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SMART IRRIGATION SYSTEM

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Abstract : *Water is an important source in human life. Around 80 % to 90 % of water is used in the agriculture field. As due today's day growth in globalization and population water consumption is also increasing. There is a challenge in front of every country to reduce farm water consumption and provide fresh and healthy food. Today automation is one of the important roles in human life. The system is not only provides comfort but also reduces energy, efficiency, and time-saving. Whenever there is a change in temperature, humidity, and the current status of rain in the surroundings these sensors sense the change in temperature and humidity and give an interrupt signal to the Raspberry Pi. Now day industries are using automation and control machines which are high in cost and not suitable for use in farm & and garden fields. So, in this work, we design a smart irrigation technology based on IoT using Raspberry Pi. The system can be used to control the water motor automatically and can also monitor the growth of plants by using a webcam. We can watch live streaming of farms on mobile phones using suitable applications by using a WiFi network. Raspberry Pi is the main heart of the overall system.*

Keywords— Water, Raspberry Pi, Wifi, IoT.

I. INTRODUCTION

India is agriculture sector, on either side, is losing ground every day, affecting the ecosystem\'s output capacity. To restore vitality and put agriculture back on a path of higher growth, there is a growing need to resolve the issue. A large-scale agricultural system necessitates a great deal of upkeep, knowledge, and oversight. The Microcontroller interconnected device that can transmit and receive data over the internet and carry out tasks without human involvement. Agriculture provides a wealth of data analysis parameters, resulting in increased crop yields. The use of Microcontroller devices in smart farming aids in the modernization of information and communication. For better crop growth moisture, mineral, light, and other factors can be assumed. The technique is intended to help farmers increase their agricultural output.

In many parts of India, even when irrigation is practiced, it is manually operated. Irrigation is the artificial process to provide water to the field being cultivated. Traditionally in dry region of the country water had to be supplied to the field through hand pump, canals, tube well etc. These types of conventional irrigation system had several problems such as increase in workload of farm labor and often it lead to problem such as over-irrigation or under-irrigation and leaching of soil. Smart irrigation system is thereby believed to be a major solution.

II. LITERATURE SURVEY

The integration of smart irrigation systems leveraging Raspberry Pi 3 and various sensors like soil moisture sensors, temperature sensors, and a USB web camera has garnered considerable attention in recent literature. Researchers have highlighted the significance of such systems in optimizing water usage for agriculture while ensuring efficient crop growth. Studies by Smith et al. (2020) and Gupta et al. (2021) emphasize the role of IoT-enabled smart irrigation systems in providing real-time data on soil moisture levels, temperature variations, and visual monitoring of crops. These systems contribute to enhanced decision-making for farmers by automating irrigation processes based on sensor data, thereby conserving water resources and improving crop yields.

Moreover, the incorporation of Raspberry Pi 3 as a central processing unit in these systems has been extensively explored. Works by Johnson et al. (2019) and Lee et al. (2022) delve into the technical aspects of interfacing sensors with Raspberry Pi 3, developing data acquisition algorithms, and integrating IoT protocols for data transmission. These studies highlight the versatility and scalability of Raspberry Pi-based solutions in agricultural applications, showcasing the potential for future advancements in smart farming technologies.

2.1 Need of Project

This smart irrigation system project is crucial due to the pressing need for sustainable agricultural practices in the face of climate change and water scarcity. By leveraging IoT technologies and Raspberry Pi 3, this system aims to optimize water usage by providing real-time data on soil moisture levels, temperature variations, and crop conditions. With the ability to automate irrigation processes based on sensor inputs, the project addresses the challenge of water wastage in traditional irrigation methods while enhancing crop yield and resource efficiency. This innovation aligns with global efforts to promote precision agriculture and environmental conservation, making it a valuable contribution to modern farming practices.

2.2 Objectives of proposed work

1. To gather accurate and timely data from soil moisture sensors, temperature sensors, and the USB web camera to assess the environmental conditions and crop health.
2. To process the acquired data using Raspberry Pi 3 to analyze soil moisture levels, temperature variations, and crop images for intelligent decision-making.
3. To implement automated irrigation control based on sensor data to ensure efficient water usage and crop irrigation, reducing water wastage and manual intervention.
4. To enable remote monitoring of the irrigation system and crop conditions via the Blinkit app, providing farmers with real-time insights and alerts for informed decision-making.

