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IoT Smart Irrigation Monitoring and Controlling System Using Arduino Microcontroller

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ABSTRACT

In India, all regions depend heavily on agriculture. However, the potential of agriculture has decreased as a result of an abrupt change in the environment and a lack of rainfall throughout India. The land is irrigated using a traditional approach with even more moisture than crop need. Water waste is avoided with the use of contemporary irrigation methods like sprinkler and drip irrigation. The most recent technology, however, significantly reduce the risk involved in agricultural production and offer effective water resources. The implementation of a reduced Internet - of - things smart irrigation system is the aim of this article. The affordable, trustworthy device is made to provide information and to irrigate areas only if there is a need for water. Farmers can view the field's status by visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud webpage BLYNK app. For measuring soil moisture, temperature, and humidity, this project makes use of the Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor. Wi-Fi module embedded inside the microcontroller uploads all the data to the cloud database of the BLYNK app. The proposed intelligent irrigation system uses less water than the conventional method.

Keywords: Micro controller, Smart irrigation system, Blynk app, Wifi module, IoT.

1 Introduction

A significant element in a nation's long-term success and its ability to develop healthily is its agricultural sector. In farmland, irrigation is crucial for achieving the best crop yield. Any area's topography has a crucial role in defining the sort of crop that may be cultivated there, the quantity of water needed, and the lifetime of the crop. Rainfall is erratic for a number of reasons, including global warming, deforestation, and other factors. This eventually leads to a water deficit, which is a significant issue that is present practically everywhere nowadays [1]. There is an overabundance of water in some locations as a result of heavy rainfall and river flooding, which causes crops to be washed away or plant roots to rot. In agricultural production, moisture content is important, because if it is too high or too low, the output is diminished or absent. Water waste also results as an outcome of this. A larger yield is achieved with a smaller investment when the proper amount of water is applied at the appropriate time. Additionally, it helps to preserve water, a scarce resource. [2].

The creation of sophisticated automation systems helps to reduce the risk based on agricultural production and offers effective water resources. In such a smart system, Arduino is utilised for nutrient monitoring and water management. For measuring moisture levels, temperature, and humidity, many sensors are used. The gathered information is kept on a server and accessed via a smartphone. But no impact to the water line leading to the field has been found [3]. Using a smartphone and the Internet of Things, it is normal practise to monitor and control crop development in farm areas. However, immediate maintenance is required [4]. An intelligent irrigation system is put in place to successfully irrigate the fields according to soil temperature, pH, and moisture levels. Depends on the type of soil and crop, the manures are suggested to use the Nave Bayes method on the database. The Wireless Sensor Network is not utilised by this technique, albeit [5]. A soil sensor is used to collect a lot of real-time data from agricultural areas. The data is gathered and sent to web application via a WSN. An acquired data is then examined and analyzed by IoT. The farmer's smartphone application frequently receives messages. Although the suggested method reduces the need for needless water delivery, its functionality has to be further improved. [6, 7]. Additionally, a raspberry pi webcam is utilized to feed live video of a website in order to check the heath of crops. To identify illness and pests in the fields, though, the notion of image processing must be used [8, 9]. Additionally, ANOVA is used to evaluate the water levels and frequency, and Arduino was used to create the setup. However, it is challenging to do an ANOVA analysis while making strict assumptions about the type of data [10]. In fertilization, plants are often given enough water to obtain good crop growth. A photovoltaic electric engine, a soil moisture sensor, and an embedded controller are used in a solar-powered autonomous irrigation system. With several moisture sensors in the field, the suggested strategy cannot be used successfully [11, 12]. The Temperature and Relative humidity Sensor measures both the temperature and humidity levels in the area around the plant. The ESP8266 NodeMCU microcontroller is used to gather data from wireless smart sensors, process it, and transfer it to a target. However, the ESP8266 NodeMCU's WiFi code uses a large amount of CPU power [13]. Construction is proceeding on an automated wireless sensor-based irrigation water regulation assistance system. Nevertheless, the system's lack of dependability has been demonstrated [14, 15].

In order to reduce water waste in irrigation fields, a low cost IoT based smart irrigation system is built in this study. The affordable, trustworthy device is made to provide data and to hydrate areas only if there is a need for water. Farmers can view the field's status by visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud website named BLYNK app. For measuring soil moisture, temperature, and humidity, this project makes use of the Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor.

