Internet of Things based Automated Agricultural Irrigation Control System

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Abstract: With the progression of automation, life is getting smooth and facile in all facets. In the moment's world, Automatic setup is chosen over manual labor setup. The mechanical design is a booming system of the ordinary thing from industrial machines to consumer goods that can carry through the tasks while engaged with other works. Indian country population is compassed beyond 1.2 billion. The population rate is adding day by day also the next 30-40 years, and there will be a severe scarcity of food, so the development of cultivation is needed. Moment, the cultivators are suffering from the de*cit of rain and water. The initial idea of this paper is to give IOT Based Automated Agricultural Irrigation Control System, thereby saving time, power & money for the agronomist. Conventional cropland irrigation requires manual intervention with automation. It can be diminished whenever there is an alteration in the temperature and moisture of the surroundings. These sensors sense the modifications in temperature and humidity and give an interrupt signal to the microcontroller.

Keywords: Soil Moisture, Temperature Sensor, Wireless Sensor networks, ESP 32 module, Arduino Uno**.**

1 INTRODUCTION

India is a village-based country, and agriculture plays a significant part in the country's development. Agriculture in our country is reliant on showers with insufficient water supplies. As a result, irrigation is used in agricultural areas. The irrigation system delivers water to the plants based on the soil type. In agriculture, two impacts are significant: the first is obtaining information on soil fertility, and the second is measuring the moisture content of the air. Numerous irrigation systems are currently being used to reduce the need for rain, and the trend is being driven by electrical power and an on-off schedule. This method places temperature and moisture sensors near the plant and the module. The gateway unit interprets the sensor data and transmits it to the controller, which controls the water intake via the pump. Temperature and moisture sensors are put near the plant and the module in this manner, and the gateway unit processes the sensor data and feeds it to the controller, which controls the water flow through the pump.

1.1 Motivation

It is critical to rapidly improve food technology products to meet the growing demand for food and the resulting decrease in supply. Agriculture is the only means of obtaining this. This is a critical component of rising and dynamic food demand for human societies. Agriculture plays a significant part in developing countries like India. Planters employ irrigation because of a lack of water and a land-water deficit that affects the declining volume of water on the planet [10]. Irrigation can be defined as the science of artificially applying water to land or soil, which means plants must be fed with water based on the soil type.

1.2 IOT In Smart Farming

Smart farming is a modern farming management concept that uses IoT technologies to boost agricultural efficiency. Planters can effectively use fertilizers and other resources to increase the quality and amount of their crops by using smart farming [6]. Agronomists are unable to work in the field 24 hours a day. Also, an agronomist may not be familiar with the various instruments available for measuring the appropriate environmental conditions for their crops [12]. IoT offers them an automated system that may work without human supervision and can alert them to take appropriate action in response to various types of challenges they may encounter while farming [5]. Even if the farmer is not on the farm, it can contact and notify him, allowing agronomists to manage more cropland, thus improving their production [13].

2. Literature Survey

2.1. WSN and ESP 32 Module-based Automated Irrigation System

If the moisture and temperature of the landfall are below a certain point, Irrigation is automatically turned on. Along with watering, light intensity management in glasshouses can be automated. The announcements are sent to agriculturalists' mobile phones regularly. Agronomists can effectively monitor field conditions from any location [15]. This approach will be more useful in areas where water is scarce [9]. This system outperforms the traditional method by 92 percent. They devised a sensor-based plan for crop monitoring [8]. The utilization of wireless sensor data transfer from the field and storage in a database and control via mobile operation provided proof of concept for automated irrigation.

2.2. Crop Monitoring System based on WSN

Balaji Banu [1] devised a wireless sensor network for monitoring farming conditions and calculating crop production and quality. Sensors detect diverse terrain conditions, including water locations, humidity, temperature, etc. The system is designed with analog to digital conversion and wireless sensor nodes with wireless transceiver modules based on the Zig-bee protocol [4]. Data is retrieved and stored using databases and mobile applications.

