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Water Management System Using IoT

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Abstract – *This paper presents an IoT device which helps to manage and plan the usage of water. This system can be easily installed and maintained for long run. The Laser sensor is placed on the tank which continuously monitors the water level in real time. This information will be updated in the cloud and user can analyze the amount of water. According to the level of water in the tank, the motor functioning is automatically controlled. When the water level falls below the threshold level the motor will be again turned on automatically.*

Key words: IoT, Relay, Laser Vl53lox, HC 12 module,ESP8266.

1. INTRODUCTION

Water is one of the most important basic needs for all living beings, but unfortunately, a huge amount of water is being wasted because of uncontrolled use and exploitation of water resource. Kerala averages rainfall of 3,000 mm a year. The general impression was that among all the states in India, Kerala had ample drinking water, but it's not the case. There are 1,164 problem villages without the adequate supply of drinking water. Even though Kerala has 44 rivers spanning its lush green landscape. Together, they contribute an annual discharge of 72, 00 million cubic meters of water which is unused to the Arabian Sea. One of the main reasons for the shortage is poor management of water.

Overflowing water tanks in residence, schools, colleges, Municipal overhead tanks, Hospitals etc. can contribute to the massive amount of water wastage. If we can control this we can save large amounts of water.

Conventional water tanks can neither monitor nor control the water level in the tank. As of now, the water level has to be manually checked and refilled according to the requirements.

So in this paper, we solve all the above mention problems with automatic water level detection and refilling of water storage system with the help of Internet of Things (IoT).

2. BASIC CONCEPTS

Presented here is a Water Management System using IoT. Water level indication, automatic water pump on/off, etc are carried out by this project.

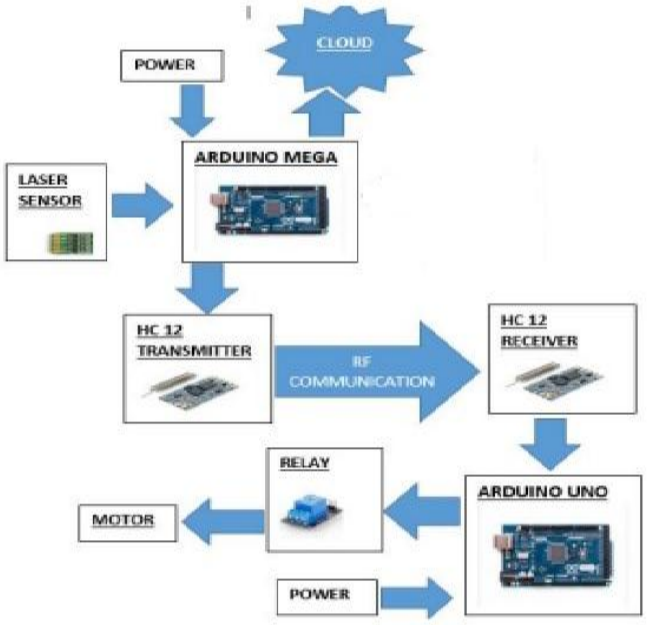

Fig -1: Block diagram.

Laser sensor used in this project is VL53LOX for precise level indication. The issue of water scarcity is becoming more prevalent. The IoT enabled water management solutions like this use sensor to collect data and share data to the cloud.

2.1 Transmitter section

The transmitter section consists of an Arduino, HC12 transmitter, laser sensor, and NodeMcu. In the automatic water level detection and refilling of water storage system, the sensor used is Laser sensor which is a replacement of ultrasonic sensor because of its accuracy and small size. The Laser sensor is used to detect the water level. The Laser sensor is placed above the tank which continuously monitors the water level in real time. This information will be updated in the cloud and user can analyze the amount of water. These sensor values are sending to water pump via the HC12 transmitter to turn on/off the pump.

The sensor values are also forwarded to NodeMCU which is used for the IoT purpose. NodeMCU connects the system to a cloud storage. Here we use Adafruit cloud platform. The platform is designed in such a way that it will show the instantaneous value of current status of water. The

water level measured by sensors is sent continuously to NodeMcu and forwarded to Adafruit cloud, it gives a graphical representation of water level from which we can analyze our water usage.

2.2 Receiver section

The receiver section consists of Arduino Uno, relay, HC12 receiver and a motor. According to the value received from the sensors about water level to HC 12 receiver, the motor will automatically turn on/off to pump the water to the tank.

Sl.No	Conditions of water level	Motor status
1	When the water level is below a minimum level	ON
2	When the water level is above the maximum level	OFF
3	When the water level is in between maximum and minimum level	It can be controlled by a user using Adafruit cloud platform

Fig -1: Motor status.

Depending on the water levels, as described above, the status of the motor will be automatically controlled. If the water level is in between maximum and minimum level set, then the user can control the status of the motor from the Adafruit cloud platform. Buttons ON and OFF have been provided for the same.

3. PROPOSED SYSTEM

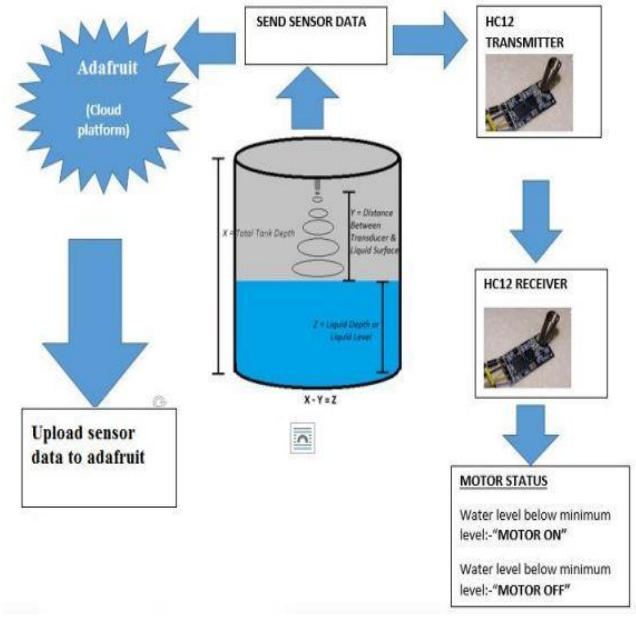

Fig -2: Block diagram.

