Autonomous Drip Irrigation system in Agriculture

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Abstract

This paper describes the design and development of a real-time, intelligent drip irrigation system for agricultural use. The system primarily relies on sensors to obtain field status information and update it to the cloud using IoT. Required parameters are also switched on or off depending on demand in accordance with the threshold levels specified in the programme. If the circumstances change, the system can keep track of the status updates. Through a web interface, the concerned authority can keep an eye on and manage the system. In this research, an IoT-based system that employs real-time input data is proposed. This technique can be applied in an agricultural setting to lessen the number of workers needed in the fields, which will reduce their constant physical presence. The ATMEGA32 processor will be utilized in the system to implement the sensor module and other communication environment. The system provides a full, affordable, effective, and user-friendly method for remote monitoring and control of agricultural fields in real-time. A prototype model is created and tested, yielding excellent accuracy.

I. INTRODUCTION

The majority of families in India depend on agriculture. With the current practices, agriculture uses a lot of water. To fulfill the fast rising global demand for food due to population expansion, farm yield must be improved. By gathering information from the sensors installed at the farm, such as soil moisture, ambient temperature and humidity, etc., one can make predictions about crop quality and productivity. This IoT setup was carried out in order to gather data for later usage.

"IoT encompasses many new intelligent concepts for using in the near future such as smart home, smart city, smart transportation, and smart farming" [1]. To increase production and excellence, we can send the information field device here to split the precise amount of fertiliser, water, pesticide, etc. Sensors are a promising tool for intelligent agriculture. The crop lifecycle is continuously influenced by real-time environmental factors such soil moisture content, ambient temperature, and tank water level. A sensor network can be created to enable accurate water control monitoring in the agricultural sector. The irrigation monitoring and control system is presented in this paper. For irrigation control, the system uses a wireless sensor network to keep track of environmental factors like temperature, soil moisture content, humidity, and water level.

There are manual and automatic modes on the system. The cloud server stores the real-time sensed data so that it can be used for decision-making and action control. Using an Android app on the farmer's smartphone, the user can monitor the management measures made at the farm and manage the irrigation.

II. Literature Survey

In a few studies, it was found that sensors were used to monitor data including temperature, soil moisture, water level, and humidity. The data was gathered and stored on servers. After doing research in this area, scientists discovered that agriculture's yield is steadily declining. The use of technology in agriculture is crucial for improving output while lowering the need for more labour and water.

A fully automated irrigation motor accessing prototype that has a number of sensors nodes positioned in various parts of the Polly home farm field. Every sensor includes a wireless networking device that receives data. The amount of irrigation is calculated using an Arduino closed loop irrigation system and dispersed soil water readings. In addition, irrigation systems can be controlled utilising data on the volumetric water content of the soil, using dielectric moisture sensors to regulate actuators and conserve water, rather than an irrigation schedule with set times and durations. Precision agriculture can now monitor and manage greenhouse parameters because to advancements in wireless sensor networks technology.

The new water shortage situation, the drying up of rivers and storage tanks, and the unpredictable environment highlight the urgent need for appropriate water management. Sensors are positioned at strategic positions around the fields to monitor the crops in order to accommodate this usage of temperature and moisture.

After doing research in this area, scientists discovered that agriculture's productivity is declining daily. However, using technology in agriculture has a significant impact on both cutting labour costs and raising yield. Some research initiatives aim to benefit farmers by offering tools that leverage modern technologies to boost agricultural productivity.

The cloud computing tools build a whole computer system, from sensors to tools that reliably feed data from agricultural fields into repositories. Through the use of wireless communication technology, this concept suggests a revolutionary approach to smart farming that connects a smart sensing system and a smart irrigation system.

It suggests a low-cost and effective wireless sensor network method to collect the soil moisture, humidity, and temperature from various field sites and to enable the water motor as needed by the crop. It puts forth a theory regarding how automated irrigation systems were created to maximise the use of water for agricultural purposes.

III. EXISTING SYSTEM

When creating a system to enhance cultivation methods by making the entire process more efficient and sustainable, there are numerous elements that must be taken into account and thoroughly researched. Numerous issues must be resolved in order to design and construct a precision agricultural system that can be widely used by numerous users and applied in various contexts.

IV. Hardware Implementation

The ARDUINO, DHT11Sensor, Soil Moisture Sensor, Water Level Sensor Relay, and Water Pump are the four main parts of the study. Below is the block diagram:

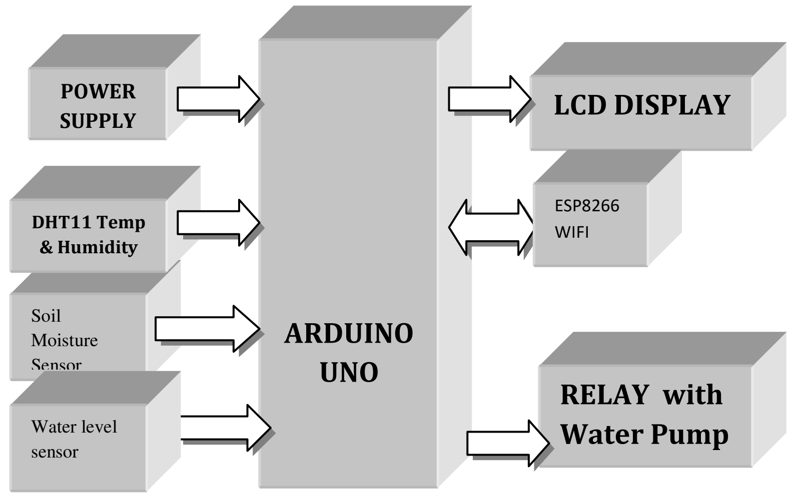

Figure 1: Block Diagram of Proposed System

A real-time smart monitoring and regulating system for the agricultural environment has been designed and developed, according to reports. The main function of the system is to monitor the temperature, moisture content, humidity, and water level of the agricultural field. Users may keep an eye on and manage transducers when they're in use. A full, affordable, effective, and user-friendly method of remote field control and real-time monitoring is provided by the system.