3. Irrigation Control System Function

User Interface: The user interface helps the user interact with the system by conveying information to the regulator and providing the user with system information. Usually, it is a computer or a smartphone.
Controlled Devices: Controlled devices comprise a wide range of equipment that this Arduino Uno and sensor is capable of. Computer Programming: Some system controllers have a user interface that allows the user to program the system. Another approach necessitates the use of a computer to program. Then we use a computer to access the Arduino IDE.
Controllers: In automatic irrigation control, relay controllers provide intelligent control operations.
Sensing Devices: Sensing devices can report values or states, such as temperature and humidity.

I/O Interface Devices: These devices give the logical communication link between the controllers and the controlled device systems.

4. Benefits of Automatic Irrigation Control

Prevents Disease and Weeds: Specialized drip irrigation systems distribute water exactly to each plant's root ball rather than spraying the entire garden like a regular rainfall. As a result, surrounding weed seeds cannot develop, reducing the weeding required. Standing droplets on the foliage produce leaf diseases prevented by water at the roots. Blight diseases cannot spread because the water does not strike the leaves or blossoms. Conserve Water and Time: Watering by hand or with a hose takes time, and early morning and evening watering routines take time away from family and work. Both drip and sprinkler irrigation systems feature timers that can be set for daily and weekly watering, so you do not have to keep track of how much water is being used because the timer shuts off the water when it has done. Your water cost should be lower if the irrigation system is successful. Preserves Soil Structure and Nutrient: Watering with a wide-open garden hose may allow too much water to infiltrate into the soil, compromising soil structure and nutrients. As a result, nutrients leak off with the water runoff, leaving fewer nutrients accessible to the plants. When you rinse with a hose, the soil may also become compacted. With suffocating compacted soil, plants may show withering or root disease. Smaller droplets are produced by drip or sprinkler watering, which helps maintain nutrients and reduce soil compaction.

Gardening Flexibility: Working in the garden while the plants are being watered will come in handy if you have a busy schedule. You can plant and prune in one garden patch while another is flooded.

5. Proposed System

Sensors, microcontrollers, Bluetooth, and Android applications can all be used to automate irrigation [1]. We employed a low-cost soil moisture sensor and a temperature and humidity sensor. They keep a constant eye on the field. An Arduino board [7] is used to connect the sensors. The sensor data obtained is delivered via wireless transmission to the user, allowing him to control irrigation. The data obtained by the mobile operators can be dissected and compared to the moisture, humidity, and temperature threshold values. The choice can be made automatically or manually with user intervention. The motor is turned on if the soil moisture is less than the threshold value, and it is turned off if the soil moisture is greater than the threshold value. The Arduino Uno board is attached to the sensors. This gadget connects via Bluetooth wireless transmission, allowing the user to obtain the data via his Android phone, receiving sensor data from the Arduino via Bluetooth [2]. In terms of gadget cost, Bluetooth technology is employed, which can be replaced by a Wi-Fi motor.

5.1 Flow Chart of The System

Data Transferring:

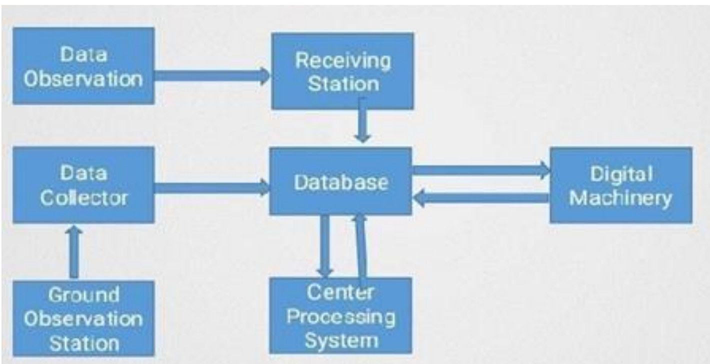

Fig-1: Data Flow diagram

6. Working of the System

An Arduino-Uno board's analogous pins link the soil moisture sensor and temperature sensor [5]. A USB cable connected to a computer or an Arduino board's adaptor provides 5 volts of electricity. A solar panel is used to continuously charge the battery during the day to provide electricity to the 12v battery, which will be charged until nightfall. When the user can operate the engine after sunset, the delegated power should be drained continually. We can save money on electricity by employing this solar panel. The Wi-Fi module is initialized and then waits for the network to connect. Adaptor [3] is used to provide 12v power to the Wi-Fi module. An Arduino Uno board's analogous pins are linked to the soil moisture and temperature sensors [5]. A 5v power supply is generated through a USB connection connected to a computer or an Arduino board's adaptor. During the day, a solar panel is utilized to charge the battery and deliver electricity to the 12v battery; it will be set constantly until sunset.

The delegated power should be discharged continually when operating the motor after sunset. We may optimize electricity utilization by employing this solar panel. The Wi-Fi module is initialized and then waits to connect to the network. The Wi-Fi module receives 12v power via adaptor [3].

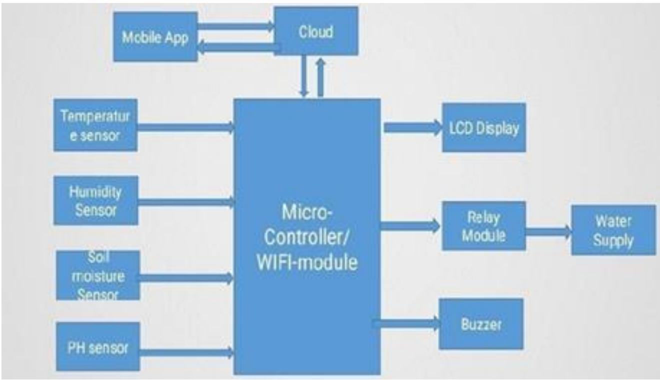

Fig-2: Working of the System

PROPOSED SYSTEM HARDWARE AND ARCHITECTURE

Components used in the proposed product

S No.	Name Of Components
1	Arduino_UNO
2	DHT11 Temperature and Humidity Sensor
3	Electric DC_Motor
4	Relay_Module
5	One k_Resistor
6	Power Supply cord for Arduino
7	Female_Headers
8	Male_Headers
9	Diode
10	Jumper_wire
11	ESP32_sensor
12	FC 28_SENSOR

Table-1: Components used in the proposed product

Work to work on the association between humans and machines. For the most part, face appearances are regular and direct means for individuals to convey their feelings and expectations. Face looks are the critical attributes of non-verbal correspondence. Feeling Recognition is a significant area of work to work on the association between humans and machines. The intricacy of feeling makes the obtaining task more troublesome. Quondam works are proposed to catch feeling through unimodal systems like looks or vocal info. All the more, as of late, the origin of the possibility of multimodal feeling acknowledgment has expanded the exact pace of the discovery of the machine[8]. Besides, profound learning procedures with neural organizations broadened the achievement proportion of devices regarding feeling acknowledgment[9]. Late works with deep learning strategies have been performed with various types of the contribution of human conduct, for example, general media inputs, looks, body motions, EEG flags, and related brainwaves[10]. Still, numerous viewpoints around here to improve and make a robust framework will recognize and order feelings all the more precisely.

