Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 6, June : 2024

REAL-TIME AUTOMATIC SMART PLANTS WATERING SYSTEM THROUGH IOT

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ABSTRACT
This paper introduce a Real-time Automatic Smart Plants Watering System(RASWS) utilizing Internet of Things(IOT) technology to efficiently manage and monitor plant hydration. The system integrates soil moisture sensors, Temperature sensors to microcontroller ESP32 and a Wi-Fi module to continuously collect and transmit data to a cloud-based platform that is Thingspeak. Users can remotely monitor the watering process through Thingspeak. The RASWS aims to enhance plant health, reduce water waste, and provide convenience for plant owners by automating the watering process and ensuring plant receive the right amount of water at the right time. Preliminary tests demonstrate the system's effectiveness in maintaining plant hydration levels and its potential to revolutionize traditional plant care methods through smart and sustainable practices.

Keywords:
ESP32, Soilmoisture sensor, Temperature sensor, Solar panel, DC Water pump,Thingspeak.

INTRODUCTION
In today's increasingly connected world, Internet of Things (IoT) technology has found applications in various domains, and one of the emerging areas is smart agriculture. As urbanization continues to expand and traditional farming practices face challenges, there is a growing interest in urban gardening and indoor plant care. However, maintaining optimal hydration levels for plants can be a daunting task for many plant enthusiasts due to varying factors like soil type, plant species, and environmental conditions. An Automatic Smart Plants Watering System (ASWS) utilizing IoT offers a promising solution to this challenge. By integrating IoT sensors, microcontrollers, and cloud computing, this system provides real-time monitoring and control of plant hydration. Soil moisture sensors measure the moisture content in the soil, while a microcontroller processes this data and triggers the watering mechanism when the moisture levels fall below a set threshold. The data collected is sent to a cloud-based platform, where it can be analyzed and used to adjust watering schedules based on plant-specific needs. The Automatic Smart Plants Watering System (ASWS) represents a significant advancement in plant care technology, integrating automation, sensors, and connectivity to revolutionize the way plants are watered and maintained. This system addresses the challenges faced by plant enthusiasts, both novice and experienced, in ensuring consistent and appropriate hydration for plants. By leveraging modern technology, ASWS aims to create a more efficient, sustainable, and user-friendly approach to plant care.Automatic Smart plant watering system stands out as a game-changer in simplifying and enhancing the plant care experience for enthusiasts and professionals alike.

LITERATURE SURVEY
[1] B. D. Kumar, P. Srivastava, R. Agrawal and V. Tiwary-Internet of Things based smart irrigation System using Raspberry Pi and Arduino, Journal of Smart Agriculture Technology, vol. 5, no. 2, pp. 45-56, 2017. Internet of Things (IoT)-based smart irrigation system that leverages the capabilities of Raspberry Pi and Arduino microcontrollers. The system was designed to address the challenges of traditional irrigation methods by providing real-time monitoring and control of soil moisture levels, thereby optimizing water usage and enhancing plant growth. The soil moisture sensors continuously measure the moisture levels in the soil. The Arduino reads the analog signals from the sensors and

sends the data to the Raspberry Pi. The Raspberry Pi processes the received data to determine the watering requirements based on predefined thresholds or user-defined settings. Decision-making algorithms can be implemented to adjust watering schedules dynamically. The Raspberry Pi sends the processed data and control commands to the user interface or cloud platform via Wi-Fi. Users can monitor soil moisture levels, and control the watering system remotely through a mobile app or web interface. Upon receiving the control commands from the Raspberry Pi, the Arduino activates the watering mechanism to irrigate the plants. The system can be configured to control solenoid valves, pumps, or drip irrigation systems based on the application and requirements. [2] D.Bansal and S. R. N. Reddy, "WSN Based Closed Loop Automatic Irrigation System," International Journal of Engineering Science and Innovative Technology (IJESIT), vol. 2, no. 3, pp. 229– 237, 2013. WSN Based Closed Loop Automatic Irrigation System presents a Wireless Sensor Network (WSN) based approach to automatic irrigation. The study aims to develop an efficient and automated irrigation system that utilizes WSN technology to monitor soil moisture levels and control irrigation processes. Soil moisture sensors deployed in the field continuously measure the moisture levels in the soil.The sensor nodes transmit the collected data wirelessly to the central control unit via the WSN. The central control unit analyzes the received data to determine the watering requirements based on predefined thresholds or algorithms. The central control unit analyzes the received data to determine the watering requirements based on predefined thresholds or algorithms. Decision-making logic is implemented to optimize irrigation schedules and conserve water. Upon analyzing the data and determining the watering requirements, the central control unit triggers the irrigation mechanisms, such as solenoid valves or pumps, to irrigate the plants. The irrigation process is controlled in a closed-loop fashion, ensuring precise and efficient water delivery based on real-time soil moisture data.

