Technical Journal, University of Engineering and Technology (UET) Taxila, Pakistan Vol. 24 No. 4-2019
ISSN:1813-1786 (Print) 2313-7770 (Online)

Automatic Water Tanker Filler Using Iot With Adafruit Cloud

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Abstract- This is a NodeMCU base regular water level manager and pointer base research work. In this research papers, we are going to compute the level of water by using sound sensors. The sound sensors utilize the theory of "echo". When the sound effects are transmitting, they return without any difficulty. Hence, by using this rule we can compute the time of move for leaving as well as recurring. By calculation, we can get the distance. We can set the motor pump turns ON by design when the water level is less in the water tank. There is a lot of drinking water tragedy in Pakistan, and also in other countries. In Pakistan, we can see many houses as overloaded tanks and they keep on overflowing water. It wastes a lot of water as well as electricity. If we don't do anything then we will face a huge shortage of water. Here we are going to apply a mechanical water level organizer for the reason we no longer have to manually switch ON and OFF the motor. There are two options; first, we can set the water filler on automatic mode and the second one we can turn it the automatic mode off. When the automatic mode is off the motor is no going to be on. These two modes can be controlled by using the AdaFruit cloud. AdaFruit cloud sends and receives the data by using MQTT. The device automatically monitors the water level and hence triggers the relay which in turn triggers the motor. This helps in reducing the wastage of water as electricity. This also reduces manpower as we no longer need to operate it manually.

Keywords- NodeMCU, AdaFruit Cloud, MQTT, Transmitting, Echo, Trigger.

I. INTRODUCTION

Water is an important natural resource that should be used more efficiently. In the daily routine system, users are supposed to visit their water tank to check the water level. The uncontrolled use of water leads to wastage of water and it causes water shortage. Water automation is a process which is an automatic system to use water. The basic idea of water automation is to confirm the proper use of water and reduce the human effort. It is used for different purposes such as irrigation in the agricultural land, water pump controlling, water usage monitoring, billing of water usage, etc. in different places like a family unit, industry, hotel, etc. Water is an essential thing for life from the beginning of the earth. Water automation is a process which is an automatic system to use water. The basic idea of water automation is to ensure the proper use of water and reduce the human effort. It is used for different purposes such as irrigation in the agricultural land, water pump controlling, water usage monitoring. The process of scheming water tank uses the manual system yet. The huge amount of water is wasted every day for using manual processes around the world [1].

The continuous wastage of water for manual use is reducing the water level of the earth due to which a lot of lands are coming slowly in the zones of un-irrigated land. In the daily routine system of the water tank, the user needs to present at the water pump to turn it ON and OFF. There are two options; first, we can set the water filler on automatic mode and the second one we can turn it the automatic mode off [2]. When the automatic mode is off the motor is no going to be on no matter what's the water level is. These two modes can be controlled by using the AdaFruit cloud or by Short Service Message. AdaFruit cloud sends and receives the data by using MQTT [3].

Researchers have implemented several water automation research projects based on water pump controller, water level detection, water detection and control of water leakage. Today technology of the water storage system consists of a mechanical sensor and water pump. When the water decrease from the actual level the mechanical sensor will detect that situation and it will generate the signal ON to the motor. After that when the water reaches the actual level, the mechanical sensor will generate the signal to switch OFF the water motor [4]. The condition of the motor and automatic sensor located in the water tank cannot be determined by the consumer because there is no indication system in the water tank system.

As a solution to this problem, the water Tank level controller is designed. There is a lot of compensation if the users overcome the existing water tank system to the water tank level controller system [5]. The main advantage of the system is it can prevent the motor from damage after long-lasting usage, the design is also capable to reduce electricity billing and energy utilization [6].

