Campus Wide Water Management System

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Abstract. The goal of the project is to fetch data on the amount of fluid in the overhead storage container. This project is aimed at limiting the tank's water levels by flipping over the water pump when the water level drops then off whenever the water content is high. As a consequence, the NODE MCU water level analysis and control assist to avert consumption of water. Using Blynk IoT app, this project sends information wirelessly to the user's smartphone. A transmitter circuit is used in this project employing an ultrasonic sensor to determine the level of water in proportion to the distance This information is relayed to the microcontroller, and a local OLED display keeps track of the water level. A relay driver is coupled to the controller, which handles the water pump. The microcontroller dictates when to flip on and off the motor depending on the quantity of fluid.

Keywords: Smart water management, Wireless water level monitoring, ThinkSpeak, MIT app inventor, Cloud computing.

1 Introduction

The water sector is facing new challenges in relation to the long-term administration of sustainable water management. Sensing and actuation functionalities are being established as a result of progressions in radio connectivity [4]. For engineering remediation, current developments in the area of sensor networks are pivotal [2]. There are several behavioral changes, such as addressing environmental catastrophe, famine, and level of urbanization in major metro areas, which make a significant contribution to an escalation of burden [3]. Some of the most pivotal issues that water management must tackle are the allocation of expenditures, the surveillance of non revenue water including the inference of mankinds' preconceptions for financial integrity [8]. As the population is expected to increase, so does the demand for water, prompting the need for better water management. In light of this fact, sophisticated technology, as well as the standardization of more robust management approaches, will be required to better meet water needs [16]. Many regions of the world would see rising water demand, ecological degradation to water supplies, and severe water stress in the past few decades [12]. Water's pivotal and water utilization and the implementation of water pertinent commodities remain minor concerns in public's opinion and government

ITSPWC 2022, May 14-15, Karur, India

DOI 10.4108/eai.14-5-2022.2318880

priorities in some economies [11]. Water transfer among basins, desalination plants, sewage regeneration, and well examination are now used to alleviate the scarcity of water resources [14]. An unceasing water domain would be rolled out through imposing faster convergence, the water, and energy interactions, and certain water loss mitigation either through the finest operation of pressure or smart device deployment [17]. The suggested system is an IoT-based smart environmental monitoring system that empowers consistent water circumstance analysis based on specific criteria [1]. The system emphasizes a circuit to analyse the function of pumping water in a unit. It can measure the concentration of water level, turn on or off the pump, and report the status [9].

2 Problem Statement

The existing water management system uses a traditional method. This may increase the human effort, labor charges and wastage of water. The current water tank is approximately 12 feet deep. The tank should always have 80 percent of its capacity full so that the other tank may be filled. There will be no water delivery to other hostels if the amount of water drops below 80% of the total. To turn on the motor, the waterman must walk nearly half a kilometer every three hours. Furthermore, the majority of the water spills and is squandered. It is difficult for the individual to keep track of the water level. This paper's significant purpose is to dwindle human labor, energy, and water swallow process.

3 Objective

The college campus uses a traditional water management system that necessitates more human work and wastes a significant quantity of water. The flow sensor quantifies the portion of water and emits the data to the waterman perhaps through a mobile platform. Furthermore, the motor may be turned on and off automatically using the mobile app. Using an Android app, the proposed system will provide a comparative study of water to be used, taking into account the number of people at each hostel, as well as water waste levels and daily, weekly, and monthly water analysis reports. This framework assembles a modest embedded system device for problem-solving time water tracking used by concentrating on water saving techniques and automatic ON and OFF of motor switch via mobile application.

4 Components

The following components were made use to build the smart water monitoring system:

A. NODE MCU
B. ESP Wi-Fi module
C. Ultrasonic sensor
D. Relay
E. DOL starter
F. LCD display

A Node MCU

Node MCU generally consists of open source board designs which are prototyping. It is an open source firmware. The name "Node MCU" is a combination of the words "node" and "MCU" (micro-controller unit). This word generally refers to the hardware based other than the augmentation kits that go with it.

