

AN AUTOMATED SMART WATER LEVEL INDICATOR USING IOT-AN EFFECTIVE PRACTICE OF SMART IRRIGATION

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ABSTRACT:

India is a country whose primary livelihood of the people is the agriculture. The Indian economy is based on agriculture -about 70% of its population depends on agriculture and it contributes to 1/3rd of the national income. About 14.7% of India's growth depends on the agricultural sector, so it's a huge cause of concern. Sometime excess of water and some deficiency of water makes crop difficult to grow. In such situation automation play an important role to maintain water level without human interaction. Indian monsoon being erratic in nature, there is irregularity in the distribution of rainfall throughout the year. The irrigation system helps the farmers to be less dependent on rain water. Balanced irrigation has been considered essential for optimal development of crops. Superfluous irrigation leaches nutritive elements of the soil as the water seeps down due to the gravitational force of earth. It also causes water logging. Similarly, scant irrigation can be harmful as water does not reach the lithosphere. Irrigation practices in India need constant monitoring. This proposed paper focuses on reducing the water wastage by using smart irrigation. It discusses how Internet of Things (IoT) can be used to achieve optimal irrigation by continuously monitoring the water level. It also discusses how water supply can be maintained using the proposed mobile application.

KEYWORDS:

Internet of Things; Arduino; irrigation; water tank; waterproof sensors; ESP8266 WiFi module.

INTRODUCTION

With India's population crossing 1.3 billion in 2016, a balance between the optimum population growth and a healthy nation is far to be achieved. Despite of being self-reliant in food production, starvation death is frequent in India. Water shortage in India is also a particularly acute crisis. Between 1947 and 1967 India underwent the Green Revolution, resulting in a huge increase in agricultural production, making India one of the world's biggest exporters of grain. Unfortunately, this huge surge in agriculture requires significant water resources for irrigation and to accelerate the onset of present water shortages.



This paper focuses mainly on reducing the wastage of water and minimizing the manual labour on field for irrigation. It is providing an alternative to a primitive method of irrigation in which an alarm intimates a farmer when water reaches a certain level of the tank. The farmer then shuts off the alarm manually and closes the water inlet to stop the supply. Water leakage from the tank or a damaged alarm can result in the wastage of a valuable resource. The proposed system will allow farmers to continuously monitor the water levels inside the

water tank and the moisture level in the field, controlling the supply remotely over the internet. When moisture goes below a particular level, sprinklers would be turned on automatically, thus achieving optimal irrigation using Internet of Things.

IoT helps organizations and individuals access information, facilitating major decision making processes. It revolves around increased machine-to-machine communication and reduced human-to-human or human-to-computer interaction. It refers to a wireless network between objects. It enables new forms of communication between people and things, and between things themselves. An object can be a physical device, building, vehicle, machinery etc ..embedded with electronics, software, sensors, actuators and network connectivity to collect and exchange data. Things are able to take actions on their own initiative; thus human-centric mediation role is eliminated. The Arduino board, a microcontroller, controls the digital connection and interaction between objects in the proposed system, enabling the objects to sense and act.

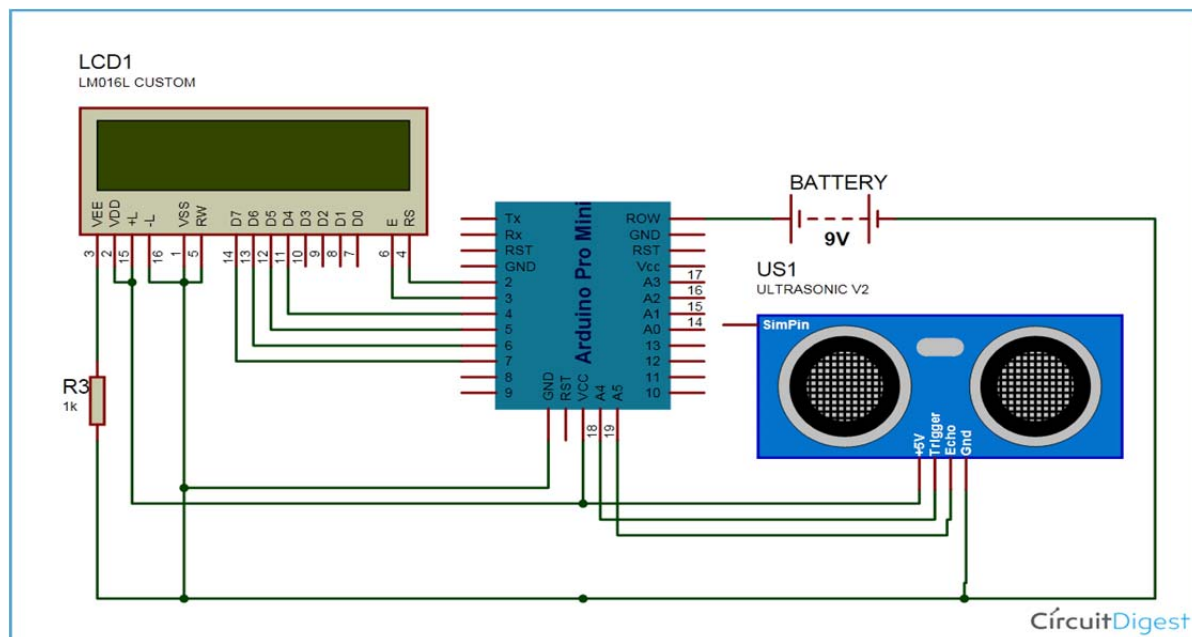
The Wi-Fi module ESP8266 connected to Arduino contains TCP/IP stack which enables the microcontroller to access the Wi-Fi network. Also, with its powerful on-board processing, various sensors and other application specific devices can be integrated to it. The Arduino Integrated Development Environment connects to the Arduino to upload programs and communicate. In the proposed system, sensors detect the level of water and send readings to a fixed access point, such as a personal computer, which in turn can access irrigation modules installed in the field or the physical module in the water tank, wirelessly over the internet. [4]