2 Recent Works

Dmitrii Shadrin et al [2020] provide an embedded AI enhanced system that ensures analyze the market and on-site prediction of plant leaf growth dynamics. The embedded device can execute the neural network-based AI on board and is based on a low power embedded sensing device with such a graphics processing unit. The system's AI is built around a recurrent neural network known as long short term memory network. To use a typical Li-ion battery, the suggested method ensures the device's autonomous functioning for 180 days. Depend on cutting-edge mobile graphics chips for "smart" device inspection and management. This research methodology expands numerous opportunities for use of integrated unit, particularly in the field of farming.

Mary B. Alatise et al [2020] Mobile robots with autonomy have recently gained in popularity due to their usefulness and modern-day uses. It has become more hopeful and practical because of their capacity to explore in an atmosphere without the help of physical or electro-mechanical direction devices. Automated robots are being employed to improve services and daily tasks in a range of settings, includes corporations, industry, healthcare, educational facilities, farms, and homes. Due to the different fields of work they carry out, such as transporting large objects, monitoring, search and rescue operations, etc., mobile robots have become more necessary as a result of technology advance. Various research have been conducted on the advantages, applications, and challenges of mobile robots.

Xinyue Kan et al [2020] The suggested method guarantees resolution-complete covering, has the ability to be tweaked to enable quick exploration, and creates pleasant tracks for Generate automobiles to track in real-time at steady velocity. This method effectively make a deal off among coverage and exploratory speed, and depending on the way it is imparted, it could outcompete existing web coverage algorithms in the total shaded area or exploratory speed. This is demonstrated by gazebo simulations and device tests with such a non-holonomic wheeled robot.

Samuel T. Langlois et al [2020] have discussed the ability to divide up huge tasks into smaller, less manageable jobs, automated multiagent systems could be employed in a variety of fields, including farming, search - and - rescue, and fire prevention. Nevertheless, adding complexities through the use of several entities makes it harder for autonomous reasoning and judgement. Ground robots, unmanned drones, and autonomous unmanned vehicles are examples of entities that may need efficient and robust but strong reasoning techniques.

Khalid A. Eldrandaly et al [2019] have generate the IoT response may be centred on a thing looks spatial variation. For instance, crop variance reveals the need and nature of agricultural output. Additionally, the security and surveillance systems may be alarmed by the spatial variance of human mobility. The "Internet of Spatial Things (IoST)" notion is agitated by this difficulty. This work, which is focused with revising IoT from a specific viewpoint, is the first to take inspiration from the point of view of the IoST. The exposition of the IoST concept's description and architectural elements makes an argument for it. Additionally, the IoST levels are covered in depth. In addition, a fresh IoST reference model is suggested.

3 Proposed work Explanation

This study evaluates the efficacy of a low cost Internet of Things based smart system in addition to reducing waste in agricultural fields. Figure 1 shows the suggested schematic diagram for a smart irrigation system.

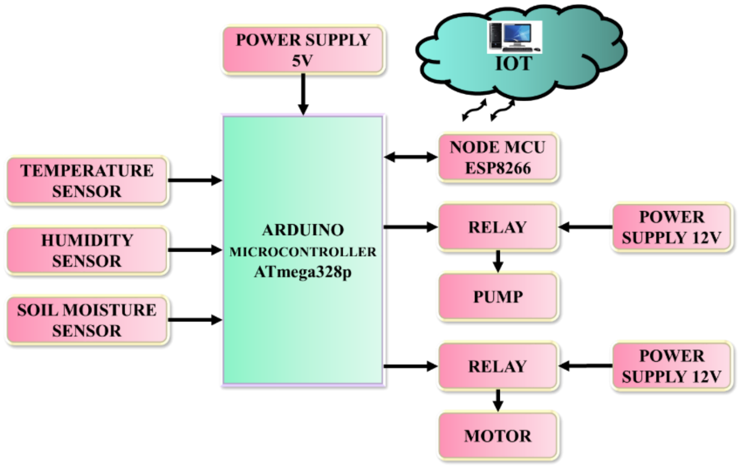

Figure 1: *Proposed block diagram*

The sensor unit and the Arduino Microcontroller unit are the two components of the suggested system. The sensing unit is made up of sensors for soil moisture, humidity, and temperature. To improve data handling in the cloud-based storage system, a microcontroller unit is created with both a Wi-Fi module named NODEMCU. BLYNK app, a cloud-based website, keeps track of and updates the customer's data. The Wi-Fi module incorporated inside the microcontroller uploads all of the information to the cloud database of the BLYNK app. The DHT11 sensor combines temperature and humidity sensors. It is linked to an 8-bit microprocessor that runs at 5.5V of voltage. These sensors included a resistive-type humidity measuring element as well as an NTC temperature element. These sensors produce calibrated digital output with great reliability. Usually maximum water content of soil is measured by the soil moisture sensors. It seems to have two electrodes that are dropped into the ground, and if the ground is moist, electricity can flow from one electrode to the other; otherwise, it produces a weak output. Therefore in suggested system, a controller unit is interfaced with a 12V submersible pump motor. A 12v relay is connected to the water engine and control unit for control and security purposes. Relay functions in up usual condition and turns off the water supply.