II. Literature Review

An automatic water level indicator was shown in [7], which system is used 4 different probes with the name of 1, 2, 3 and 4. These probes are placed at the different levels of the water tank in the way like 2, 3 and 4th probe will sense the water and 1st probe will be used as a reference level to above three probes. Three different coloreds LED is used in this research work which is connected to three transistors. Naked ends of these 4 probes are connected within the water tank through a rod. Wire length is adjusted according to the probes so that the required water level indicated. The working process of this system is the circuit contains four exposure probes, named 1, 2, 3 and 4. Which are submerged at unlike levels of the water in the tank. A little filled (level 1), half-full (level 2) and filled (level 3). The circuit is assembled in the way that three LEDs used here of different color signals at different water levels. A relay is used here to provide current to the motor [2] [8].

When the voltage is supplied, the water is indicated by the 3rd and 4th probe a small current flow from resistors and LED just get on through which circuit gets the indication level of water [9]. Same in the way when water is indicated by probe 2nd again small current passes through probe 4th to 2nd and hence connected LED gets turned on and water level can be got. Finally when the water is sensed by the 1st probe current passed from 4th to 1st probe and green LED gets on which means the water tank is full of water [10].

The research work is about a water level controller through SMS notification. It provides updates to the user about the empty water tank as well as the water level in the tank. The research work works under control engineering principles [11]. The research will mechanize the procedure by insertion a particular sensor item in the container that is used at times of obtain dimensions of water and deal with the motor by design [12]. The research work eliminates the hard work of users for every day fill of the tank and checks for the excess of water. Different problems like access to water in the tank of attention, no water in the tank state and motor defaults cause of nonstop use is avoided. Even with elegance, these systems do not clarify the inform water stage of the resource reservoir. Furthermore, through no light circumstance, the announcement is sent to users [13].

In general structure of the system executes under battery influence and consists of 4 circuits operational, sensor circuit, organizer circuit, SMS circuit, and relay driver circuit. This Sensor senses the water level in the tank that is constantly fed to the organizer system [14].

The system first checks the empty level of the tank and then checks the condition of load shedding. The motor will operate only when there will be no load shedding. SMS service can only be functional when the system encountered the load shedding [15]. The motor automatically turns off when the water level is full in the tank. The programmed pump controller declines the exertion of any physical exchanging and human cooperation [16]. This framework deals with the sake of water conductivity. Also this framework has capacity supply as sunlight based power for power reinforcement, which gives the nonstop power supply if there should arise an occurrence of burden shedding which is extremely regular in Pakistan [17]. This task chips away at 5 volt DC with 50 to 60 Hz. It works with 220 volts and with the assistance of venture down transformer where the voltage of venture down from 220AC to 9AC. At that point, the extension of diode convert 9volt air conditioning to 9volt DC and by utilizing 2200uf capacitor and limit the oppose factor and furthermore smoothened the wave [18]. The primary role is in that framework is zener diode and zener opposition. It checks the voltage and keeps up 5volt DC as a contribution to our framework. It will actuate on sun based vitality till the warmth is available and when there is any change happens in force of daylight the framework consequently moves to control reinforcement and get consistent power from the capacity battery. At the point when the low power reinforcement the framework movements to the WAPDA control supply [19].

In the venture, we offered earth to the water tank and spot metallic connections at various dimensions of the water tank. At the point when the hole is loaded up with water between these connections at that point bordering circuit shut and an ebb and flow streamed [20].

III. Experimental Setup

1. Implementation

To calculate the water level of water tanker there are a lot of methods but we are using a separate technique based on the concept of Sonar. We are using an SR04 sensor that contains 'echo' and 'trigger; trigger sends sound waves towards the water when it reaches the surface of the water it bounces back from the surface of the water here echo note the duration till its receiving the reflected sound wave. Now we have duration after which sound wave returns from the surface of the water to the sensor. Here to find the distance we are using the following formulas as below mentioned.