EXISTING METHOD

This system uses NodeMCU ESP8266 and different sensors like Soil moisture sensor,Temperature sensor.Soil moisture sensor and DHT11 sensor measures soil moisture,humidity and temperature of the Soil and suggest watering of the crop at right time and for a certain duration.The NodeMCU ESP8266 Processes sensor data and compare it with predefined thresholds to determine irrigation requirements. It uses temperature and soil moisture readings to determine if irrigation is needed based on user-defined thresholds. The water pump supplies water to the plants until the desired moisture level is reached. Once the desired moisture level is reached, the NodeMCU ESP8266 deactivates the relay module to turn off the water pump.It uses power supply which converts electrical energy from primary source i.e batteries,grid power into usable form for electronic devices.The NodeMCU ESP8266 connect to the Wi-Fi to enable remote monitoring and control of the system through Blynk app.The ESP8266 Peformance is less and due to external power supply lagre amount of energy is consumed and Blynk app stores only present data.To eliminate this drawbacks we used ESP32 which is dual-core processor which offers better performance and multitasking capability, Sloar panel produce renewable energy and thingspeak is used which stores present amd previous data.

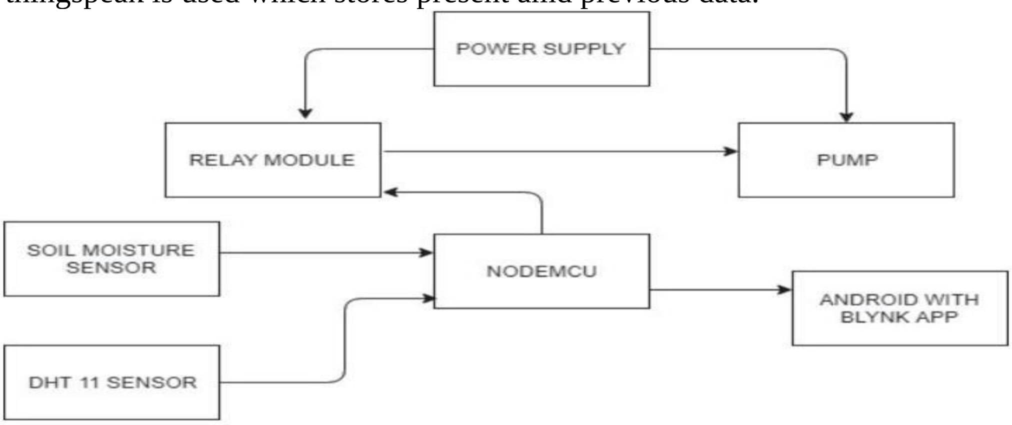

Fig:1 Block diagram for existing method

Industrial Engineering Journal
ISSN: 0970-2555
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PROPOSED METHOD

The Proposed system uses ESP32 which is dual core processor,soil moisture sensor,Temperature sensor.The ESP32 reads the data from from the DHT11 temperature sensor and soil moisture sensor at regular intervals. It measures ambient temperature and humidity levels using the DHT11 sensor and soil moisture levels using the soil moisture sensor. The ESP32 processes sensor data and compares it with predefined thresholds to determine irrigation requirements. Threshold levels are taken by testing the type of soil.It uses temperature and soil moisture readings to determine if irrigation is needed based on user-defined thresholds. If soil moisture levels are below the threshold and temperature conditions are suitable, the ESP32 activates the relay module to turn on the water pump. Otherwise, if soil moisture levels are within the desired range, the watering system remains inactive. The water pump supplies water to the plants until the desired moisture level is reached. Once the desired moisture level is reached, the ESP32 deactivates the relay module to turn off the water pump.The system operates using power from the solar panel during daylight hours and switches to battery power during nighttime or when solar power is insufficient. The ESP32 connects to the internet via Wi-Fi to enable remote monitoring and control of the system. Users can access the system's status, receive alerts, and adjust settings through a web-based interface.

