Sustainable Water Usage in Agriculture Through IOT Based Automation

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ABSTRACT - In the past, farmers would have to assume the fertility of soil and speculate what crop could grow. They didn't know about the humidity, position of water and especially rainfall conditions impacted planting crops. Now, the Internet of Things (IOT) is educating farmers, empowering them with the possibilities of modern, proficient or even sustainable agriculture to face obstacles of farming. The technology of IOT allows farmers to gather information about the conditions of rainfall, temperatures and humidity. Using IOT technology, farmers can access their farm from anywhere and anytime. Wireless sensor networks can cover the farm conditions and microcontrollers can be used to regulate and automate farm processes. A smart phone can also provide farmers access at any time of every farming condition around the world using IOT. The technology of IOT can help reduce the costs and increase the demanding efficiency of traditional agriculture.

Keywords:Fertility,Humidity,Empowering,Sustainable, Temparature,Efficiency,Regulate,Obstacles

1.INTRODUCTION:

Water scarcity is one of the most pressing challenges in agriculture in the 21st century. As demand for food and freshwater increase, freshwater sources decline. Solutions for better water management must be utilized. Conventional irrigation methods overuse and waste water that is inefficient and causes a negative effect on the environment in the long term. A proposed solution to this issue, with the assistance of new technology, is IoT, with its ability to monitor and control water usage in real-time. The study investigates an IoT based automated irrigation system aimed at achieving sustainable water use in agriculture. The system utilizes an ESP32 microcontroller which is required to collect and transmit environmental data. Besides the ESP control unit, other vital components include a DHT11 sensor for measuring temperature and humidity, a rain sensor to measure rainwater, an LCD to visualize data, and a motor to dispense water based on the sensor data (the ESP32 also features Wi-Fi for communication and data transfer). The design includes a stabilized power supply.

2.LITERATURE SURVEY:

[1] Patel, Shah, and Patel (2017) advanced the development of an IoT-based smart irrigation framework with a system that incorporated soil moisture sensors to sense the dryness of soil and activate water provision through a microcontroller. The results showed a marked efficiency in saving both water and labor, representing both a sustainable and economical opportunity. Salient to their findings emphasized the role of threshold based autonomy in which the irrigation system would be activated only when soil moisture was below current limits in order to avoid wasted water.

[2] Expanding upon this notion, Lakshmi and Raghavendra (2018) designed a system with an Arduino along with GSM modules to facilitate this device. Their stated use of micro-controllers along with basic communication modules provided SMS alerts to user end-users of the soil condition as well as the system status. They highlighted the cost and simplicity of a device like this in more rural and semi-urbanized areas where high-end technologies do not exist.

[3] Bhanupriya and Usha (2019) expressed interest in adapting Wi-Fi enabled ESP8266 modules to allow a mobile application to provide real time sensor

information to farmers through their app. They articulated that user-friendly interfaces would allow growers and plants managers the ability to download and visualize their irrigation systems while at any location. Their methodology included cloud-based platforms for visualization that allowed...

3.PROPOSED METHODOLOGY:

To boost agricultural productivity, which benefits both the farmer and the country, we must adopt technologies that determine crop quality and provide tips. The Internet of Things (IoT) is reshaping agriculture, providing farmers with brand new options like advanced and sustainable agriculture, to enable them to meet their challenges in the field. IoT technology is used to gather information related to important agricultural conditions such as moisture, rainfall, humidity, and temperature. IoT technology connects the farmer to their farm from any place at any time. Wireless sensor networks track various farm conditions, and micro controllers manage and automatically control farm process. A smart phone allows the farmer to stay in touch and current with ongoing farm conditions, while using IoT technology, at any place and time in the world. IoT technology has the potential to reduce costs and increase agricultural productivity through advancements in traditional agriculture.