1. Distance = duration*speed of sound/2
2. Speed of sound in cm/s = 0.00343

On the base of distance the attached relay is triggered and motor become in running state when water reaches below specific limit and motor turns off when water level reaches at its peak point motor become off and again turn off when water is below specific point We are using AdaFruit cloud to send and receive data, data is sent via MQTT protocol; which is commonly used for IoT. There are two options; first, we can set the water filler on automatic mode and the second one we can turn it the automatic mode off. When the automatic mode is off the motor is no going to be on no matter what's the water level is. These two modes can be controlled by using the AdaFruit cloud or by Short Service Message. AdaFruit cloud sends and receives the data by using MQTT as shown in Figure 1 purposed architecture.

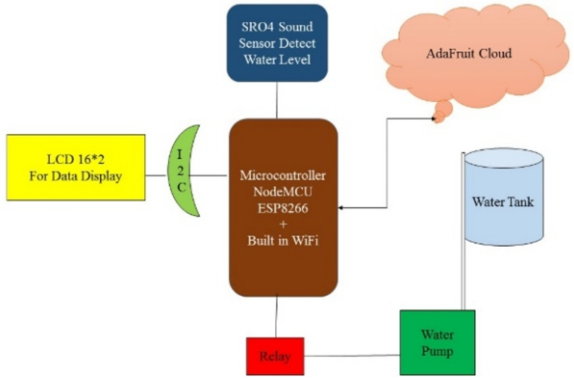

Figure. 1. Proposed Architecture

A. Component based Circuit Description with Hardware

a. NodeMCU:

NodeMCU is an open source firmware and microcontroller as mentioned in Figure 2. It has built-in Wi-Fi which gives us easily and hassle free connectivity with the internet. It is mini in size, but it performs great tasks. All of the sensors and actuators are connected with it like relay, SRO4, LCD and water pump. By using WI-FI it is connected with the AdaFruit cloud. It detect all data from sound sensors and send signal to relevant circuit and control all mechanism as a mini computer, All processing done by using NodeMCU.

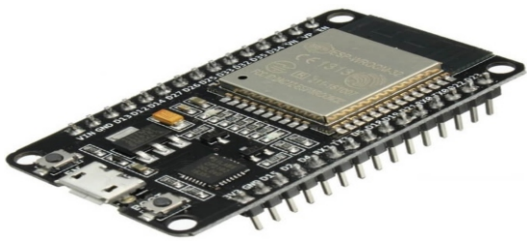

Figure. 2. NodeMCU Board

b. Liquid Crystal Display (LCD):

A display unit knows as Liquid Crystal Display (LCD) as shown in Figure 3. It is used to display data of some sort of message on the screen. It displays an ASCII character. Like light-emitting diode, LCD allows display more thin display then cathode ray tubes.

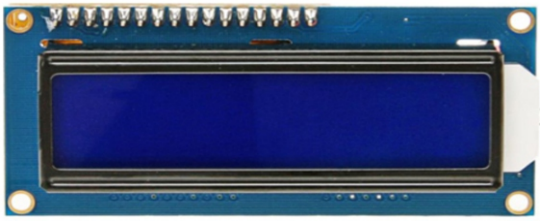

Figure. 3. Liquid Crystal Display for Output

c. I2C:

I2c is a circuit that is used to make the easy connectivity using LCD with NodeMCU.

Figure. 4. I2C Board

d. Sound Sensor:

Ultrasound sensor is also known as the Sonar sensor (SR04) as see in Figure 5. It is used to find out the distance of objects, and its working principle is the same as the working principle of sonar. It has a built-in trigger and echoes. It is used to detect the water level of the tank. As we know the speed of sound which is 343m/s. To get the distance in cm we will use this formula:

1. Distance= (Duration*speed of sound)/2

Figure. 5. Sound Sensor SR04 Board

e. Motor:

Water pump is a device which uses electrical energy to perform mechanical work as shown in Figure 6. By using it we will be able to fill the water tank according to the required quantity. But there is an issue because it cannot be directly connected to the NodeMCU.

To make it connected and for control purpose we are using a relay. Which is also a circuit that can be controlled by applying small amount of current to it.