B ESP Wi-Fi module

The ESP8266 is a Wi-Fi microchip and it is a competitive module, with built-in TCP networking software and microcontroller. It is small in size and allows connecting a microcontroller along with a Wi-Fi network by making simple connections.

C Ultrasonic sensor

An ultrasonic sensor is a device which can send ultrasonic sound waves to figure the distance to the particular item present. Ultrasonic sensor consists of a transducer which can discharge and receive those pulses that propagate information about the proximity of those items.

D Relay

A relay is an electrically actuated or deactivated nozzle. The electromagnetic induction principle governs the behavior of a relay. When a power is applied to an electromagnet, it produces its own magnetic field around it. Relays have the tendency to change one or more circuits. In a relay, each breaker is referred to as a pole. Throws indicate how often circuits a relay joins. The electromagnetic induction principle governs the behavior of a relay. It falls within the scope of this theory.

E DOL starter

A DOL starter also characterized as a direct on line starter or across the line starter is a three-phase induction machine starting framework. An electric motor is highly correlated across its three-phase input in a DOL starter, and the DOL commencing utilizes the complete line voltage to the collector terminal.

F LCD display

Instead of relying on a backlight or monochromator to create hue or monotone imagery, a liquid-crystal display is a perfectly smooth screen or perhaps other dynamically manipulated electro - optic equipment that shutters light. LCDs can be switched on (positive) or off (negative) according to the modulator setup (negative). Resonators are deployed that provide the distinctive design of white and blue LCDs.

5 Methodology

The proposed system includes an ultrasonic sensor, LCD display, relay, DOL starter, and ESP8266 Wi-Fi module for data transfer (Node MCU). The Arduino uses less power and has a tiny footprint, which is ideal for critical point-of-sale technological criteria. An on-chip ADC switches conventional sensor senses to digital medium for further computation on the MCU. The sensor's measured value will be routed to the MCU's microcontroller, whereas the other two sensor responses will be hooked up to the MCU entities' microcontrollers to acquire this analogue output. Esp8266 is an extremely affordable Wi-Fi module with a complete TCP/IP protocol Wi-Fi microchip and a microcontroller chip. Considering their enhanced cache storage, the code launches from exterior flash promptly during computation of the program, boosting system efficiency and diminishing memory footprint. It's trivial to set up a Platform using the Wi-Fi Module. The Node MCU uses the “pulseIn” function from the Arduino IDE to calculate the time taken for the sound waves to hit the obstacle and come back and after that uses mathematical functions to provide us with the water level's altitude. The LCD display is interconnected with the I2C panel, which enables it to minimize the number of pins necessary to connect the LCD. The I2C device limits the number of ports to only four. The LCD displays the distance range in between moisture content and the peak, including whether the motor is on or off. The distance data is used for a control action in which a relay and a water pump is used which always maintains the water level between 30-70% of the height of the tank. One wire of the pump is grounded, and the second wire is inserted into the NO output of the relay. The common output of the relay is given with a 12V DC supply with the help of an adapter. In the input of the relay we have a VCC which has 5V DC supply, the GND pin is grounded.

And the IN(input) pin we give a signal from the Node MCU but since the output is of digital state 3.3V. It is first amplified using a BC547 transistor and then given to the relay which converts the 3.3V state to 5V so that the relay can understand the value. The NO output is disconnected when the IN is set LOW and connected when IN is HIGH till the distance reaches 70% so that the pump is ON and will get LOW when the distance reaches 70% and the pump is switched OFF. Fig. 1 depicts the block diagram of the proposed model.