3.1 BLOCK DIAGRAM:

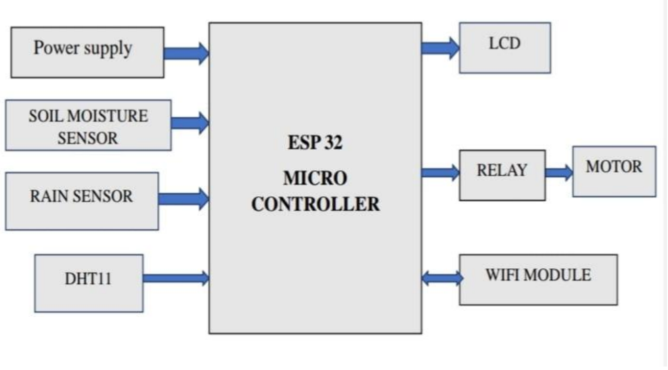

Figure 1: Block Diagram

a. ESP32 MICRO-CONTROLLER:

This ESP32 act as a main regulator of the system which act as a input for power force, soil humidity detector, rain detector and DHT11. After reading data from the rain detector and DHT11 the ESP32 will reuse the information and give the information to the blynk garçon

b. DHT11 SENSOR:

The DHT11 is an affordable digital detector used to measure temperature and moisture. This detector can be connected with a ESP32micro-controller to measure moisture and temperature in real time. The DHT11 moisture and temperature detector can be employed as a detector and as a module, the difference between the two substantially being a pull- up resistor and a power- on LED. The DHT11 is a relative moisture detector. This detector uses a thermistor to measure the girding air temperature and a capacitive moisture detector to measure relative moisture.

c. RELAY:

A relay is an electrically controlled switch. Many relays use an electromagnet to mechanically operate a switching medium, but other operating principles exist as well. Relays are used when it is necessary to control a circuit by a low-power signal (with complete electrical insulation between control and controlled circuits) or to control several circuits by one signal. The first relays were used in long distance telegraph circuits to repeat the signal coming in from one circuit and re-transmit it on another circuit. Relays were used heavily in telephone exchanges and early computers to carry out logical operations.

d. MOTOR:

In general, an irrigation system uses a motor that turns on a pump to supply water to plants. The motor is what turns the available electricity into mechanical energy in the form of a pump moving water through pipes to wherever it is required for the plants. The type of motor is primarily based on the source of water and type/design plans for the irrigation system. Common types of motors used in irrigation systems are DC motors or some other type of submersible pump designed for the specific irrigation system. In this system, the motor is controlled by the microcontroller through a relay or transistor switch that is only turned on when the soil moisture sensor sends its reading of dry soil. Once the microcontroller activates the relay, the motor will run to pump water through the pipes automatically irrigating the plant. When enough moisture has returned to the soil the actuator will turn the motor back off to prevent watering too much.

e. POWER SUPPLY:

The power input to the circuit is taken from regulated power supply and the a.c input, ie., 230V a.c from mains supply is stepped down to 12V through the compact low power motor and is fed to a converter. The output obtained from the converter is a pulsing d.c voltage. Therefore, in order to obtain a pure d.c voltage, the output voltage from the converter is fed to a filter to have filtered out any a.c factors still remaining after rectification. The filtered output voltage now feeds into a voltage regulator to obtain a pure constant dc voltage.

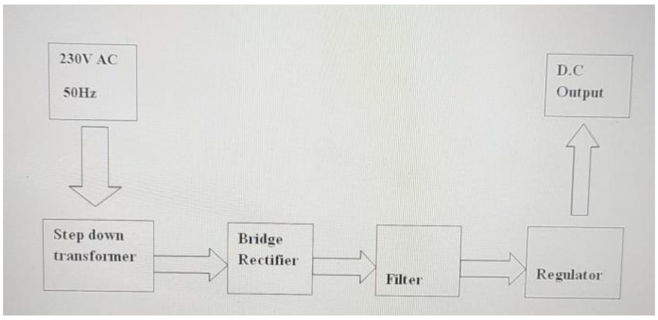

Figure 2: Block diagram of power supply

f. SOIL MOISTURE SENSOR:

The soil moisture sensors measure the moisture level of a parcel of soil. Typically, soil moisture sensors utilize two probes acting as electrodes, where, as they are inserted into the soil, an electrical current passes between the probes with the resistance or capacitance between increasing or decreasing depending upon the moisture level of the soil. Wet soil has a lower resistance therefore conducts electricity better than dry soil. Soil moisture sensors are critical for determining when the soil needs water (in an IoT irrigation system). Soil moisture sensors measure moisture levels in the soil, allowing the IoT system to make smart decisions about when to turn the irrigation system on and off by providing moisture readings, which can be incorporated into the system's database. Soil moisture sensors aid with water conservation and plant health.

g.RAIN SENSOR:

Rain Detectors are able of detecting rain and measuring its intensity by detecting water driblets on the plate. It generally consists of a conductive plate or a water-sensitive board that has exposed traces. When rainwater splashes onto the detector, the current overflows from trace to trace and closes a circuit, dwindling the resistance. After that, the detector generates an analog or digital signal which corresponds to the quantum of water. That signal is transferred to the applicable microcontroller(like the ESP32) for processing that data and/ or driving an alarm or automatically shutting windows or draining systems etc.

3.2 SYSTEM ARCHITECTURE& WORKING PRINCIPLE:

The Automatic Plant Irrigation System employs a microcontroller (ESP32) as its central control unit and includes sensors and programs that measure, monitor, and automate watering based on environmental readings. The system includes a DHT11 sensor that collects temperature and humidity data, and a rain sensor which will detect the rainfall and not irrigate unnecessarily. Soil moisture can also be included, if it is possible with an analog input. The ESP32 connects to a cloud server or mobile app (with built-in Wi-Fi) to allow monitoring & control from a distance. The action of turning the water pump (motor) on or off will be done remotely with a relay module in accordance to the levels provided by the sensor readings and limits set by the user. In addition to the mobile or remote aspects of the system, the action of temperature, humidity, and moisture dispensing will be supplied localized as real-time by a LCD display. The entire project is powered by a regulated power supply to ensure that the power is never lost. Overall, this project encompasses a smart, connected, energy efficient irrigation system that will aid in reducing manual work that is required to care for plants we cultivate and use less water by responding in real time.

