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RESEARCH ARTICLE

IoT based Automatic Water Level Monitoring and Controlling System

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ABSTRACT

Yet just 3% of the water is fresh water suited for human consumption, despite the fact that 70% of the earth's surface is covered by water. Also, due to the expanding urban population, water conservation is essential in the modern environment. Most of the time, water spills when filling the overhead tanks, causing severe water loss for regular human needs. In order to address this issue, the IoT plays a major role to effectively utilize the water. Smart Water Level Controlling System [WLCS] was built on the Internet of Things and mobile devices has been developed to reduce the water wastage. This model can be used in any environments that can assist the wastage of liquid resources. This efficiently reduces water loss by keeping track of the volume of water in the overhead tank of home and notifying the user. This method makes it very comfortable for the user to regulate the system via mobile phone, preventing water loss from overhead tank overflow and also underflow. The total model can be monitored and operated using mobile phone or the web that includes the usage of water, level of water, leakage of water and also the other parameters like temperature etc.

Keywords: Internet of Things, Cloud, IoT Node, Sensors, M2M

INTRODUCTION

Water distribution is one of the concerns that receive less attention in metropolitan environments. Water-related problems abound, but one minor one is conflict between residents in flats over access to water that meets their needs. Water is the primary element used in daily living, whether for home or commercial purposes. Our ecology is being negatively impacted by excessive water waste. Water shortages brought on by excessive wasting may trigger a variety of environmental issues, including droughts, climate change, rising pollution, and increased human demand. It is crucial to use and manage water properly because fresh water is not readily available in large quantities. It is vital to keep a watch on water waste in all areas, including residential, commercial, and industrial setups. There is an immediate need to have an eye on the wastage of water across various sectors. This project's goal is to create an automatic water tank level and pump control system that has a variety of features for controlling the water pump in accordance with the amount of water in the storage tank system. An ultrasonic sensor positioned on the storage tank is utilized to detect the water level. This sensor is used to determine when the water level in the overhead tank is higher or lower. Node MCU controller is used to automate the process of pumping water to the overhead storage tank. In accordance with the information received, it operates the sensors that measure the water level and turns on and off the pump.

1. To design an automatic water tank level mechanism monitoring and to control the level of water quantity in the tank.
2. To keep track of the water level in the tank, which determines how much water is stored inside, to determine if it drops below a predetermined level while the motor is on and rises when it is off, eventually rises when the water is cut off.
3. To display the state of pump, levels of water and the level of main tank
4. To ON/OFF automatically by monitoring the water level in the main tank.

In most recent years, the adoption of internet and its applications has expanded quickly. Without the internet, it would be challenging because everyone depends on it for their profession. Moreover, wireless sensor networks—low power gadgets comprising a processor, storage, power supply, a transmitter, and one or more sensors—are becoming commonly employed. In this project, we will integrate these two in order to collect data from the aquatic environment, present it on the website, and do so utilizing wireless networks. A network of locally intelligent devices (such as sensors and actuators) known as the "Internet of Things" (IoT) shares control mechanisms to push and pull status and command information from the networked world. Internet of Things, then, refers to a network of physical devices that may collect data from sensors and transmit it to a server or computer across a network. The Machine to Machine (M2M) communication, which is capable of communication without human intervention, is also closely tied to the Internet of Things. This paper will define the system that will channel water from the first to the final user in the utilized environments. The primary reason for using IOT is its global networking capability to automatically control and monitor the level of the overhead tank without the need for human involvement. Also, by connecting to the Blynk server, we can monitor and operate the complete system from anywhere in the globe.

LITERATURE REVIEW

The authors in [1] offered a concept for a water level monitoring system that incorporates a PIC microcontroller and an LCD screen to alert the person in responsibility. The water level is continuously monitored, and when it reaches the critical level, the data is displayed on the LCD display panel. To reduce the possibility of water scarcity in the water supply, the system has been checked for proper operation. In paper [2] the researchers offered a concept of water level management using ultrasonic sensor (automation) to determine the level of the water and displaying on the LCD screen using ultrasonic sensor. The paper [3] proposed the design of monitoring system of the water level with an incorporation of GSM module which is too vigilant to the person in-charge by the help of Short Message Service (SMS). The water level is continuously monitored, and information about the issue has been sent via SMS to the appropriate in-charge phone. To reduce the possibility of water scarcity in the water supply, the system has been

checked for proper operation. This notion of the PLC ground automated operation of detection of water in monitoring & distribution system was put forth in [4]. It enables us to detect the water monitoring automatically in accordance with the usage in specific locations. In [5] the authors proposed the Automatic water tank level monitoring and controlling system using Arduino uno board the system automatically controls the levels of water preventing the overflow from the overhead tank and controls the pump if the level of water is below the determined margin in the overhead tank. The authors in [6] proposed the indication of the water level with LED'S using Arduino uno. The red light used to indicate the water is about to finish and the green light used to represent that water in the tank is about to fill. Here we are using the IoT based system for controlling and monitoring of the water or any liquid crystals that makes more interactive interface to be operated.