The fundamental objective of developing a precision agriculture system is to incorporate more information and communication technologies into cultivation operations to enable more successful agriculture while also minimising the environmental impact of this cultivation (i.e., improving the sustainability of agriculture).

V. SYSTEM DESCRIPTION

Establishing a connection with a sensor network that uses an ATMEGA32 to collect data from several types of sensors and allows for the monitoring of all these parameters on an LCD display. Depending on the situation, a motor can be controlled autonomously.

Step 1: Initialize the sensors, gather the data from them, and store it in the Arduino.

Comparing sensor data with predetermined threshold limits is step two.

Step 3: Save the data on a web server for upcoming investigation.

Step 4: Create a statistical model based on the information obtained from sensors installed at the farm to enhance smart farming.

Step 5: Autonomously turn on and off the devices using sensor data as needed.

Inductive paradigm will be used for this study. Investigating previously used systems and identifying the best technologies to use can help us narrow our focus, concentrate our study, and create a useful and effective system. The deductive approach can't be used because it's impossible to form an initial hypothesis and then afterwards defend it. A qualitative approach will be employed because the purpose of this study is to investigate wireless sensor network topologies and applications in the agriculture industry. We will comprehend the process's purpose and proper design more fully using this approach. The four sections below provide a more detailed division of the work: Design and carry out a survey, as well as read the literature.

- This system is useful for monitoring all activities related to farming
- Also useful to track the growth of plant
- This system maintains the moisture level to maintain the steady growth of plant so that production will be maintained.
- System will monitor the soil moisture level to control the drip irrigation system.
- This system is also useful to supply liquid fertilizers, for this purpose level maintenance of water and liquid fertilizer will be maintain.

Results and Observations

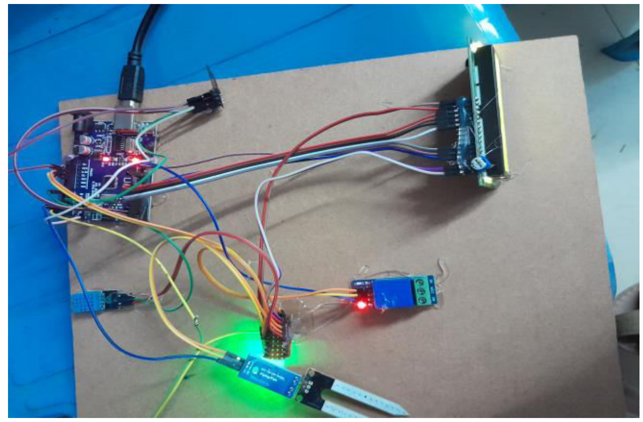

Figure 2: Experimental output of the system

Figure 3: Experimental analysis

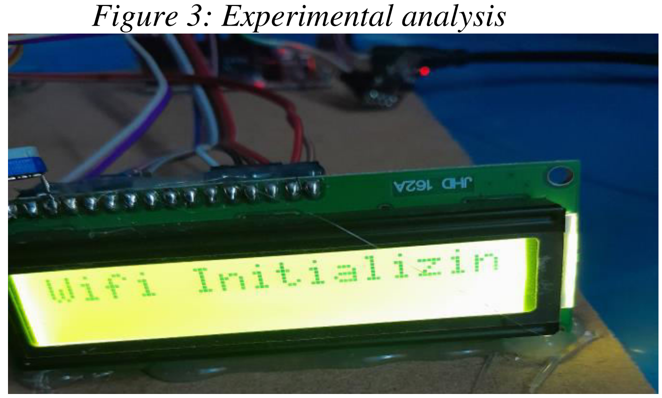

Figure 4: WiFi initialization at the field

Figure 5: Status of Motor based on the need

APPLICATION

Outcome:

• Autonomously turn on/off the devices utilizing sensor data as needed.

• A variety of sensors can be used to detect environmental data.

• A statistical model based on data collected through sensing enables efficient use of water and fertilizer resources.

• The system provides a full, affordable, robust, and user-friendly method for remote field control and real-time monitoring.

Conclusion:

The system primarily keeps an eye on agricultural field factors like temperature, moisture content, humidity, and water level. Using sensor data turn the gadgets on and off automatically as needed.

The data gathered from numerous sensors is available and can be used to create statistical models.

Based on the soil structure, crop status, irrigation, bug and pest detection, users can watch over and manage the field motors.

The system provides a full, affordable, effective, and user-friendly method for remote monitoring and control of agricultural fields in real-time. A prototype model is created and tested, yielding excellent accuracy.

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