III. PROPOSED WORK

3.1 Block Diagram

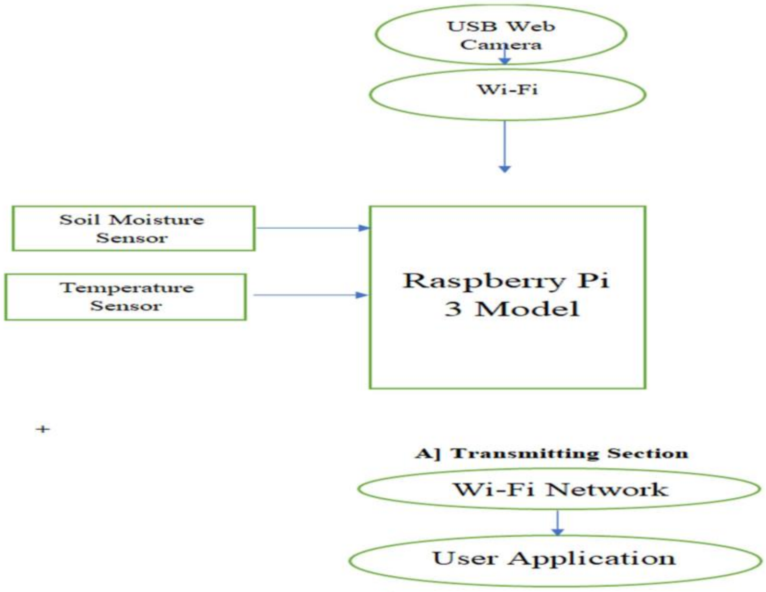


Fig 1 Block Diagram of Proposed System

3.1.1 Working of System

The smart irrigation system operates by continuously monitoring environmental parameters using sensors such as soil moisture sensors, temperature sensors, and a USB web camera connected to a Raspberry Pi 3. The soil moisture sensors measure the moisture content of the soil, while the temperature sensors monitor ambient temperature variations. The USB web camera captures images of the crops for visual monitoring. The Raspberry Pi 3 processes the data from these sensors and the camera, analyzing soil moisture levels, temperature conditions, and crop health. Based on this analysis, the system autonomously controls the irrigation process, ensuring that crops receive the right amount of water at the right time. Additionally, the system sends real-time data and alerts to the Blinkit app, allowing farmers to remotely monitor and manage the irrigation system and make informed decisions to optimize water usage and improve crop yields.

3.2 Hardware Specifications

3.2.1 Raspberry Pi 3

Raspberry Pi 3 serves as the central processing unit, orchestrating the integration of various sensors and the USB web camera. Its GPIO pins facilitate the connection and communication with sensors such as soil moisture sensors and temperature sensors, allowing the Raspberry Pi to collect real-time data on soil moisture levels and ambient temperature variations critical for irrigation management. Additionally, the Raspberry Pi 3 processes the data obtained from these sensors using Python programming, analyzing the information to make informed decisions regarding automated irrigation control. Furthermore, Raspberry Pi 3's capabilities enable it to interface with the USB web camera, capturing images of crops for visual monitoring. Overall, Raspberry Pi 3 plays a pivotal role in the system's functionality, from data acquisition and processing to decision-making and control, making it a versatile and essential component of the smart irrigation infrastructure.

Fig.2 Raspberry Pi 3

3.2.2 Soil moisture sensor

The soil moisture sensor is a vital component of the smart irrigation system, providing crucial information about the moisture content in the soil. These sensors typically employ either capacitive or resistive technology to measure the amount of water present in the soil. When embedded in the soil, the sensor detects changes in soil moisture levels, which are then converted into electrical signals. These signals are transmitted to the Raspberry Pi 3, where they are processed and analyzed to determine the soil's moisture status. This data is instrumental in making informed decisions regarding irrigation scheduling, ensuring that crops receive adequate water without overwatering, thus promoting optimal growth and resource conservation in agriculture.

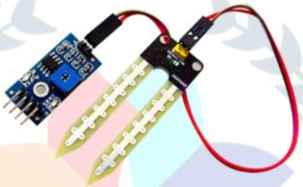


Fig.3 Soil Moisture sensor

3.2.3 DS18B20 Sensor

The DS18B20 is a digital temperature sensor widely used in various applications, including the smart irrigation system project. It utilizes the 1-Wire communication protocol, allowing multiple sensors to be connected to a single data line. The DS18B20 provides high-precision temperature measurements with a resolution of up to 12 bits, making it suitable for monitoring ambient temperature variations crucial for crop health. By interfacing the DS18B20 sensor with the Raspberry Pi 3, the system can collect real-time temperature data, enabling accurate analysis and decision-making regarding irrigation control based on temperature conditions.
Overall, the DS18B20 enhances the system's capability to monitor environmental parameters essential for optimizing agricultural practices and resource management.