To measure moisture content, temperature, and humidity, this process made use of the Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor. The user can quickly keep an eye on their farm's fields by visiting an Adafruit IO channel link. Wi-Fi module included into the microcontroller uploads all information to an Adafruit IO cloud database. In the end, the water efficiencies in various soils including sand, clay, and sandy clay are compared. Users may observe that this technology uses less water than a conventional process.

3.1 Soil Moisture Sensors

Two electrodes of the soil moisture sensor are dropped into the ground whenever applied power. If the ground is wet, electricity passes from one electrode to the other, and a trigger pulse is then sent to the controller. It is employed to calculate the soil's volumetric content. Show a quite low activation output level whenever the soil is dry. A soil moisture sensor is presented in Figure 2.

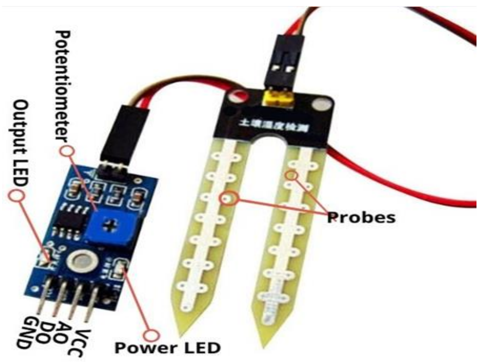

Figure 2: *Soil moisture sensor*

3.2 DC Pump Motor

The Submarine Pump Motor can be powered by a 3 to 9 volt source. A power source that can deliver water at a rate of up to 16 lpm with an extremely lower power feeding of 220mA is given by linking the pipe with the motor opening and submerging it in water. Ensure that level of water is consistently higher than motor's surface. Operating the engine in dry conditions, which results in noise and overheating. Figure 3.shows the schematic diagram of DC Pump motor.

Figure 3: *Schematic diagram*

4 Results and Discussion

The soil is treated using a traditional method with some more moisture than crop need. Freshwater wastage is avoided with the use of contemporary irrigation systems like sprinkler and drip irrigation. The most recent technology, though, significantly reduce the risk involved in agricultural production and offer effective water supplies. The development of a low cost Internet of things smart irrigation system is the aim of this article. The low cost device is made so that farmers can observe the field by visiting the BLYNK app stream link and receiving the information obtained by the device via a cloud-based site called BLYNK app. For measuring soil moisture, temperature, and humidity, this process made use of the Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor. Wi-Fi module included into microcontroller uploads all the information to an Adafruit IO cloud database. Figure 4 depicts the hardware configuration of smart irrigation. The results of the BLYNK app's measurements of temperature, humidity, and soil moisture are shown in Figure 5.

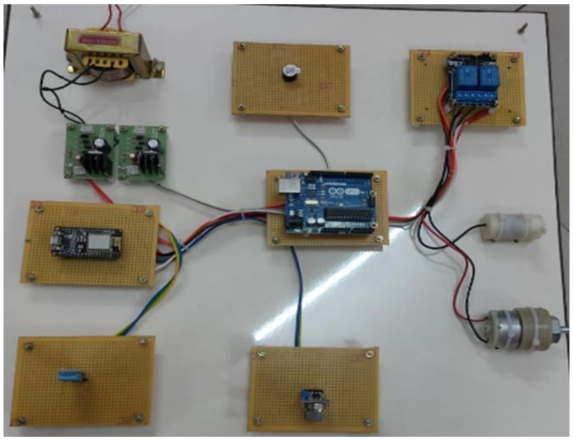

Figure 4: *Hardware setup*

Figure 5: *Result obtained on BLYNK app*

5 Conclusion

The implementation of a low-cost Internet - of - things smart irrigation system is the aim of this article. The affordable, trustworthy device is made to provide information and to irrigate areas only if there is a need for water. Farmers can view the field's status by visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud site called BLYNK app. This experiment measures soil moisture, temperature, and humidity using a Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor. The Wi-Fi module incorporated inside the microcontroller uploads all of the data to the cloud database of the BLYNK app. Compared to the conventional method, the suggested smart irrigation system uses less water.

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