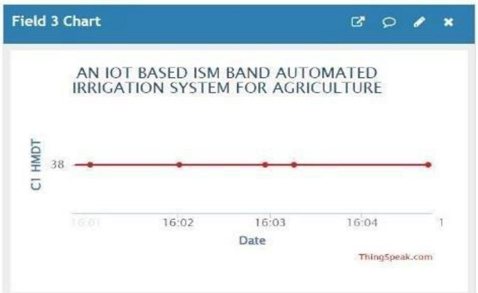
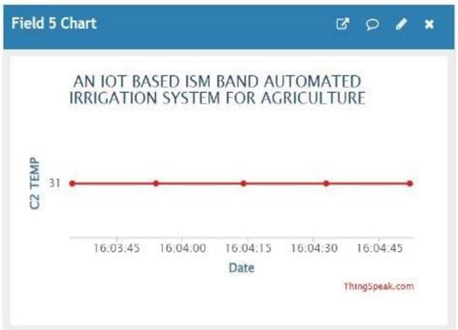
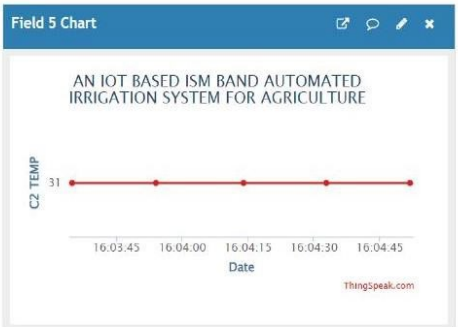
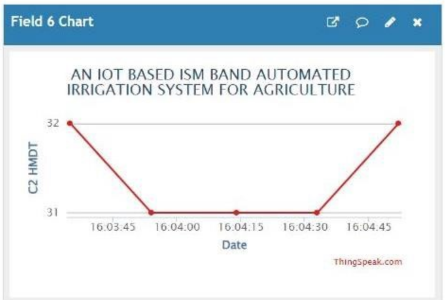


Fig 7: RESULTS OF SOIL MOISTURE AND DHT11 SENSOR OF SLAVE NODE 2







From Thinkspeak Platform we will get the graphical form output. Field 1 is the soil moisture, Field 2 is Temperature, Field 3 is Humidity its after sensing. When there is less water or below 20% in soil the water will pump to the agricultural field, after it reaches certain level the water pump will stop. In the above ex. Only the Soil moisture graph is varying and temperature, humidity will be constant. When there is a water in soil temperature, humidity will vary and Soil moisture will be constant.

ThingSpeak is an open-source IoT platform developed by MathWorks. It provides an easy way to collect, analyze, and visualize data from connected devices or sensors. Users can connect various IoT devices and sensors to ThingSpeak and send data to the platform for storage and analysis.

ThingSpeak provides a convenient and scalable solution for IoT data collection, analysis, and visualization, making it easier for developers and researchers to harness the power of the Internet of Things.

VIII. ADVANTAGES AND DISADVANTAGES

1. Precision irrigation: An IoT-based irrigation system uses sensors and data analytics to measure the precise amount of water needed by plants. This results in more precise and efficient irrigation, which can save water, reduce costs, and increase crop yield.
2. Remote monitoring and control: With an IoT-based irrigation system, farmers can remotely monitor and control the irrigation system using a smartphone or computer. This enables them to respond quickly to changes in weather or crop conditions, and make adjustments as needed.
3. Reduced labor costs: An automated irrigation system eliminates the need for manual labor to turn on and off irrigation systems. This can save farmers time and money, and allow them to focus on other tasks.
4. Increased crop yield: An IoT-based irrigation system can help farmers optimize irrigation schedules, resulting in healthier crops with higher yields. This can increase profitability for farmers and help feed a growing population.
5. Efficient water use: By measuring soil moisture levels and using weather data to predict evapotranspiration rates, an IoT-based irrigation system can reduce water waste and promote more efficient water use.
6. Scalability: IoT-based irrigation systems can be easily scaled up or down to fit the needs of different farms, making them a flexible and adaptable solution for agriculture.
7. Environmental sustainability: By reducing water waste and promoting efficient water use, an IoT-based irrigation system can help reduce the impact of agriculture on the environment. This can help ensure the long-term sustainability of agriculture for future generations.

DISADVANTAGES

1. Initial Cost: The initial cost of setting up an IoT-based irrigation system can be high, as it requires hardware components such as sensors and actuators, as well as software for monitoring and control.
2. Technical expertise: Farmers may need technical expertise to install and maintain the system, which can be a challenge for those with limited technical knowledge.
3. Connectivity Issues: The system relies on a stable internet connection for data

transmission, and connectivity issues can disrupt the functioning of the system.

4. Security Concerns: The system is vulnerable to cyber-attacks, and farmers need to ensure that appropriate security measures are in place to protect the system from unauthorized access.
5. Power Outages: Power outages can disrupt the functioning of the system, and farmers need to have backup power sources in place to ensure uninterrupted irrigation**.**

IX. CONCLUSION

In conclusion, a IoT-based ISM-band automated irrigation system for agriculture is an innovative solution to the challenges faced by farmers in the 21st century. The system provides precision irrigation, reducing water wastage and optimizing crop yields. It also enables remote monitoring and control, reducing labor costs and improving efficiency. With its scalability and customization options, this system can be tailored to fit the specific needs of different crops, soil types, and environmental conditions. By providing sustainable and efficient water management solutions.

X. FUTURE SCOPE

The future scope of an IoT-based ISM-band automated irrigation system for agriculture is promising. With the advancements in sensor technology and wireless communication, the system can be further optimized to provide even more precise and efficient water management solutions. The integration of artificial intelligence and machine learning can enable the system to make more informed decisions and adapt to changing environmental conditions. The system can also be integrated with other agricultural technologies, such as drones and robotics, to enable more automation and reduce labor costs. Furthermore, the system can be expanded to cover larger areas and be used in different parts of the world to address the global water scarcity issue.

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