II.RELATED WORK:

A.TANK OVERFLOW CONTROL MODEL

The tank overflow control model is a primitive method in which a wire is introduced at a desired water level inside the tank. When water reaches this level, it touches the open wire and completes a circuit resulting in an alarm to notify the farmer. The farmer then shuts off the alarm manually.

In case of water leakage, the buzzer will never go off and the motor may keep running for a long duration, causing wastage of water and electricity.[6]



B. AUTOMATED IRRIGATION SYSTEM WITH IOT:

This proposed system uses a technique for irrigation in which the farm is periodically irrigated using the sprinkler, with a certain volume of water. The irrigation stops automatically once the given volume of water has been sprinkled.

This system doesn't take the moisture content of soil into consideration before irrigating it. This may result in the farm getting over irrigated if the moisture content of the soil is already high. [1]

C.THE SOIL MOISTURE CONTENT MONITORING AND IRRIGATION SYSTEM CONTROL, WHICH IS BASED ON INTERNET OF THINGS

This model calculates the soil moisture and irrigates the farm accordingly. The soil moisture content is not monitored continuously. Once water has been sprinkled, it doesn't check if the moisture content of the soil is sufficient.

III.PROPOSED SYSTEM

The proposed system allows users to continuously monitor the water level in the tank, remotely on a mobile application through internet. The mobile application can be used to shut the water supply automatically, irrespective of the physical location of the user, provided the user has internet connectivity.

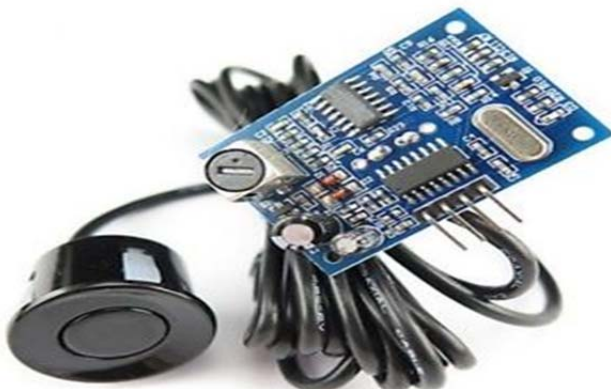
Thus the task of switching off the motor manually has been automated. The smart irrigation system can be installed in farms to monitor the moisture content of the soil continuously. It would turn on the sprinklers automatically when water content of the soil goes below a certain level. The user can check if the farm is well irrigated remotely on the mobile application, without visiting the farm. These systems would improve the livelihood of farmers extensively. Extraction of high level information from raw sensory data is one of the most important aspect of IoT. The machine interpretable data is processed to obtain useful information, which is the basis of implementation of the proposed model.

The Arduino board, a microcontroller, is the main component of the system. It controls the digital connections and acts as a bridge between the sensors and the mobile phone application. The Wi-Fi module connects the Arduino board to the hotspot providing access to the Internet. The Arduino board then transmits the readings to the mobile application over the Internet. The Wi-Fi module used is ESP8266. The ESP8266 provides internet to Arduino to facilitate communication between Arduino and Android device. The module consists of 8 I/O pins which are (TXD, RXD, CH_PD, GPIO0, GPIO2, GND, RST, and VCC). It should be provided with an external voltage of not more than 3.3V, to avoid heating. Before coding, the module should be flashed, to update the firmware with proper baud rate. It can be connected to Arduino's 3.3V pin or a separate 3.3V and 500mA supply. However, the Arduino works at 5V. If the TX and RX pin of Arduino and Wi-Fi are connected, the circuit may become unstable and get damaged. Hence, a battery eliminator is used to provide 3.3V to the Wi-Fi module and 5V to the Arduino. Sensors measure the water level inside the tank and the moisture content of the soil. The waterproof-ultrasonic JSN-SR04T sensor is used for non-contact range detection. It can be used to determine the distance to an object. Its minimum range is 2cm and maximum range is 4m. It can be powered using a 5V DC power supply. Soil moisture sensor measures the moisture in the soil. It has 2 probes which act as a variable resistor. Higher water content in the soil results in better conductivity between the probes and a lower resistance.