Our project is mainly classified into different phases. They are:

1. Water level detection using laser sensor.

2. The laser sensor value transmission through HC12 Transceiver.

3. Based on laser sensor value motor is controlled using relay module.

4. Upload sensor value to cloud platform called Adafruit via ESP8266.

3.1 Microcontroller- Arduino

The Arduino Uno is used as the microcontroller in this system. It has 14 digital input/output pins, from which we are using 2 pins for connecting sensors- Laser sensor, HC12Transceiver, a USB connection, a power jack and a reset button is also present. We are using NodeMcu which contains a Wi-Fi module ESP8266 for giving the system an Internet-based approach.

3.2 Laser sensor

In the automatic water level detection and refilling of water storage system, the sensor used is Laser sensor which is a replacement of ultrasonic sensor because of its accuracy and small in size. The sensor is placed on top of the tank facing downwards. The Laser sensor is used to detect the water level.

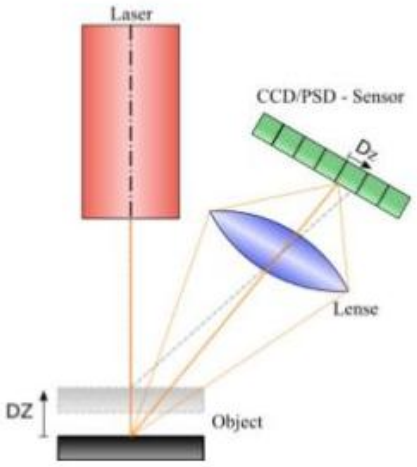

Fig -2: Laser sensor working.

Features:

The Laser sensor offers several features that help to achieve these goals. The special features include:

- Fully integrated miniature module
- 940nm Laser VCSEL
- VCSEL driver

- Ranging sensor with advanced embedded microcontroller
- 4.4 x 2.4 x 1.0mm.
- Fast, accurate distance ranging
- Measures absolute range up to 2m.
- High infrared light levels is ambient for operation
- Advanced embedded optical cross
- Talk compensation to simplify cover glass selection.

3.3 HC 12 Transceiver

The HC-12 is a half-duplex wireless serial port communication module with 100 channels with working frequency range of this transceiver is 433.4-473 MHz and multiple channels can be set with the stepping of 400 KHz with transmitting range of up to 1KM.

The MCU inside the module doesn't need to be programmed separately by user. The transparent transmission mode is only responsible for receiving and sending data in the serial port. So, it is easy to use.

Fig -3: Long range communication via HC12 Transceiver.

3.4 Relay

220v alternating current (AC) powers the AC devices. Arduino cannot control such high voltage and amperes. For that purpose a relay is used. Arduino controls this relay to control AC devices according to the program. So we are using a relay as a switch to control high power devices (here water pump). Here we use the relay for controlling motor. According to the water level, the receiver section gets a command to turn ON/OFF the water pump. As water pump works on AC, this AC has to be controlled to automatically turn ON/OFF according to our system requirements. So, we use a relay in order to achieve this need.

4. IoT IMPLEMENTATION

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Microcontroller (Arduino Uno) communicates with NodeMCU via SPI communication. We configured NodeMCU as master and microcontroller as a slave. The sensor values received to the slave will send it to the master. NodeMCU has an ESP8266 Wi-Fi module which helps in connecting to a local router. This router then connects to internet and uploads these sensor values to the Adafruit cloud platform. We can access this cloud platform from anywhere in this world simply by logging into our Adafruit account.

5. RESULT

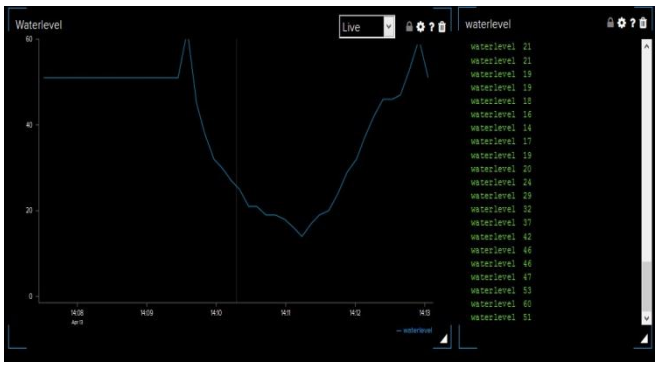

Fig-5: Graph obtained from Adafruit cloud platform

We implemented our proposed system in one of the residential water tanks, where the motor pump is 500 meters away. The water level is analyzed and maintained automatically with the help of our project. The graph obtained in the Adafruit cloud platform is shown above.

6. CONCLUSIONS

Our intention of this research work was to establish a flexible, economical, easily configurable and most importantly, a portable system which can solve our water wastage problem. It is a robust system and small in size.

Our proposed system for water level monitoring comes under the field of Internet of Things (IoT). Our main objective was to design a smart system for approximating the water level in the tank and prevent overflow or analyse the water usage. This analysing feature can also help us in finding whether there is any leakage in the tank or not.

Nowadays liquid level monitoring is vital in many industries too like oil, automotive etc. Using our smart system we can analyse the usage and also detect the leakage in the tanks of these industries.

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