Proposed Model

The goal of this work is to implement an automated water tank and pump to control the system that automatically regulates water/liquid levels to avoid overflow from the overhead tank and controls the pump if the level of water/liquid is below the established margin in the overhead tank. In this project, we have extended the water level monitoring and control by using the cloud platform and internet as shown in fig.1. There is possibility of multi-device connected by using Blynk apps and open ended cloud platforms. By using Blynk, the device can be monitored and controlled using mobile device and web control across the globe. The sensing part of the performing system includes ultrasonic sensor. The sensing information is being given to Node MCU. The Node MCU is configured to turn on the pump and buzzer automatically when the water/liquid level falls below a certain threshold. As the water/liquid level drops below the set level, the buzzer begins to buzz in high frequency. The controller activates the pump when the water/liquid level reaches the crucial level, and it begins pumping the liquid. The water/liquid will continue to be pumped and the tank will continue to fill without any issues. The water/liquid buzzes with a low frequency sound when it reaches a predetermined maximum level, and the pump turns off automatically if the tank is full.

Experimental Setup and Results

This system can monitor the level of water just by using our mobile phone from anywhere in the world. The only thing that we need is a Wi-Fi network in the vicinity of our tank. We made this project using a Node MCU esp8266 Wi-Fi module, ultrasonic sensor, and Blynk app. On the top of the water container lid, we place an ultrasonic sensor to read the level of the water container. The ultrasonic sensor is used for distance measurement by sending ultrasonic waves. The basic principle of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment, they return back to the origin as ECHO after striking on any obstacle. The only calculation of this system is the traveling time of both sound waves (outgoing time and returning time to origin after striking on any obstacle). And after few calculations it is possible to get the results Node MCU processes the data and gives us the data of water level and valve/pump status is saved with a timestamp. Each and every data obtained from the node has its timestamp and the Microcontroller node (Node MCU) transmits data to the Blynk server. The Blynk server also provides configuration information to the microcontroller. Water container height, Max upper-level limit, lower-level limit, mode, and on/off the pump are configuration parameters that are broken down into two modes, auto and semi-auto. If the water level is below the lower-level limit and the pump/valve is in automatic mode, the water will automatically fill the container and stop when it reaches the upper level limit or is equal to it.

In semi-auto mode, the microcontroller operates like auto mode if on/off is in the on position, but if on/off is in the off position, the pump or valve will remain off until on/off is in the on position. Also, we can use a relay module in order to control the motor to fill the tank, sitting anywhere in the world. We can not only just monitor the water level but also (control the Water level) fill the tank from anywhere in the world as shown in fig.2. The different parameters for the water tank like max level of tank, min level of tank, threshold value and also the total capacity of water tank are considered for the evaluation of the work for automatic controlling and monitoring of water tank from anywhere and any place. Table 2 describes the pump on/off scenario and also the status of the buzzer. The flow chart of the

proposed model is given below. The proposed experimental setup was given in fig.3 and fig.4. The water level usage and tank liquid level and temperature of the liquid are given in fig.6, fig.7 and fig.8. The readings can be observed in cloud and Blynk app as shown in fig.3 and fig.5.

Algorithm

Step 1: Firstly, we want to establish a stable private Wi-fi connection to the existing Node MCU System and create a private Blynk server application interface and connect mobile and multiple devices to the connected server.

Step 2: Now pull the data values and measure the distance (height of the water level) by using ultrasonic sensor.

Step 3: Now compare the Water level with the constraint values of MAX and MIN values from the initial values declarations in the code dumped in the Node MCU.

Step 4: If the value of water level is less than the minimum value (Water level<MIN) then buzzer gets buzzes with high frequency of sound and automatically Motor also gets ON.

Step 5: Else if water level is in between the max and min value (MAX<=Water level<=MIN) then buzzer gets OFF, but the motor is still in ON mode.

Step 6: Else water level is greater than max value (Water level>MAX) then the buzzer gets ON and the pump motor Gets turned OFF.

Step 7: The temperature and pressure of the liquid is also observed.

CONCLUSIONS

Here, we created a circuit that uses IOT to control and track the water level in an above tank. Also, it reduces the issue of water waste brought on by improper home monitoring. The essential components are a Wi-Fi device, a Node MCU, and an ultrasonic sensor. To begin with, it must be determined whether our module is linked to Wi-Fi. If connected, it will immediately display the water level on any web-linked devices (mobile) or in the web. It regularly checks the tank's water level. To prevent water loss, the water pump will automatically start if the level exceeds the lower limt that has been established and cease when it reaches the higher limit of the tank. The model is designed in such a way that it saves electricity, cost, and mostly reduces the traditional water overflow challenges. In future we are planning to extend the system with water quality and also the predictive analysis of water usage at a particular scenario.

