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A Smart Irrigation System

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ABSTRACT: India's agricultural sector is crucial to the country's progress in food production. In our country, Agriculture is reliant on the monsoons, which provide insufficient water. So the irrigation is used in agriculture field. Internet of Things (IoT) is a milestone in the evolu_tion of technology. IOT plays an important role in many among them is agriculture, which has the potential to feed billions of people on Earth in the future. The objective of this paper is designed to address this issue; the entire system is microcontrol based and can be controlled wirelessly from a distance, eliminating the need to worry about when to irrigate a crop in accordance with the soil's requirements. condition This study is an attempt for an automated irrigation system which enable the users to regularly supervise relative humidity of the soil at different sites through the entire agricultural field for more accurate setting up of irrigation cycles. The sensing unit is modeled on a feedback mechanism with centralized control system which monitors the soil's relative humidity (RH) and manages the field's water supply in real time. A wireless communication is established between the sensor as well as controlling unit and the sprinkler. In practice, the pump on which control action is to be taken is at a distance from the land.

KEYWORDS: Smart Irrigation, Sensors, Relative humidity; Temperature; automated irrigation system; feedback control; data acquisition

I. INTRODUCTION

monitors the soil's relative humidity (RH) and manages the field's water supply in real time. agricultural practices for the better productivity Unplanned water use is causing the ground water level to drop daily; in addition, a lack of rain and a shortage of land water contribute to the planet's declining water supply. These days, one of the biggest issues facing the globe is the lack of water. We need water in each and every field Water is also vital to our daily existence. One of the fields that requires water is agriculture tremendous quantity. Wastage of water is the major problem in agriculture. Every time excess of water is give to the fields. There are numerous methods for preventing or reducing water waste in agriculture. The objective of the sys_tem is to a) conserve energy & water resources b) handles the system manually and automatically c) detects the level of water. Climate change and imprecise farming practices have led to low agricultural yields compared to population growth. The majority of irrigation is carried out through canal systems, in which water is pumped into fields at regular intervals without the fields' water level being monitored. This type of irrigation affects crop health and yields less because certain crops are overly sensitive to soil moisture content. A smart irrigation system, contrary to a traditional irrigation method, regulates supplied water. The feedback mechanism of a smart irrigation system is a moisture sensor and temperature and humidity sensor. Evapo - transpiration (ET), thermal gypsum blocks, photography, capacitive techniques, and neutron scattering techniques are a few of the technologies that enable moisture sensing. Capacitive sensors, however instantaneous, are costly and need to be calibrated often with varying temperature and soil type A large agriculture field presents is with different part of areas, hence, It is not very sensible to monitor moisture at one spot in the field. Consequently, what is required is a dispersed array of sensor nodes and dispersed pumping units to deliver water to certain designated areas covered by the sensor units. Using an inexpensive moisture sensor in combination with an automated irrigation system is proposed in this paper.

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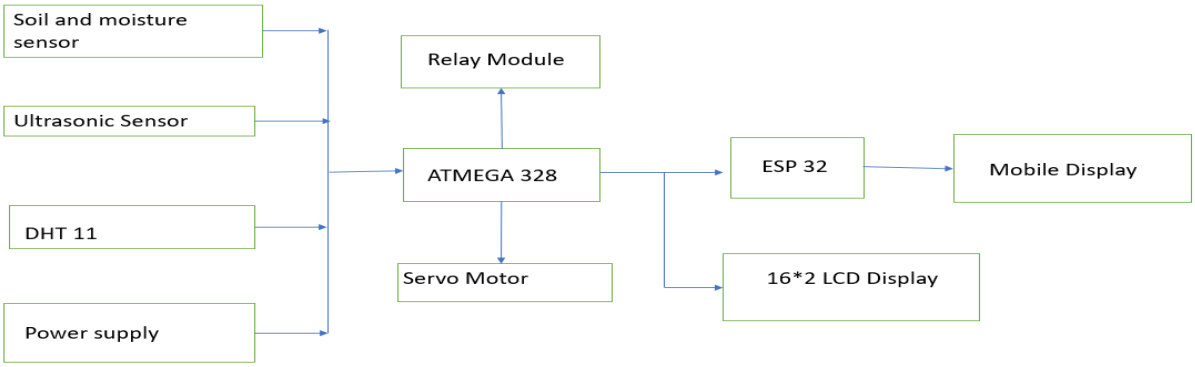
II. BLOCK DIAGRAM