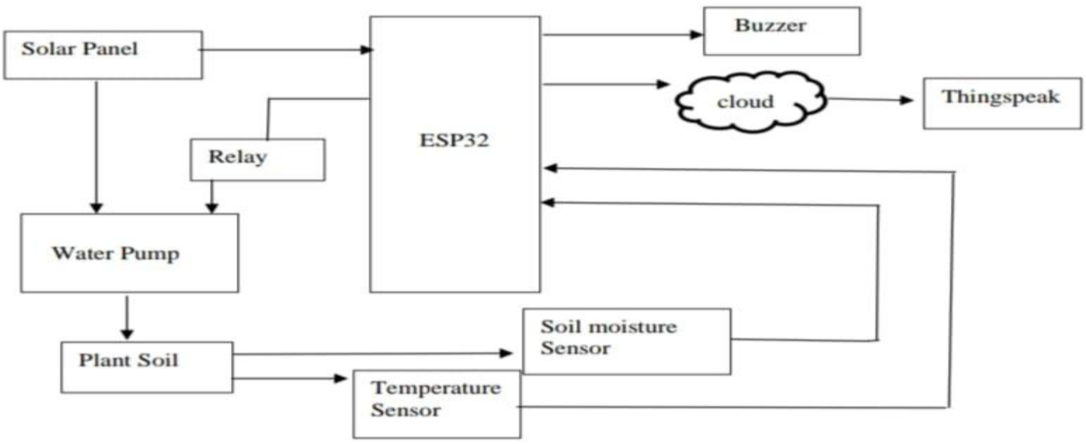

Fig:2 Block diagram for proposed method

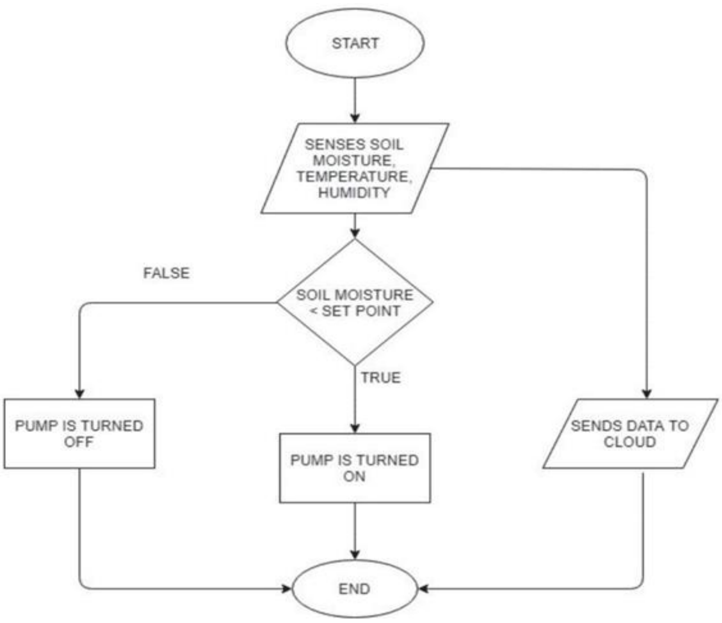

Fig:3 Flow chart for proposed method

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A. ESP32

The ESP32 is a popular low-cost, low-power system-on-a-chip (SoC) microcontroller with integrated Wi-Fi and Bluetooth capabilities. Developed by Espressif Systems, the ESP32 has gained significant traction in the electronics and IoT communities due to its versatility, performance, and affordability.

Fig:4 ESP32

A. Soil moisture sensor

A soil moisture sensor is a device used to measure the water content in soil. It helps gardeners, farmers, and researchers determine when to water plants or crops, ensuring optimal growth conditions. These sensors can be either analog or digital and typically use conductivity or capacitance methods to measure moisture levels.

Fig:5 Soil moisture sensor

B. Temperature sensor(DHT11)

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc... to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module.

Fig:6 DHT11 Sensor

C. 1-Channel Relay Module

A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system (also called output circuit or output contactor). It is frequently used in automatic control circuits.