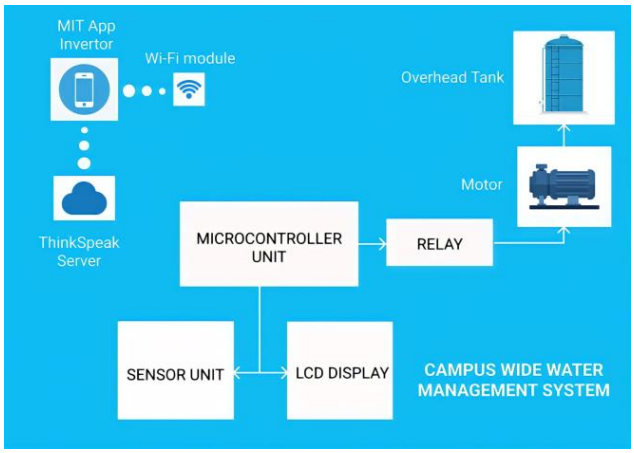

Fig. 1. Block Diagram

6 Software used

This system is built using MIT app invertor and ThinkSpeak server for the prominent accessibility of water management systems. MIT empowers inexperienced software developers to design software applications for two platforms, Android and iOS. It leverages a graphical interface akin to coding, allowing users to plug and play visual elements to develop a tool that can host on both Android and iOS standards.

ThingSpeak is a way of collecting data for the Internet of Things (IoT) that scrutinizes digital readings by the utilization of sensors such as ionic strength, turbidity, temperature, voltage, altitude, current, and so on. The respondent records information from locally advanced handsets such as the Node MCU/ESP8266 and retains it in a software application for archival hypothesis testing.

7 Conclusion

A design is implemented employing IoT to regularly review the water stratum of an over tank that could be tracked and managed conveniently using a software platform. It also minimizes the amount of water loss caused by a lack of effective construction supervision. It is composed of three components: a wifi transmitter, a Microcontroller unit, and an ultrasonic sensor (HC SR 04). To commence, it is needed to look after if our unit is hooked up to the internet through use of WiFi. The level of water will then be depicted just on LED including the smartphone if it is paired. It keeps a close watch on the level in the tank throughout all instances.The pump will eventually begin when the water hits the predetermined set lower level, and it will stop when the water reaches the specified set higher level which overcomes the wastage of water. Fig.1 depicts the simulation model of the proposed system.

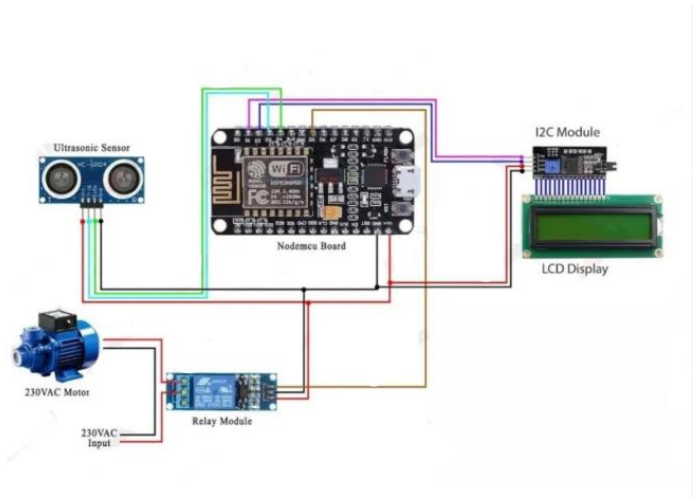

Fig. 2. Simulation Model

8 Results and Discussion

The suggested technology aids in the conservation of water in each hostel, hence decreasing manual workers, energy, and time. It also facilitates a person's ceaseless surveillance of the tank's water level.

In the elimination of this arrangement, someone should consistently be on board to constantly check on the tank level and toggle the motor on and off.

The proposed alternative enhances overall administration and lessens a certain effort and energy. Even if no one is around, the mechanization saves water and diminishes human labour. The framework comprises a NODE MCU with a sensor node that diagnoses the level of water almost every ten seconds and interpretation of the findings on the Arduino IDE digital display. A Wi-Fi module is utilized for real-time monitoring, which would update the ThingSpeak server every 20 seconds with different metrics.Through the ThinkSpeak server, the water level can be monitored by a graphical display.