III. LITERATURE SURVEY

Automated Irrigation System using NodeMCU. Integrating NodeMCU into smart irrigation systems enables real-time monitoring and control, enhancing the efficiency and effectiveness of water usage in agricultural and landscaping applications. Automated Irrigation system using NodeMCU having main goal is that optimize use of water for agriculture crops. NodeMCU can interface with various types of soil moisture sensors, including resistive and capacitive sensors. These sensors provide real-time data on soil moisture levels, allowing the system to determine when and how much to irrigate. Additional environmental data from temperature and humidity sensors can help fine-tune irrigation schedules based on weather conditions and plant requirements.NodeMCU reads sensor data periodically or in response to specific events. Analog sensors are connected to the ADC pins, while digital sensors can use GPIO pins or communication protocols like I2C or SPI. Data acquisition routines are programmed to collect sensor readings and store or transmit them for analysis and decision-making. NodeMCU communicates with external devices or services for remote monitoring and control. Wi-Fi connectivity enables NodeMCU to connect to local networks, IoT platforms, or cloud services for data logging, analysis, and user interface. communication protocols facilitate real-time data exchange and command execution between NodeMCU and external systems.

IV. HARDWARE COMPONENTS

- ATMEGA328P-PN
- NODEMCU ESP8266
- ULTRASONIC SENSOR
- DHT11
- LCD
- SOIL MOISTURE SENSOR
- SEVERO MOTOR

ATMEGA328P-PN : The ATmega328P-PN is a specific variant of the ATmega328P microcontroller, which is widely used in various embedded systems and Arduino boards.The ATmega328P is a high-performance, low-power 8-bit Based on the AVR improved RISC architecture, the AVR microcontroller. It is developed by Microchip Technology (formerly Atmel Corporation) and is part of the megaAVR family of microcontrollers.The ATmega328P microcontroller, including the ATmega328P-PN variant, is commonly used in a wide range of embedded applications, including: Arduino-based development boards for hobbyist projects and prototyping.Consumer electronics devices such as remote controls, smart home devices, and wearable gadgets.Industrial automation and control systems, including sensor nodes, motor control, and monitoring devices.Educational purposes, teaching microcontroller programming and embedded systems design.Overall, the ATmega328P-PN microcontroller offers a versatile and cost-effective solution for a variety of embedded applications, providing a balance of performance, features, and ease of use.

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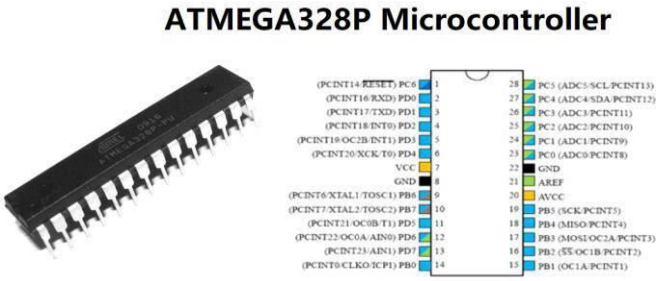
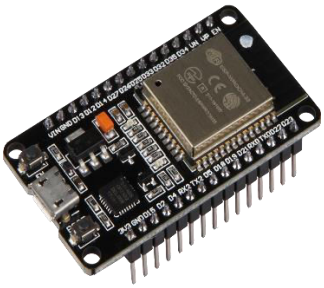
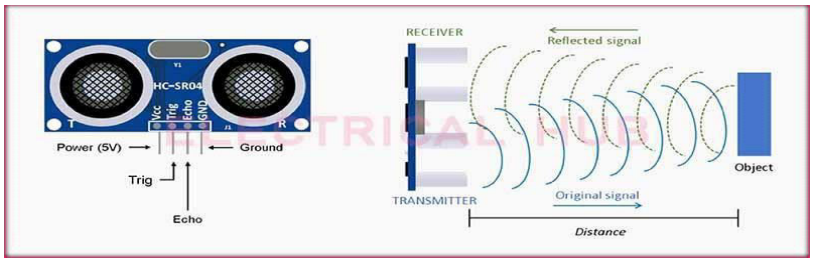