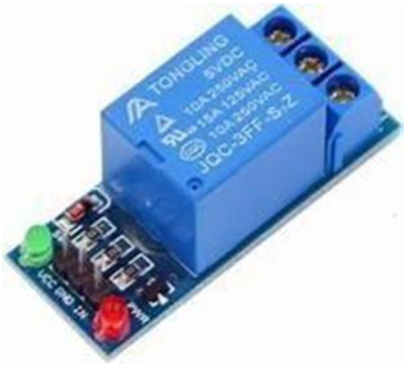

Fig:7 Relay module

D. Solar Panel

A 5W solar panel is a small-sized solar panel that can generate up to 5 watts of power under optimal sunlight conditions. It's often used for charging small electronic devices like smartphones, tablets, or rechargeable batteries.

Fig:8 Solar panel

F. Battery

The nine-volt battery, or 9-volt battery, is a common size of battery is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in smoke detectors, gas detectors, clocks, walkie- talkies, electric guitars and effects units.

Fig:9 Battery

G.DC water pump

A DC motor is an electric motor that runs on direct current power. In an electric motor, the operation is dependent upon simple electromagnetism. A current-carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and to the strength of the external magnetic field.

Fig:10 DC water pump

H. Buzzer

A buzzer is an electronic device that produces a buzzing or beeping sound when activated. It typically consists of an electromechanical component that vibrates to create sound waves.

Fig:11 buzzer

RESULTS

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been implemented. Thus the project has been successfully designed and tested. This system will meet the challenge of crop production and low cost of operation. This system has been developed for the successfully use of best yielding conditions of the crop by managing the wastage of water

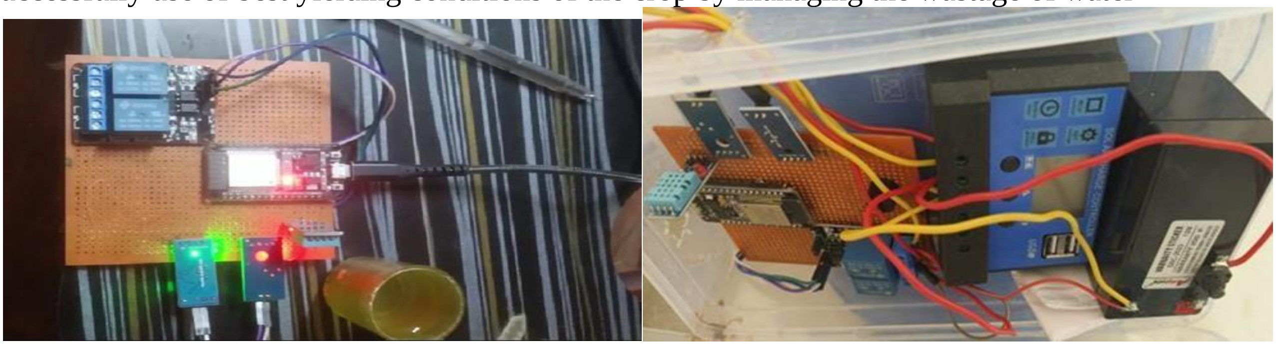

Fig:12 Hardware connections and testing for output

Working:

An automatic plant watering system typically consists of a water tank, a pump, tubing or piping, and sensors. Here the soil moisture sensors detect soil moisture levels and trigger the pump to deliver water to the plants when needed. Some systems may also include timers or controllers for scheduling watering cycles. The pump draws water from the water tank and delivers it through the tubing to the plants' root zones. This setup ensures plants receive the right amount water, preventing overwatering or underwatering, and can be especially useful for in and outdoor gardens where regular watering may be difficult to maintain manually.