The level of water in the tank and the tank level percentage can be continuously monitored in the ThinkSpeak server in the created fields for regular intervals.

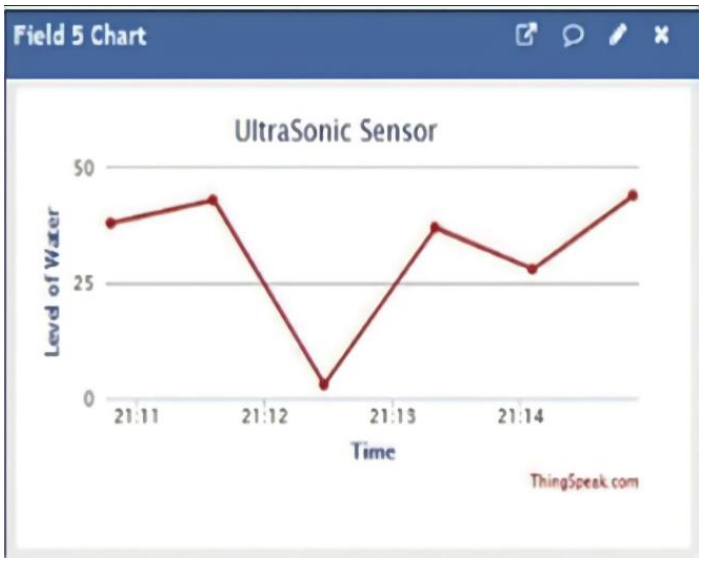

Fig. 3. Graphical representation of tank level

Fig. 4. Graphical representation of water level in percentage

9 Future Work

Water Quality Measurement -When a solenoid valve is being used in industry to hoist water from a lower storage or a surrounding wetland or river, sludge, sand, gravel, domestic trash, unwanted materials, and polymers can clog the pipework connected to the motor. As an outcome, we should use Turbidity sensors to check the water's basic standard. It influences how often light is diffused by dissolved microparticles in the water. The surface tension of water increases with the proportion of additional solids in suspension in the water increases. A pH sensor, on the other arm, is used to examine the acidity and quality of the water

Rain Water Storage - Demand for water will strike 30-40% of the global total by 2025, and climate variability, as per the research, would worsen the situation. Scarcity of water will influence a predicted 1.8 billion individuals by 2030, with three quarters of the world's inhabitants in drought-prone areas. It is able to prevent desertification resulting from water runoff after intense rainfall by conserving rainwater on a slope or mountain. Rainwater harvesting structure is a simple way to implement, requiring minimum care. As a result, preserving filtered water is imperative. Rainwater is a primary factor of it. As a conclusion, our long-term approach is to build a rainwater reservoir for legitimate purposes.

10 Acknowledgements

Our gratitude passes on to Dr.V.KUMAR CHINNAIYAN, M.E., Ph.D., Professor, Head of the Department, Electrical and Electronics Engineering, for his valuable support and encouragement during this project. We are grateful to Ms. B. Lalitha M.E., (Sr.G), Assistant Professor, Department of Electrical and Electronics Engineering, the Project Supervisor for her timely suggestions and constant encouragement and support that led to the accomplishment of the project.

11 Literature Review

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This document portrays a remedy of water stress that many civilizations and the world confront in the twenty-first century. The intended study centered on IOT-based surveillance systems, execution, and management of multiple water distribution. Ultrasonic sensors and a Node MCU were being used to create the tracking system. This is characterized by non-water level control. The system distributes water from the roots or dam to numerous tanks, in which it is pumped to tanks by motors. Each supply is connected to each tank via solenoid valves, which are used to drain excess to each tank.

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The objective of this proposed article is on the concept of water level monitoring and performance in the field of water ionic conductivity. It demonstrates the exploration of microcontroller-based water level

sensing and control in both a wired and wireless setting. The use of a water level control strategy might help to reduce both household electricity usage and water excess. It can show how much water seems to be in the tank and enable Global Water varieties such as cellular data loggers and satellite data communication systems for distant water management.

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