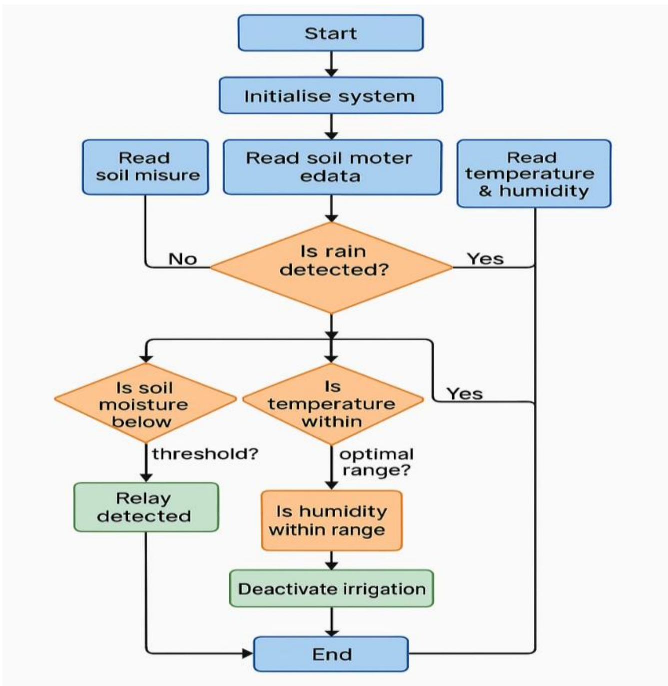

Figure2: Flow Chart of Working of proposed system

3.3 HARDWARE IMPLEMENTATION:

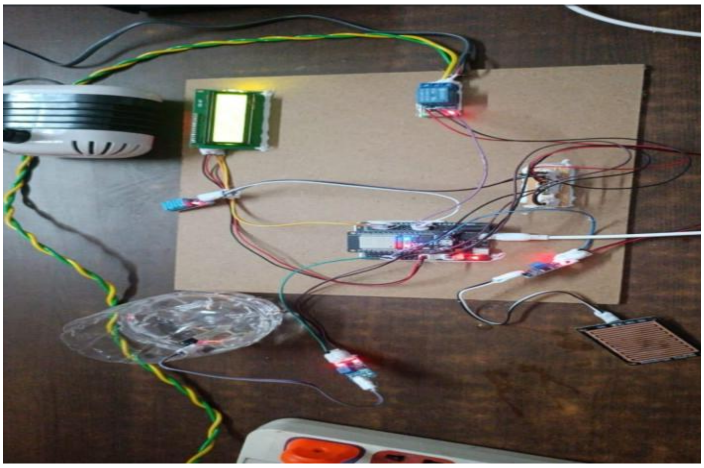

Figure 3: Physical Connection of System

This Automatic irrigation system is based on ESP32 Micro-controller, this system utilizes both hardware and software algorithms. Where Blynk is the server for the entire system where we can see the output or by using LCD also we can the resultant output.

4.RESULTS:

We can see the result in the LCD for soil level,temperature and humidity and on the blynk server

Figure4.1: LCD at starting stage

Figure4.2: Initializing IOT based plant irrigation system

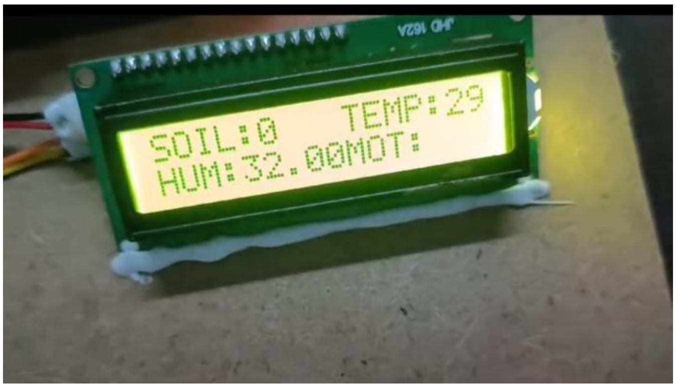

Figure 4.3: Soil,temperature,humidity values in LCD

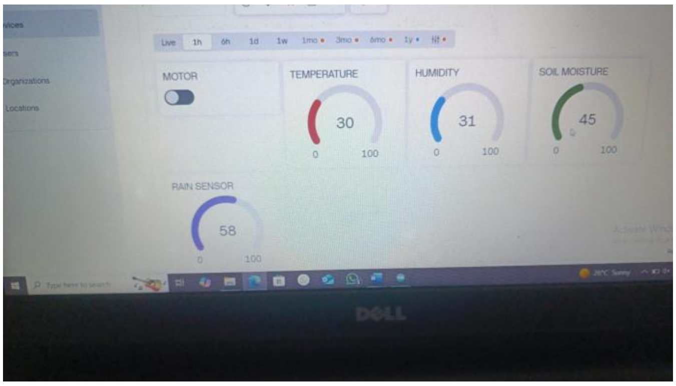

Figure 4.4: Output on Blynk server

5.CONCLUSION:

The smart irrigation system that was implemented is economical for improving water resources for agriculture. The systems configuration is to control the turning on/ off of water sprinklers according to the soil moisture levels thus making the process easier to use. This design has led to the conclusion that there are concrete improvements in irrigation and dealing with IoT and automation. Thus system is a solution to the challenges faced in the con- developing process of irrigation.

6. FUTURE SCOPE:

For future expansions, this endeavor could be optimized by scaling this system to manage huge acres of land. Also, incorporating this system could assess both the quality of the soil and the development of the crop in each soil. Sensors and microcontrollers are well interfaced in this system and the communication is wireless between each node as well. All of the observations carried out as well as any experimental work indicated that this project is a complete solution to field deployment and irrigation issue. Implementing organizational support in the field can certainly help facilitate cropping practices to increase the nutrient harvest and increase production overall.

6.REFERENCES:

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