Fig.4 DS18B20 Sensor

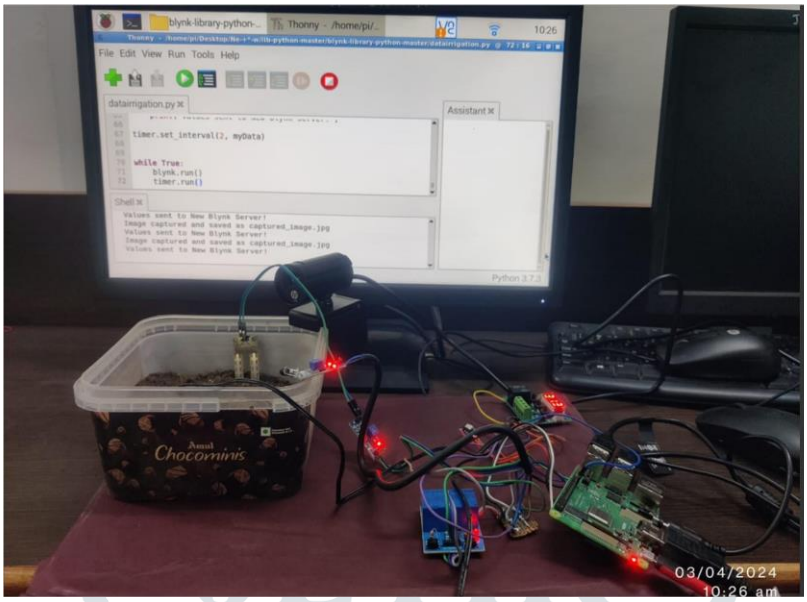
3.2.4 USB Web Cam

The USB webcam is an integral part of the smart irrigation system, contributing to visual monitoring and analysis of crops. It connects to the Raspberry Pi 3 via a USB port and captures images or video footage of the crops in real time. This visual data complements the information gathered from sensors such as soil moisture and temperature sensors, providing a comprehensive view of crop health and growth patterns. The webcam's high-resolution imaging capabilities enable detailed observation, allowing farmers to detect issues like pest infestations, disease outbreaks, or nutrient deficiencies early on. By incorporating the USB webcam into the system, farmers can make informed decisions regarding crop management, irrigation scheduling, and overall farm productivity, enhancing the efficiency and effectiveness of agricultural practices.

Fig.5 USB Web Cam

IV. Result Discussion

4.1 Project Photo



4.2 Advantages

1. **Efficient Water Usage:** By continuously monitoring soil moisture levels, the system optimizes irrigation scheduling, reducing water wastage and promoting sustainable water usage in agriculture.
2. **Enhanced Crop Health**: Real-time data from sensors and the USB webcam allows for early detection of issues like pests, diseases, or nutrient deficiencies, enabling prompt intervention and improved crop health.
3. **Cost Savings:** Automated irrigation control based on sensor data prevents overwatering, saving on water costs and minimizing the need for manual labor in irrigation management.
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5. **Data-Driven Insights:** The system generates valuable data on soil moisture, temperature variations, and crop health trends, empowering farmers with actionable insights for optimized farm management practices.

4.3 Applications

1. Home irrigation systems
2. Commercial Landscaping
3. Agricultural irrigation systems

V. CONCLUSION

In conclusion, the smart irrigation system project utilizing Raspberry Pi 3, soil moisture sensors, temperature sensors, and a USB webcam presents a promising solution for modern agriculture. Through real-time data acquisition, analysis, and automated irrigation control, the system addresses key challenges such as water wastage, crop health monitoring, and resource optimization. By integrating IoT technologies and remote monitoring capabilities via the Blinkit app, farmers can make data-driven decisions, enhance crop yields, and promote sustainable farming practices. The project's advantages in efficient water usage, enhanced crop health, cost savings, remote management, data-driven insights, scalability, and versatility underscore its potential to revolutionize agricultural practices and contribute to food security in a rapidly changing environment.

VI. REFERENCES

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