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Fig:13 Hardware Setup

The above figures shows the hardware connections and setup

Fig:14 Output in serial monitor shown in Arduino IDE

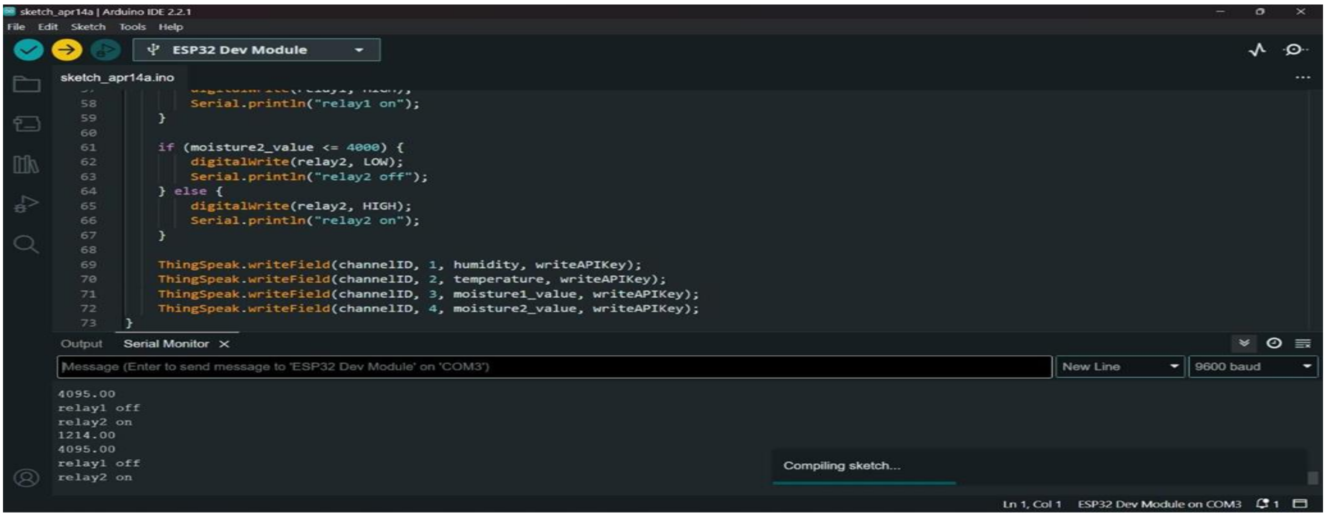

Fig:15 Outputs in serial monitor shown in Arduino IDE

- When the Soilmoisture level is greater then threshold (i.e 4000) then the relay is automatically switch on the water pump.Otherwise the relay will be in off condition.

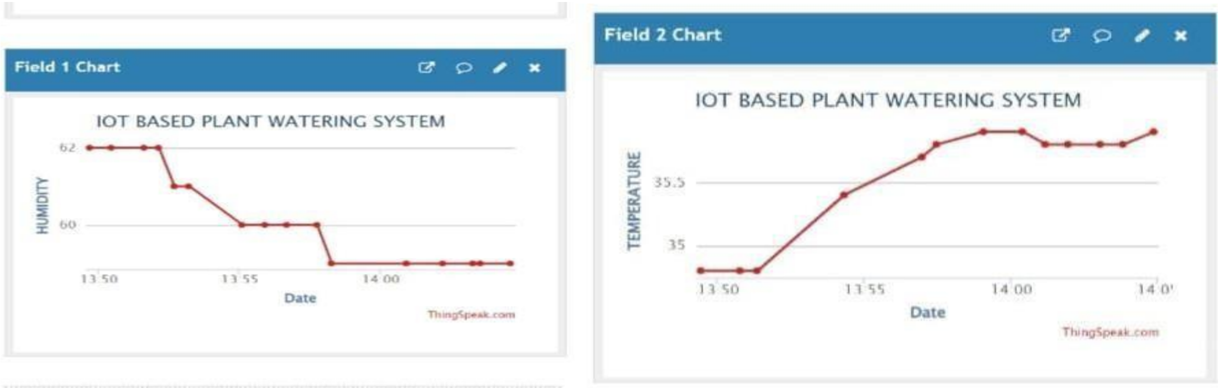

Fig16 Humidity and Temperature plots in Thingspeak

Fig:17 Soil moisture plot in Thingspeak

Fig:18 Soil moisture plot in Thingspeak

CONCLUSION

The primary applications for this project is for farmers and gardeners who do not have enough time to watering the plant. this project is leading to a fully automated farming system where the farmer can sit back at home and do the farming process by using his mobile app. Also, the data uploaded into the servers can be used for analytical purposes of the farming procedures and improve the farming practices all around the world. Each and every plant data will be saved on the cloud server and what farming practices led to the best production in various regions will tell about the best irrigation practices of each crop and by using the system update of the software our productivity will be increased year by year as more analytics will be done on the data.It approaches automating the agriculture industry,it provides a stainable and computationally efficient approach based on the Internet of Things.

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