International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

IOT Based Agriculture Monitoring System

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Abstract:
India is mostly an agricultural nation. Agriculture is the primary source of income for the majority of Indian families. It is critical to the growth of an agricultural country. Agriculture accounts for around 16% of overall GDP and 10% of total exports in India. Plants have an important role in sustaining the ecological cycle; thus, appropriate monitoring is necessary to ensure optimum plant development and health. Because our country's economy is founded on agricultural products, automatic plant leaf identification is a critical study area right now. Automatic leaf detection has a lot of advantages in crop monitoring and automatically detecting leaf disease. Water is the most important resource for agriculture. Irrigation is one technique of supplying water; however, it wastes a lot of water in some circumstances. So, in this sense, IoT can save water and time.

In our suggested system, we use several sensors such as temperature, humidity, and soil moisture sensors, which detect the various parameters of the soil and autonomously irrigate the land depending on the soil moisture value by turning the motor on and off. These detected metrics and motor status will be presented on the user's webpage.

Keywords: Humidity sensor, Arduino, Temperature sensor, Soil moisture sensor, And Internet of things (IoT).

1. INTRODUCTION

Agriculture is the primary source of income for India's biggest population and a key contribution to the Indian economy. However, technological participation and applicability for the agriculture industry in India must be promoted and cultivated. Although the Indian government has launched a few attempts to provide farmers with internet and mobile messaging services linked to agricultural inquiries and agro vendor information. According to the report, agriculture accounts for 27% of GDP and employs 70% of the Indian population Pavithra D.S, M.S. Srinath (2014).

IoT is transforming agriculture and allowing farmers to overcome the enormous challenges they confront. Agriculture must overcome growing water shortages and limited land availability while satisfying the world's burgeoning consumption demands. These concerns are being addressed by new creative IoT applications, which are boosting the quality, quantity, sustainability, and cost efficiency of agricultural produce.

Agriculture consumes 85% of available freshwater resources worldwide, according to data, and this percentage will continue to dominate water usage due to population expansion and growing food demand. There is an urgent need to develop science-based water-use strategies, encompassing technological, agronomic, managerial, and institutional improvements.

The Internet of Things (IoT) is a technology that allows a mobile device to monitor the operation of a device. The Internet of Things (IoT) is concerned with linking communication things that are put in multiple locations that may be far apart. The Internet of Things (IoT) is a network technology that detects data from various sensors and allows anything to connect to the Internet to exchange data.
It can also be used to change the device's status. The central processing unit will also incorporate a communication device that will receive sensor data and transfer it to the user's device. This will be accomplished by the use of a more advanced communication device, such as a Wi-Fi module. The central module converts the data it processes into relevant data and relays it to the user. The data may be seen by the user using a portable device such as a smartphone or tablet. Water shortage is a major worry for farmers nowadays. This project assists farmers in irrigating farms more efficiently by using an automated irrigation system depending on soil moisture.

2. Literature Survey

Understanding the current methodologies, Understanding the needs, and generating an abstract for the system are all steps of primary study.
This work on "Automatic Irrigation System on Sensing Soil Moisture Content" aims to develop an automated irrigation mechanism that turns the pumping motor ON and OFF based on the earth's dampness content. In this research, only soil moisture is evaluated, however the suggested project extends the existing project by include temperature and humidity information. C. Arun, K. Lakshmi Sudha (2012).
Remote Agricultural Greenhouse Monitoring Using Wireless Sensors and Short Message Service (SMS). In this study, data is sent by SMS, however the suggested method transmits values to a mobile application. Izzatdin Abdul Aziz, MohdHilmiHasan, Mohd Jimmy Ismail, MazlinaMehat, NazleeniSamihaHaron, (2008).
This suggested article is an Arduino-based remote irrigation system created for agricultural plantation, which is installed in a remote area and distributes necessary water to the plantation when the soil humidity falls below the set-point value. However, we were unaware of the soil moisture level, thus to solve this disadvantage, the suggested system contained extra features such as soil moisture value and temperature value, which were presented on the farmer mobile application Jeonghwan Hwang, Changsun Shin, and Hyun Yoe (2010).
"Irrigation Operate System Using Android and GSM for Efficient Use of Water and Power" This system utilised GSM to control the system, which may be more expensive, thus to solve that, the suggested system used an Arduino Yun board, which already has an inbuilt Wi-Fi module, LaxmiShabadi, NandiniPatil, Nikita. M, Shruti. J, Smitha. P&Swati. C (2014).
"Plantation Irrigation Controlled by a Microcontroller" In this research, an older generation with less memory microcontroller is utilised to manage the system, however the suggested solution uses an Arduino Yun board, which is user pleasant and allows for easy programme dump. S. R. Kumbhar, Arjun P. Ghatule(2013).
In this research, irrigation is carried out using soil moisture readings, but the suggested method also shows temperature and humidity information Siuli Roy, Somprakash Bandyopadhyay (2007).
By referring to all of the preceding papers, it is discovered that no such systems exist with all integrated features, but the proposed system includes all of these features, such as displaying temperature,

humidity, and soil moisture values, as well as automatic switching on and off of the motor based on soil moisture values.