Figure. 6. Water Motor

f. Relay for Motor:
We will use a relay module which is a circuit can be controlled (ON/OFF) by providing a small amount of current as shown in Figure 7.

Figure. 7. Relay Board

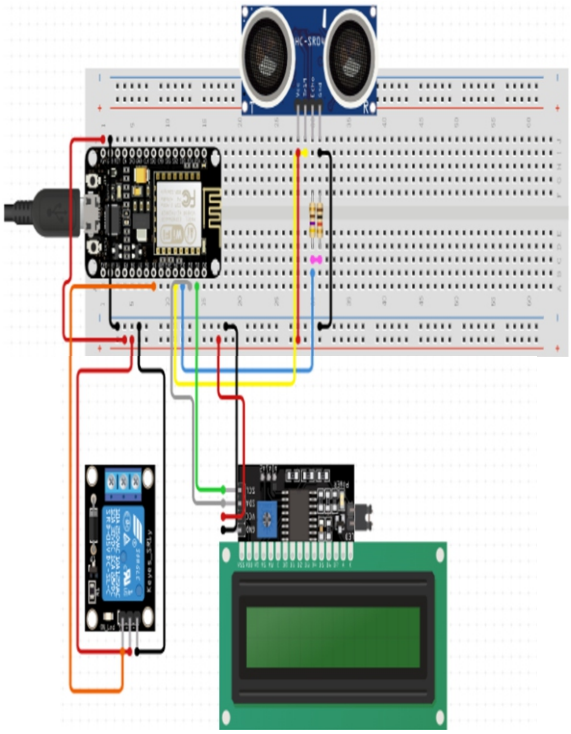

Figure. 8. Proposed NodeMCU Circuit Diagram

2. Proposed Architecture Diagram
Figure 8 shows the upper circuit diagram NodeMCU as a model for the programmed acquisition of water and proposed by the detection system. Show the example of the Internet with all the organs of sensations and clouds, the AdaFruit filling tanker NodeMCU circuit software platform.
Figure 8 shows the NodeMCU model hardware circuit above. Which made this area of the adafruit domain model obscure?

B. Software Details
a. NodeMCU Software:
The ultrasonic sound sensor detects the water level from a water tank. The NXP trigger module send an ultrasonic wave and start counting the time until the echo reaches the receiver. The response time is defined as T, the aerial sound is measured at 340 m / s and the distance of the water level from the sensor is defined as per sound sensor. The GPIO (General Purpose Input Output) Arduino pin is connected to the water pump relay. Therefore, when the highest desired water level threshold is reached. Arduino automatically activates a signal at the pump relay to turn it off. When it reaches the lower threshold, the pump is stopped.

b. Python Desktop Application:
Socket programming and the TCP / IP client-server model are implemented for bidirectional communication between the adafruit cloud server and clients running versions of the application. In designing our customers, Python displays data in real-time and stores it in a table when an end-user needs further processing. The visualization of Python's real-time graphical user interface is shown in Figure 9.

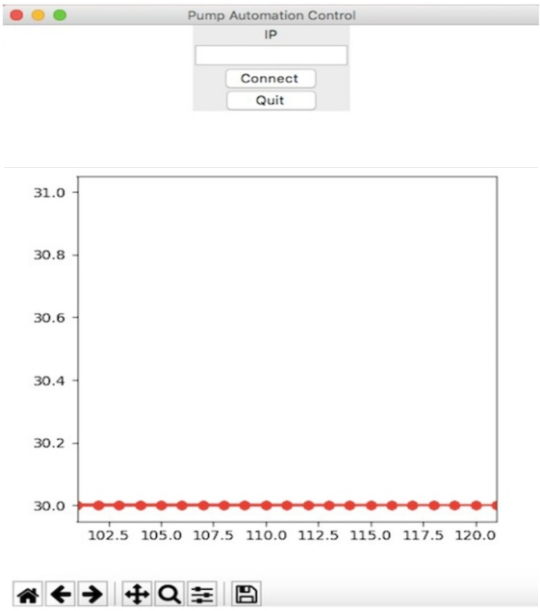

Figure. 9. Python Real-time data visualization2

Each client must connect to the Adafruit cloud server and receive data continuously until the user closes the socket connection. If the user does not communicate with the server within a specified time, the Adafruit cloud server closes the socket. This model, called the client-server model, has been implemented in this research to communicate with Adafruit cloud server and clients.