NODEMCU ESP32: The NodeMCU ESP32 is a versatile development board that integrates the ESP32 microcontroller, which features a dual-core Tensilica LX6 processor, clock speeds up to 240 MHz, and 520 KB of SRAM. It supports both Wi-Fi and Bluetooth connectivity, making it ideal for a wide range of IoT applications. The board includes a rich set of peripherals, including multiple GPIO pins, SPI, I2C, UART, ADC, DAC, and touch sensors, enhancing its capability to interact with various sensors and modules. It also supports programming environments like Arduino IDE and MicroPython, making it accessible for both beginners and advanced developers. With its robust performance, connectivity options, and ease of use, the NodeMCU ESP32 is a popular choice for developing connected devices and smart applications.



ULTRASONIC SENSOR: An ultrasonic sensor is a device used to measure distance by emitting ultrasonic sound waves and detecting the reflected waves. It consists of a transmitter that emits high-frequency sound waves and a receiver that listens for their echo. The sensor calculates the time interval between the emission and reception of the sound wave to determine the distance to an object, based on the speed of sound. Ultrasonic sensors are widely used in various applications such as object detection, distance measurement, level sensing in tanks, and obstacle avoidance in robotics. They are favored for their accuracy, reliability, and ability to operate in diverse environmental conditions, including complete darkness and varying lighting situations. Commonly used modules include the HC-SR04, which is popular for its ease of use and compatibility with microcontrollers like Arduino.



DHT11: The DHT11 is a low-cost digital sensor used for measuring temperature and humidity. It features a capacitive humidity sensor and a thermistor to measure the surrounding air, outputting a digital signal on the data pin. With a temperature range of 0-50°C and humidity range of 20-90%, the DHT11 provides decent accuracy suitable for basic environmental monitoring. Its sampling rate is once every second (1 Hz), and it communicates with microcontrollers via a single-wire protocol, making it simple to integrate with platforms like Arduino and Raspberry Pi. Despite its limited accuracy compared to more advanced sensors, the DHT11's affordability and ease of use make it popular for

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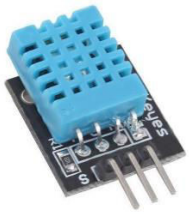
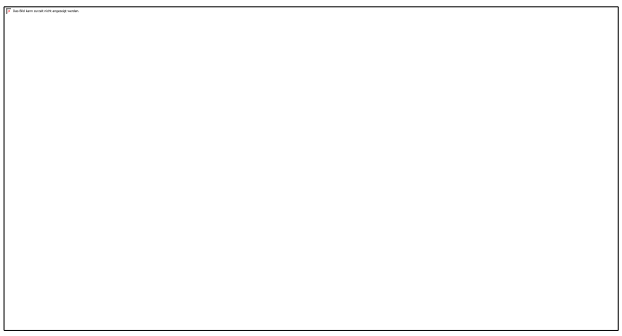
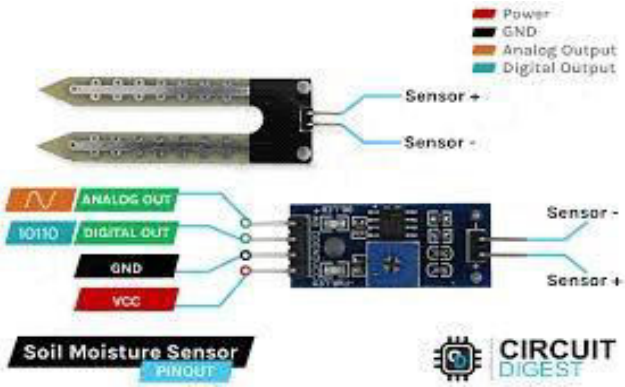
hobbyist projects and educational purposes.



LCD: The LCD 16x2 is a widely used alphanumeric display module capable of showing 16 characters per line on its two rows, making it ideal for a variety of applications requiring text display. It uses the HD44780 driver, which allows for easy interfacing with most microcontrollers using either a 4-bit or 8-bit parallel communication mode. Each character is displayed in a 5x8 pixel matrix, and the module can display custom characters defined by the user. The LCD 16x2 features a backlit screen, enhancing visibility in various lighting conditions. Its simplicity and compatibility with platforms like Arduino make it a staple in DIY electronics, educational kits, and embedded systems for showing information such as sensor data, system status, or user interfaces.