Detection And Characterization of Emotions Using Facial Features

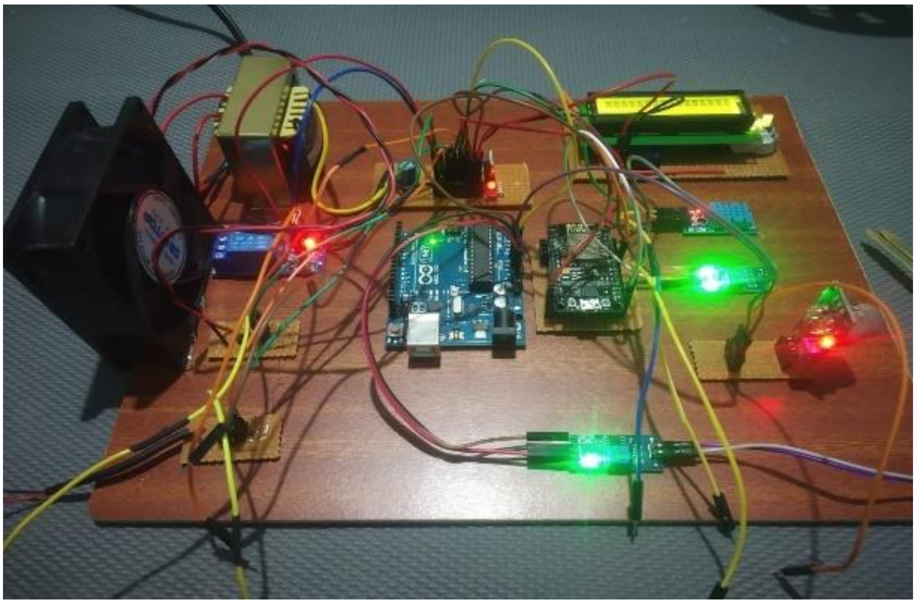

Fig-3: Circuit of the Prototype

7. RESULTS:

- Print Settings of the Valve:

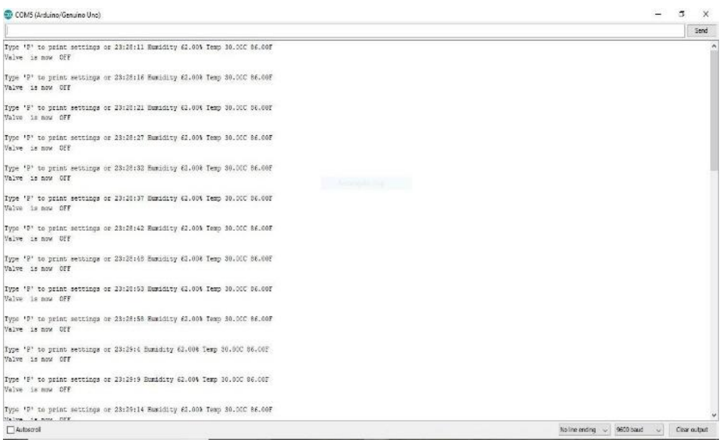

Fig-4: Print Settings of the Valve

- When the humidity is less than 80%, and the timer is set, the valve opens:

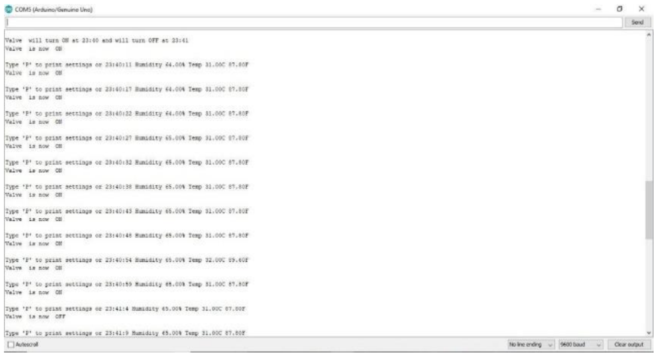

Fig-5: The valve opens when the humidity is less than 80%, and the timer is set,

- When humidity is more than 80%

Fig-6: When humidity is more than 80%

8. Conclusion

The automatic irrigation control using an Arduino Uno has been experimentally proven to work satisfactorily, and we were able to establish the timekeeper and control the motor over time. This method not only captures temperature and humidity measurements; but also prevents the engine as a result. Analyzing the atmospheric state, the motor will sustain water delivery automatically, allowing for the maintenance of greenery without human involvement.

9. Future Work

Using this system as a framework, the system may be modified to include various other features, such as motor control through a mobile application and WiFi-controlled monitoring. These will improve the prototype's functioning capabilities and effectiveness. Using the sprinkler concept; may be implemented not just in agriculture but also in lawns and gardens in any location. When combined with robotics, it has the considerable potential [11]. This will give automation a new level.

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