c. Web-Client Application:

The AdaFruit cloud server will host a website developed in HTML and JavaScript. This web page displays the real-time chronology of the water level as a function of time, pump status (on/off) and pump switching thresholds.

The prototype of the site hosted by Adafruit cloud server is shown in Figure 10. HTML was used to make a website static and JavaScript is implemented to communicate with the server and display dynamic data in real-time. This ensures minimal traffic between the server and the client.

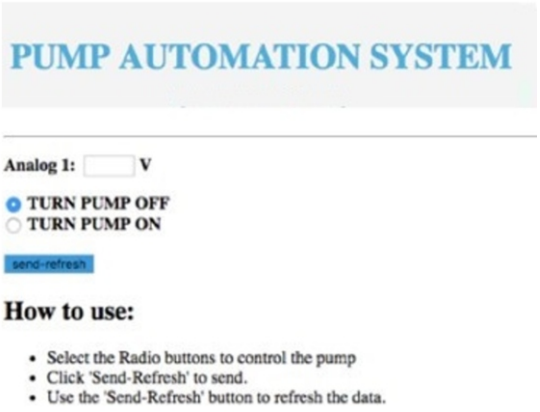

Figure. 10. Web-Client Application data visualization

Here, a user can easily view real-time water level data and use a pump on a PC or a mobile web browser by accessing the IP address of the AdaFruit cloud server.

IV. Results and Discussion

IoT-based water monitoring data is analyzed to measure their performance metrics in terms of accuracy and response time. The total response time used to complete a sensor power cycle is 126 ms. a total of 500 measurements were recorded in this work. In the experimental design, the distance between water and ultrasound sensor is converted to centimeters (cm). For benchmarks and indicators, three levels of indicators are classified: security level (a distance greater than 45.0 cm), security level (distance between 35.0 cm and 45.0 cm) and security level (distance less than 35 cm) 0 cm). The level of uncertainty and the level of danger activate the LED and then update the results on the Web Dashboard. A higher water level indicates a danger level and activates the buzzer configured as part of the proposed system. Figure 11 below shows the result of measuring the water level over the distance to the time required during the sampling periods.

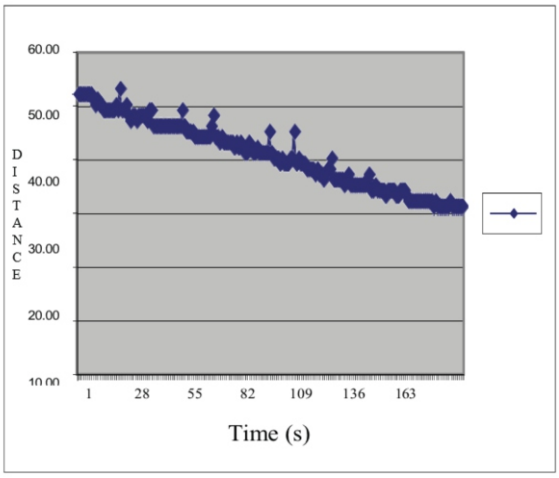

Figure. 11. Detection of Water level data

The results in Figure 11 above show a linear correlation between the measured distances (i.e. the water level) and the time required for water level readings. The result demonstrates the reliability of the system as it provides a constant reading for the entire sampling period.

A. NXP Ultrasonic Sound Sensor Results:

The automation of water filling in an air tank is the objective of our research. The NXP calculates the time between these transmitted signals and the echoes of the ultrasonic sensor and detects the water level of the tank. This water level determines whether the pump should be on or off. These thresholds are adjusted by the two touch screens NXP and NodeMCU. The tests of implementation of the two cards are illustrated in Figures 12 and 13.