SOIL MOISTURE SENSOR A soil moisture sensor is a device used to measure the volumetric water content in soil, providing essential data for applications in agriculture, gardening, and environmental monitoring. It typically consists of two probes that are inserted into the soil to measure the resistance or capacitance, which changes with the soil's moisture level. The sensor outputs an analog or digital signal that can be read by microcontrollers like Arduino or Raspberry Pi. By accurately monitoring soil moisture, these sensors help optimize irrigation systems, ensuring plants receive the right amount of water, thus conserving water and improving crop yields. Soil moisture sensors are valued for their affordability, ease of use, and ability to provide real-time data, making them a critical tool for sustainable agriculture and gardening practices.



SEVERO MOTOR A servo motor is a rotary actuator designed for precise control of angular position, speed, and acceleration. It consists of a motor coupled to a sensor for position feedback, typically employing a DC motor, a potentiometer, and a control circuit. The motor receives a control signal that represents a desired output position, and the integrated circuitry adjusts the motor's movement to align with this signal. Servo motors are known for their accuracy, repeatability, and ability to maintain a set position, making them ideal for applications such as robotics, CNC

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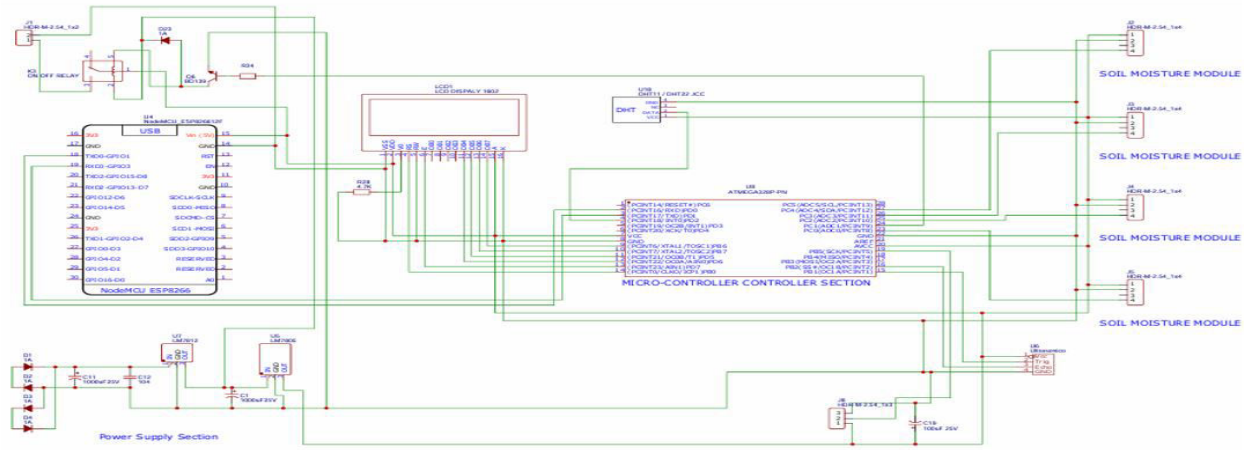
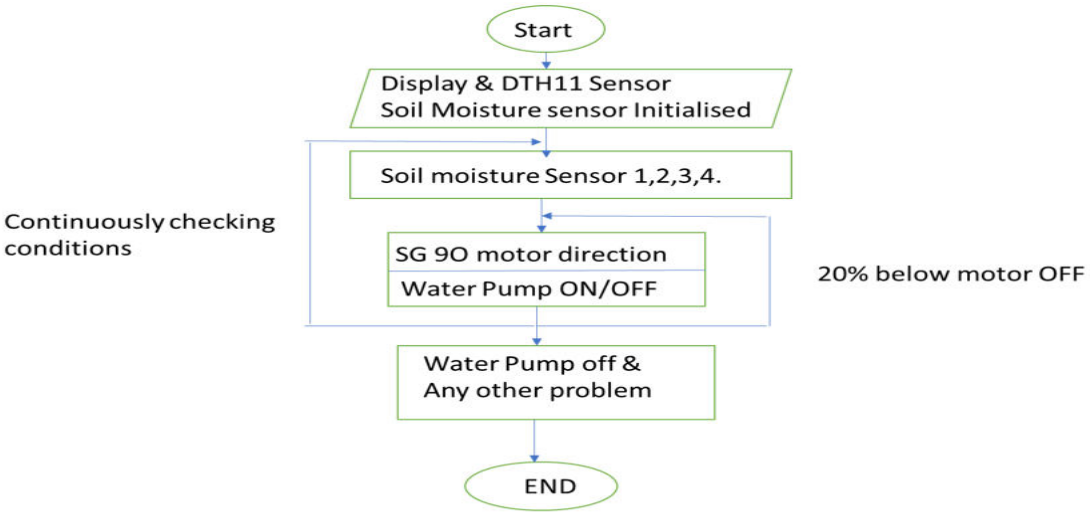
machinery, radio-controlled vehicles, and automated manufacturing. They operate within a specified range of motion, usually 180 degrees, and are controlled via Pulse Width Modulation (PWM) signals, which are easy to generate with microcontrollers like Arduino. Their reliability and precise control capabilities make servo motors a fundamental component in many precision-driven projects and devices.