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Table 1: Hardware and Software Components

SL.NO	TYPE	Description
1	HARDWARE REQUIREMENTS	NODEMCU
		Relay module
		5V Motor
		Buzzer
		Battery
		Ultrasonic Sensor
		Connecting Wires
2	SOFTWARE REQUIREMENTS	Arduino IDE
		Blynk App & Server

Table2. Different levels of Water indication table

SL. No	Water level	Buzzer Status	Pump/Motor Status
1	Min	ON (HIGH FREQUENCY)	ON
2	Min<Water Level<Max	OFF	ON
3	Max	ON (LOW FREQUENCY)	OFF

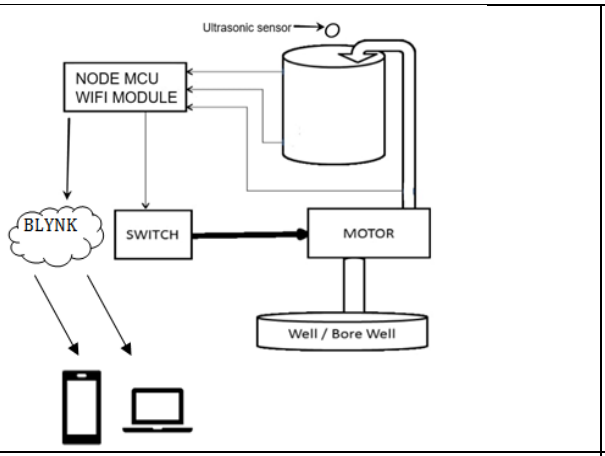

Fig.1. System Model

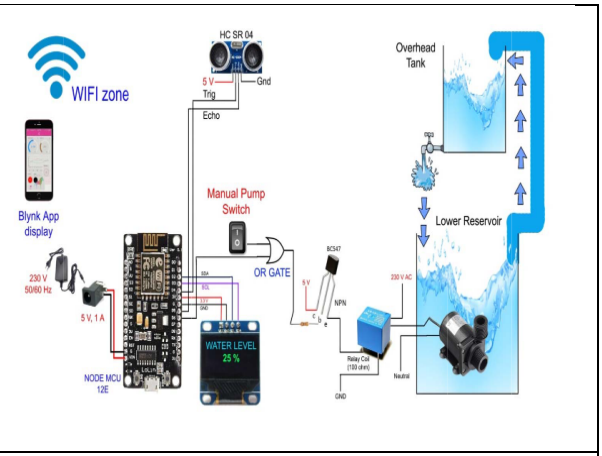

Fig.2. Proposed System using IoT

Fig.3. Experimental setup

Fig.4. System Prototype

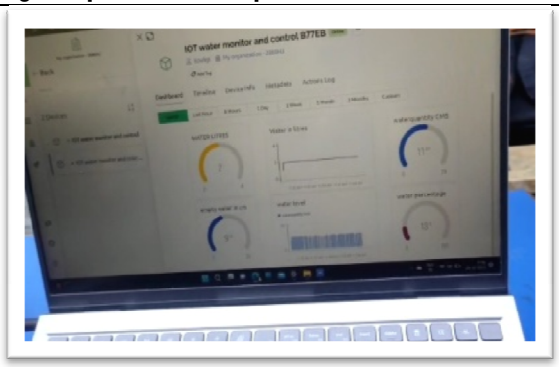

Fig.5. Cloud based representations

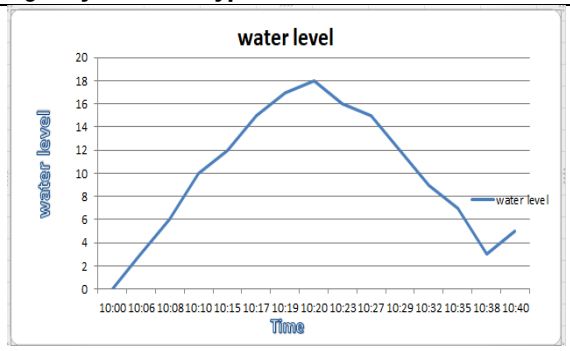

Fig.6. Timestamp based water level usage

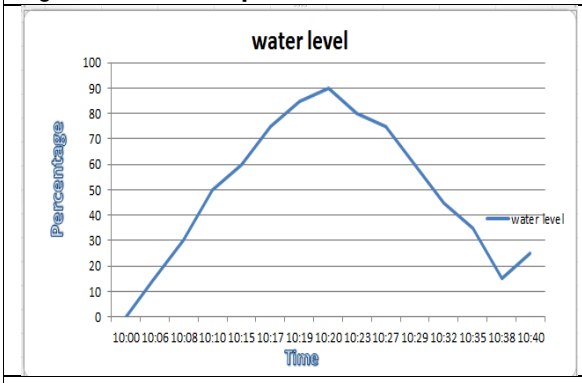

Fig.7. Water Usage

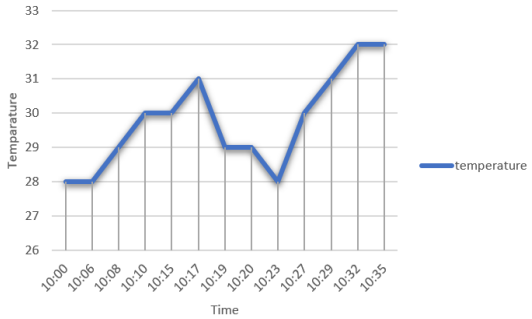

Fig.8. Liquid temperature