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The Internet of Things (IoT)-automated smart water level indicator: a practical application of smart irrigation

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ABSTRACT

Most people in India rely on farming for their income. Seventy percent of Indians have to make a living in the agricultural sector, and it provides thirty percent of the country's total revenue. The agricultural sector accounts for around 14.7% of India's GDP, making its decline a major issue. Both too much and too little water may be detrimental to crop growth. The use of automation plays a crucial role in this scenario as it allows water levels to be kept constant without the need for human intervention. As a result of the unpredictable behaviour of the Indian monsoon, annual precipitation is distributed in a very unreliable manner. As a result of the irrigation system, farmers are able to rely less on precipitation for watering crops. It has long been believed that proper irrigation is crucial for agricultural growth. Excessive watering depletes soil nutrients since water naturally seeps downward owing to earth's gravity. It also leads to flooding. As with little rainfall, the failure of irrigation water to reach the lithosphere might have negative effects. Constant vigilance is required to ensure the safety of India's irrigation methods. The purpose of this proposed article is to discuss the usage of smart irrigation as a means of decreasing water waste. It explains how constant water level monitoring through the Internet of Things (IoT) may lead to more effective irrigation. It also explains how the suggested mobile app may be used to reliably keep water flowing.

Keywords: IOT, Irrigation, Water Level

INTRODUCTION

In 2016, India's population surpassed 1.3 billion, and the country is still a long way from reaching a sustainable level of population growth. Starvation-related deaths are common in India, despite the country's ability to provide for itself in terms of food production. This situation is exacerbated by India's severe water deficit[1]. The Green Revolution, which took place in India between 1947 and 1967, led to a dramatic rise in agricultural output, positioning India as one of the world's largest exporters of grain. This dramatic increase in agricultural production, however, requires substantial water resources for irrigation, which in turn hastens the advent of existing water shortages. The primary goals of this work are to (1) decrease water waste and (2) lessen the amount of labour required in the field for irrigation. It's a modern improvement on an antiquated irrigation system that uses an alarm to notify the farmer when the water level in the tank rises to a specified threshold [2]. The farmer then manually disables the alert and blocks off the water source. Waste of a precious resource might occur if water leaks from the tank or if the alarm fails to go off. This new method will enable farmers to monitor the moisture content of their water storage container and the soil's moisture content, allowing for remote control of water distribution through the internet. By monitoring soil moisture and activating sprinklers when it drops below a certain threshold, we can achieve optimum irrigation using the Internet of Things. The Internet of Things (IoT) improves people's and businesses' ability to access information, which in turn aids in the making of crucial decisions [3]. It centres on a shift away from face-to-face and keyboard-to-screen interactions in favour of those between machines instead. A wireless network is a term used to describe a connection between physical things. It paves the way for novel methods of interaction between humans and inanimate objects. Any item containing electronics, software, sensors, actuators, and network connection may be considered a "object," which can be anything from a physical device to a structure to a vehicle to a piece of equipment. Things may now act on their own will, removing the need for human mediators. The suggested system's objects are able to perceive their environment and respond accordingly thanks to the Arduino board, a microcontroller that manages the digital connection and interaction between them.

Connecting an ESP8266 Wi-Fi module to an Arduino provides the microcontroller with a TCP/IP stack, allowing it to communicate over the air. Because of its robust on-board processing, it can also accommodate a wide range of sensors and other application-specific devices. The Arduino may be programmed and communicated with using the Arduino Integrated Development Environment. In the suggested system, sensors monitor the water supply and relay that information to a central hub, such a computer, which then communicates wirelessly with the field's irrigation system or the tank's physical module. [4]

CONNECTING DOCUMENTS: FIRST MODEL FOR CONTROLLING TANK OVERFILLING

The concept for controlling tank overflows is as simple as dropping a wire into the tank at the appropriate amount of water. When the water reaches this point, it will hit the open wire and complete a circuit, setting off an alarm to warn the farmer. Once the farmer is finished, he or she will manually turn off the alarm. In the event of a water leak, the engine may continue to operate for an extended period of time without ever sounding the alarm, wasting both water and power.

AUTOMATED IRRIGATION SYSTEM WITH IOT

The sprinkler is used to provide a predetermined amount of water to the farm at regular intervals in this suggested system. Once a certain amount of water has been sprayed, the irrigation system will shut off automatically [5].

However, this kind of irrigation does not account for the soil's moisture levels. Because of this, if the soil moisture level is already rather high, the farm can end up being over-irrigated.

C.An IoT-based system for monitoring soil moisture content and regulating irrigation systems This model determines how much water the soil needs based on the current conditions. Without regular

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checks, we can't tell how much water is in the soil. Once the soil has been sprayed with water, the system does not determine whether or not further water is needed.