3. Proposed System

Figure 1 shows an overall block diagram of a Raspberry pi-based autonomous irrigation system, which consists of three sensors connected to a controller and the perceived values from these sensors sent to a webpage.

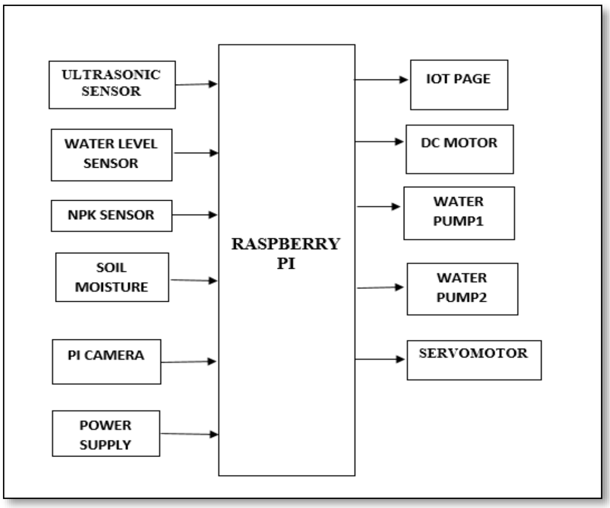

Figure 1. Block Diagram

Figure 1 shows a block diagram of an IoT-enabled smart irrigation system. Farmers begin to use various monitoring and controlled systems in order to boost productivity with the use of plant leaf detection and automation of agricultural factors such as temperature, humidity, and soil moisture are monitored and controlled systems that may help farmers improve output.

This proposed work includes an embedded system for autonomous irrigation control. This project includes a wireless sensor network for real-time irrigation system sensing. This system offers a consistent and needed volume of water for the agricultural land while minimizing water waste. When the moisture level in the soil falls below a certain threshold, the system automatically turns on the engine. When the water level returns to normal, the engine turns off automatically. The motor's detected parameters and current status will be presented on the user's webpage.

3.1.Ultrasonic SensorWater level sensor

Figure 2. Ultrasonic sensor Water level sensor

This is used to find the Hight of the plant. The HC-SR04 sensor used in this project to offers superb non-contact range discovery with high precision and stable readings in a simple-to-utilize bundle from 2 cm to 400 cm or 1″ to 13 feet.

3.2. Water level sensor

This simple water level sensor circuit monitors the presence of water in a certain location or container. The circuit sends an acoustic alarm when it senses a drop of water leak.

3.3.NPK sensor

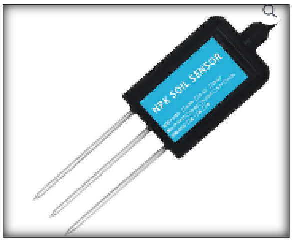

Figure 3. NPK Sensor

The soil NPK sensor is suitable for detecting the content of nitrogen, phosphorus, and potassium in the soil, and judging the fertility of the soil by detecting the content of N, P, and K in the soil.

- Power supply: 5-30VDC.
- Maximum power consumption: ≤0.15W.
- Operating temperature: -40~80℃

3.3.1NPK parameters:

- Range: 0-1999 mg/kg(mg/L)
- Resolution: 1 mg/kg(mg/L)
- Precision: ±2%FS.
- Response time: ≤1S
- Protection grade: IP68
- Probe material: 316 stainless steels
- Sealing material: Black flame-retardant epoxy resin
- Default cable length: 2 meters, cable length can be customized
- Dimensions: 45*15*123mm
- Output signal: RS485/4-20ma/0-5v/0-10v

3.4.PI camera:

Sony IMX477R stacked, back-illuminated sensor, 12.3 megapixels, 7.9 mm sensor diagonal, 1.55 µm × 1.55 µm pixel size

- Ouput: RAW12/10/8, COMP8
- Back focus: Adjustable (12.5 mm–22.4 mm)
- Lens standards: C-mount, CS-mount (C-CS adapter included)
- IR cut filter: Integrated
- Ribbon cable length: 200 mm

- Tripod mount: 1/4”-20

3.4.1. DC motor:

- Output Power: 1/4 HP; 300 W; 1/2 HP; 1 HP
- DC Voltage Range: 10.8 to 18.0
- Standard DC Voltage: 12V
- Output Power: 0.0568 to 1.26

3.5.Servo motor:

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with 3 horns (arms) and hardware.