V. SIMULATION



VI. FLOWCHART



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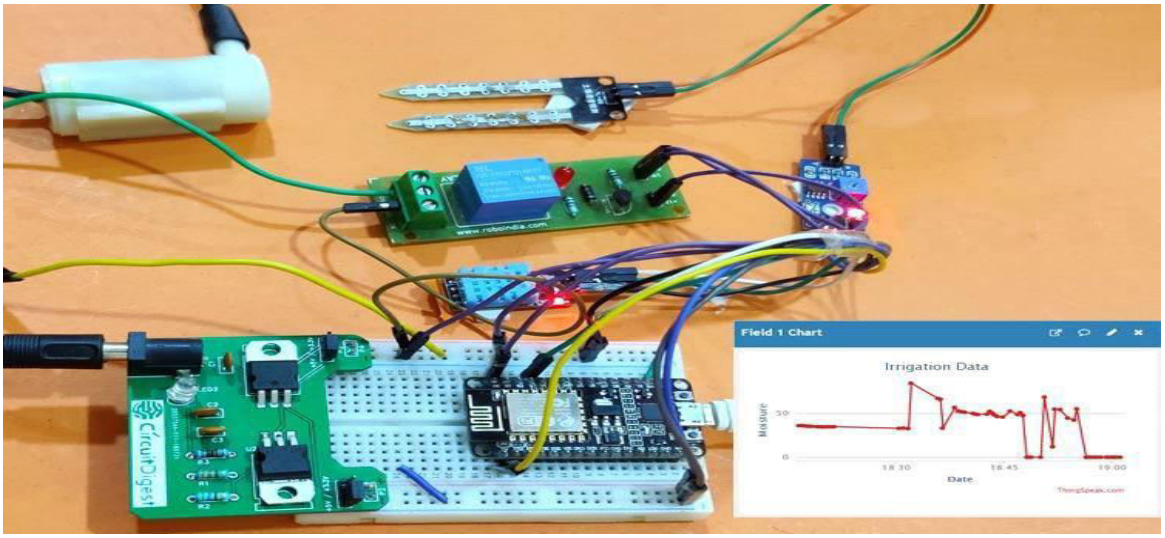
VII. HARDWARE IMPLEMENTATION



VIII. CONCLUSIONS

The automated irrigation system implemented was found to be feasible and cost effective for optimizing water resources for agri_culture production. By enabling farming in areas with limited water resources, this irrigation technology enhances sustainability. The irrigation system helps the farmer by making his work more intelligent. Water conservation techniques for irrigation must be practical and economical as the demand for water rises and aquatic habitats need to be preserved. Water can only be supplied to the necessary area of land since various sensors are being employed. This technology significantly lowers the amount of water used. It needs minimal maintenance. The power consumption has been reduced very much. Crop waste is significantly decreased while crop output rises. The extension work is to make user interface much simpler by just using SMS messages for notifications and to operate the switches The integrated instrumentation platform can find its further applications in various allied industries also. These are all possibilities that can be implemented in future.

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