In Figure 12, the NXP microcontroller is connected to the Wi-Fi module to act as a server for wireless data transfer to the remote NodeMCU. NodeMCU displays the water level data in real-time and automatically starts the pump using the NXP command (see Figure 13). The user can control the pump and change the water threshold via the NodeMCU connected touch screen, the web application, Python or the Web application. In some scenarios, it is possible to reconfigure the connected NXP WLAN as an access point when NXP and NodeMCU are close to each other, where both wireless modules can be connected without a router. Besides, NXP and NodeMCU must be in the range of modules. By using IoT hosting websites such as ThingSpeak, AdaFruit or by knowing the IP address of the local network connected to the Internet by registering the routers on noip.com,

it is also possible to implement a real time monitoring of water level data in the Internet.

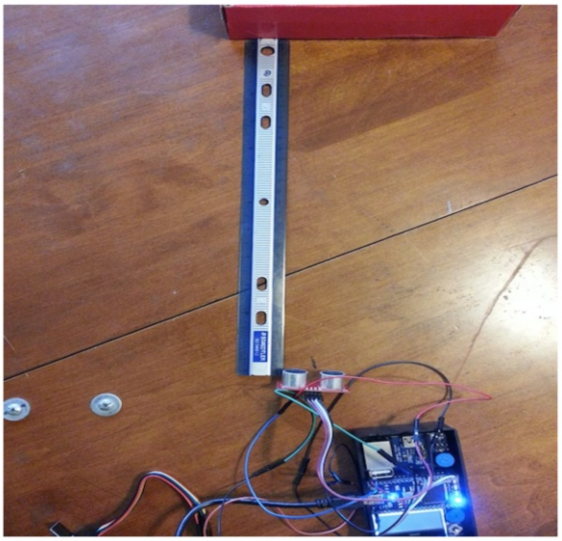

Figure. 12. Ultrasonic Sensor with NXP Distance measurements result

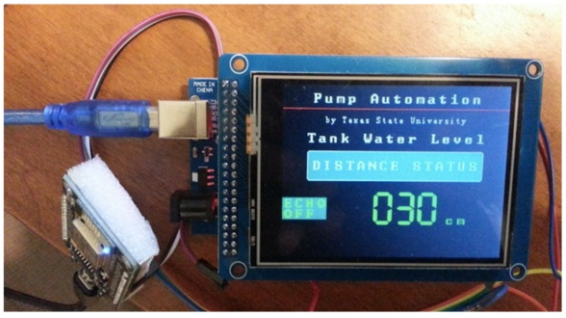

Figure. 13. NodeMCU Distance measurements result

V. Contributions of Research Work

This research article is written for the easiness of human beings and to save water and electricity with the help of automated water tanker filler, which involves hardware and the AdaFruit cloud. The water pump can be set on automatic mode or this mode can be turned off. If the automatic mode is off from cloud the motor will not on automatically ON/OFF. It does not depend on the water level, but when automatic mode is ON the motor will turn ON/OFF based on water level mean now it is dependent upon water level. These modes can be changed by sending a message on/off to using an android app these modes can be controlled. When app will receive a message on/off then android app will send value to IFTTT using internet, and IFTTT will send value to AdaFruit. When command will be received on our cloud based system, then these command based our system will respond.

This research paper is an integrated solution implement to be independent, then the versatile and user-friendly for automatic control of the water. This gives the flexibility to the user, and configures the level of water thresholds in the real-time. Also water data will be monitored and the hold of the ship in the water using the application services, and web based desktop system.

VI. Future Direction

In the future, we propose that architecture will implement with a biological parameter for determining the water content. This system is installed in different basins and water tanks. It will continue to be necessary for the water distribution system, especially in agriculture and canals, and will collect water data and transfer it to an Adafruit cloud using help of IOT technologies.

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