4. Module (1) Plant’s leaf disease

A PI camera was used to monitor the leaf disease. If a leaf disease is discovered, the name of the illness appears on the homepage.

Figure 4. Healthy and unhealthy leaf

Fungal infections include Damping-off and root rot, Downy mildew, Fusarium wilt, and White rust. They are the result of fungus. Extremely wet weather promotes disease onset, as spores are dispersed by splashing water.

For numerical computing, we utilized the tensor flow tool. It may be used in controlled environment farms to identify disease symptoms anytime they develop on the plant's leaves.

5. Module (2) Plant Growth Monitoring

An ultrasonic sensor is used to track the plant's growth. The height of the plant is displayed on the website.

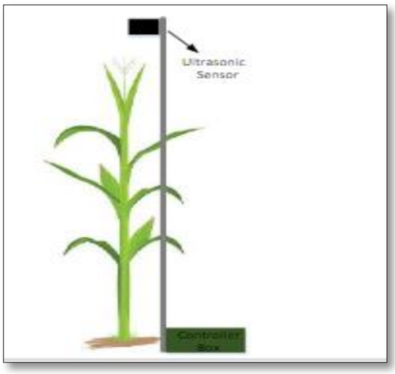

Figure 5. Layout Design

The device will be put precisely above the plant for height sensing in order to monitor the plant. Figure 3 shows the layout concept for placing the ultrasonic sensor.

6. Module (3) Monitoring Moisture

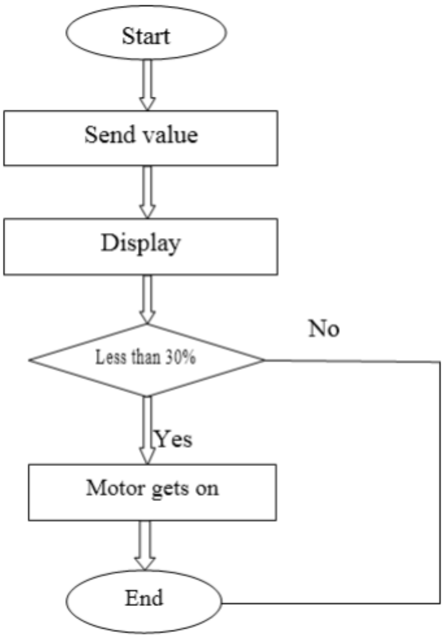

Figure 6. Flow chart of soil moisture sensor

Soil moisture sensors monitor the amount of water in the soil. Soil moisture is an important component of the atmospheric water cycle. When the soil moisture is low, the sensor module produces a high degree of resistance. It features digital as well as analogue outputs. Although digital output is easier to use, it is not as precise as analogue output. Based on moisture level, the motor turns on and off automatically.

7. Module (4) Monitoring NPK in The Soil

All over the world, an increasing number of consumers are looking for foods that are healthier for themselves but also for the environment. As the demand rapidly increases, major food companies are rolling out ambitious sustainability initiatives. Recently, many such plans have focused on regenerative agriculture: a way of farming that promotes healthier ecosystems by rebuilding soil organic matter. So, increasing soil health by analysing problem areas with the help of NPK (nitrogen (N), phosphorus (P) and potassium (K)) sensors leads to increasing yields, low expenses and fulfilling the fertilizer supply with demand.

8. Conclusion

The application of agriculture networking technology is not only necessary for contemporary agricultural growth, but it is also an essential symbol of agricultural development's future level; it will be the future direction of agricultural development.

After constructing the agricultural water irrigation system hardware and analyzing and researching the network hierarchy features, functionality, and corresponding software architecture of precision agriculture water irrigation systems, actually applying the internet of things to highly effective and safe agricultural production has a significant impact on ensuring the efficient use of water resources as well as the efficiency and stability of the agricultural production.

With greater progress in the field of IoT projected in the next years, these systems might be more efficient, quicker, and less expensive. In the future, this system can be made intelligent, in which the system predicts user actions, rainfall patterns, harvest time, animal intruders in the field, and communicating the information through advanced technology such as IoMT, so that agricultural systems can be made independent of human operation, resulting in high quality and yield.

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