PROPOSED SYSTEM

With the suggested method, users may check the tank's water level in real time using an internet-connected smartphone app. No matter where the user is, as long as they have an internet connection, they may use the mobile app to automatically turn off the water supply. As a result, turning off the motor is no longer a laborious process. There is a smart irrigation system that can be placed in farms to constantly check the soil moisture level. If the soil moisture drops below a specified threshold, the sprinklers will turn on automatically. User may use smartphone app to see whether farm is adequately watered without physically being there. Farmers' standard of living would drastically enhance due to the use of these methods. Extraction of high level information from raw sensory data is one of the most critical component of IoT. Data that can be understood by computers is used to guide the suggested model's implementation [6].

The heart of the system is the microcontroller board known as the Arduino. In addition to mediating communications between the sensors and the mobile app, it also regulates the digital connections. The Wi-Fi module links the Internet-capable Arduino board to the nearby wireless network. After taking measurements, the Arduino board sends them through the web to the mobile app. The ESP8266 wireless LAN chip is implemented. The ESP8266 connects Arduino to the internet, allowing the board to talk to Android gadgets. TXD, RXD, CH PD, GPIO0, GPIO2, GND, RST, and VCC are the module's eight input/output pins. To prevent overheating, an external voltage of no more than 3.3V must be supplied to the device. The module must be flashed before coding can begin so that the correct baud rate can be uploaded to the firmware. The 3.3V pin of an Arduino or a dedicated 3.3V and 500mA power source may be used. Arduino, however, requires just 5V to function. Connecting the Wi-RX Fi's pin to Arduino's TX pin might cause instability and even damage to the circuit. As a result, a battery eliminator is needed to power both the Wi-Fi module (requiring 3.3V) and the Arduino (requiring 5V). The soil and tank water levels are also monitored by sensors. Non-contact range detection is achieved with the help of the waterproof ultrasonic JSN-SR04T sensor. To calculate how far away something is. It has a range of 2cm at its closest and 4m at its furthest. A 5V DC power source is suitable for use with this device. The level of moisture in the soil is determined using a sensor. It's has 2 probes that you can adjust to change the resistance. When there's more water in the soil, the probes can communicate more easily with one another and encounter less resistance.

CONTENTS

a.JSN-SR04T Waterproof Ultrasonic Module

Two pins, named Trigger and Echo, on the waterproof ultrasonic sensor are used to determine the distance to an item by sending out sound waves and measuring how long the resulting echo lasts[7].

Wi-Fi Module with ESP8266

It's the most popular IoT gadget since it's so easy to use and doesn't cost much money. While the ESP8266 module's needed hardware connections are simple, there are a few power considerations to

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keep in mind:

Powering the ESP8266 with 5 volts can damage it. Note that the ESP8266 requires 3.3V serial communication and does not accept 5V inputs. Since the microcontroller used in most Arduinos is a 5V device, level conversion is required for communication. Cellular Phones That Use the GSM Standard, or C.GSM MODEM:

To connect to a GSM wireless network, you'll need a GSM modem, which is a specific kind of wireless modem. Like a regular cell phone, it has a SIM card slot and may be used with a data plan from a mobile provider [8]. Both external devices and PC Cards/PCMCIA Cards may function as GSM modems. Connecting a GSM modem to a computer through a serial connection or USB cable enables the computer to send and receive data via a mobile network. While most often used to link mobile devices to the web, many GSM modems also support SMS and MMS messaging. To communicate with other devices, the GSM Modem uses radio waves.

WORKING:

An ultrasonic sensor is included into the tank monitoring module's circuit. Indicating a running motor for water inflow, LEDs light up until the water level falls below a certain threshold. The code is stored on an Arduino board, which also reads data from ultrasonic sensors. Water levels are shown on an LCD screen. The water tank's floating pad and ultrasonic sensor are installed outside and within, respectively. The ultrasonic sensor determines the depth of the tank when the floating pad is at the bottom of the tank. The tank fills up as soon as the engine is turned on. The pad floats on the water's surface to show how high or low the tank's water level is. Every 1000 milliseconds, the ultrasonic sensor on the floating pad updates the mobile app with the latest distance reading. When the sensor detects that the tank is full, it alerts the system, which then immediately turns off the water supply [9]. The UART, or Universal Asynchronous Receiver Transmitter, is a device used to convert serial data to parallel. Input to the Arduino comes from an ultrasonic sensor. The Blynk server receives the upload of this information. The Android app makes it possible to see it on a mobile device. The Arduino Integrated Development Environment was used to create the Arduino software.

Android Studio was used for creating the mobile app.

A server request is sent from the application. When a request is sent to the server, it returns the desired value, which may then be seen in the relevant application [10].

When sensor readings are below a certain threshold, an LED will light up. The information on the water level is sent to the user through the internet via the wifi module. The water level may be checked from the comfort of one's own home by use of a mobile application.

CONCLUSION

The proposed smart irrigation system will be beneficial since it would maximise irrigation while combating water scarcity by encouraging more responsible water use using cutting-edge Internet of Things (IoT)-based technology. The needs of various crops may be accommodated by adjusting the smart irrigation module. All of this information may be saved on the server. An effective irrigation

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system and larger yield would come from the system retrieving data from a server based on the crop chosen by the farmer through a mobile application.

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