IV.COMPONENTS USED:

A.Waterproof Ultrasonic Module JSN-SR04T

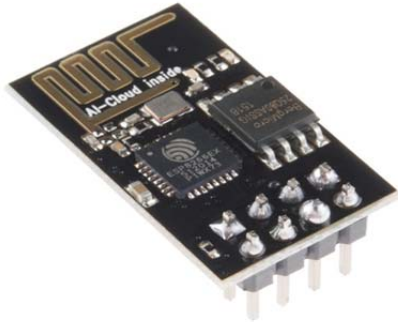
The waterproof ultrasonic sensor has two pins: Trigger and Echo, which are used for calculating the distance of the object by generating sound waves and thus calculating the time duration of the echo that is generated.



B.ESP8266 wifi module

It is the leading IOT devices in the world in which it is very cheap and effective to use. The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power:

- The ESP8266 requires 3.3V power—do not power it with 5 volts!
- The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs.so you need level conversion to communicate with a 5V microcontroller like most Arduinos use.



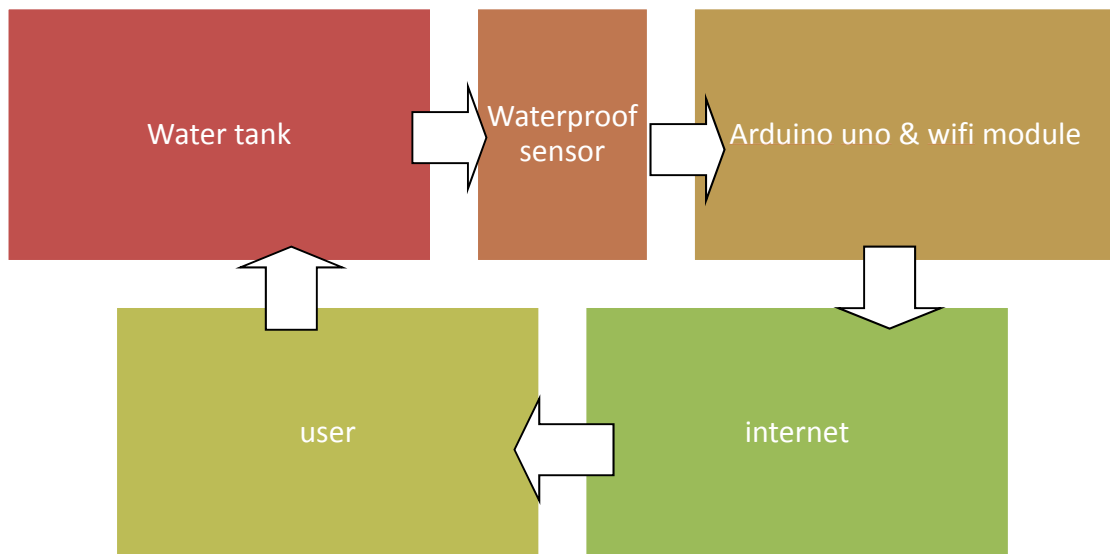
C.GSM MODEM:

A GSM modem is a specialized type wireless modem that works with a GSM wireless network. It accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be an external device or a PC Card / PCMCIA Card. An external GSM modem is connected to a computer through a serial cable or a USB cable, When a GSM modem is connected to a computer, this allows the computer to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS message. GSM Modem sends and receives data through radio waves.

V.WORKING:

The circuit for tank monitoring module consists ultrasonic sensor to measure water level. LEDs glow till water level is below threshold value, showing a running motor for water inflow. Arduino board stores the code and obtains reading from ultrasonic sensors. LCD is used to display the water level. The ultrasonic sensor is planted on top of the water tank and a floating pad is placed inside the tank. When the floating pad is at the bottom of the tank, the ultrasonic sensor calculates the depth of the tank. As the motor is switched on, the water level in the tank starts rising. The floating pad floats on top of water in the tank, indicating the water level. The ultrasonic sensor detects the distance of the floating pad periodically (every 1000ms) and changes are reflected in the mobile application. When the tank is full, the sensor notifies the system, which shuts down the supply of water automatically.

Universal Asynchronous Receiver Transmitter (UART) is used for translation between serial and parallel data. The ultrasonic sensor provide data to the Arduino. This data is uploaded on the Blynk server. It can be seen on an Android device through the application. We used Arduino IDE for writing Arduino programs.



For developing the mobile application, we used Android Studio.

The application sends a request to the server. The server responds by giving the requested value, which can be seen on the application.

LED starts glowing when the reading from the sensors falls below the threshold values. The wifi module sends the water level indication details to the user through internet connectivity. By using the mobile app, the user can monitor the water level from the home.

V. CONCLUSION

The proposed smart irrigation system will act as a boon by optimizing irrigation while addressing the issue of water shortage by inducing judicious use of water through innovative IoT based technique. The smart irrigation module can be modified according to the specific need of different crops. This data can be stored on the server. Based on the crop selected by the farmer on the mobile application, data would be retrieved from the server and the system would adjust itself accordingly, resulting in efficient irrigation and increased harvest.

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BIOGRAPHY:



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