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Fully Automated System for Monitoring & Controlling Water Usages using IoT

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Abstract— *In India, this unexpected shortage of water supply has become a common phenomenon in summer. The situation is worsened as there is no fixed time allotted for releasing the water from Municipality Water Tank. Apparently, there is no early warning system to monitor the water level of tanks of housing societies. The situation gets worse when there is no person in charge to do the maintenance of the tank at the time when it is needed. Wastage of water is mainly due to the overflowing of tanks. Conventional tanks can neither monitor nor control the water level in the tank, leading to a large amount of wastage. The need for removal of these short-coming and providing an efficient and economical solution has been the main aim of this project.*

Keywords— ESP8266 Wi-F Module, Arduino, Android, Solenoid Valve, Ultrasonic Sensor, Motor Pump.

I. INTRODUCTION

The process of monitoring and controlling the water tank uses the manual system yet. The very large amount of water is wasted every day for using manual processes around the world, the majority of the water wastage takes place because of the overflowing water tank. In the absence of a person, water keeps on overflowing until the valve or motor is switched off. Mankind has always facing the issues of water scarcity and water wastage. We have worked on System for Monitoring & Controlling Water Usage using IoT. This system will help address the issue of water scarcity and water management in the large township and also in small housing societies, which will help conserve water and keep a track of water and inform the residents in a situation.

II. LITERATURE REVIEW

The Literature review contains a brief discussion of some recent works of automation system for monitoring & controlling water usage using IoT.

Design of water tank, monitoring system based on mobile device is presented. With the (IRMA) Interface for Monitoring Water tanks system the user can control and monitor the watering facilities online, via any mobile device, either connected to a wireless network or the GSM network.

[I]The ultrasonic sensor will identify the water level present in the tank. This system helps to conserve water and keep track of water usage. It assists the users to check the water level in the water tank. Using the solenoid valve can avoid the wastage of water by cutting off the water supply. The project works automatically and hence reduces human effort.

[II]The concept of the internet of things (IoT) is used to continuously monitor and track water usage via the wireless sensor nodes. Server collects the data through Wi-Fi to process and track usage and wastage of water at every outlet. When water is used at the excess level it gives an alarm and an alert is sent to the user. The user can keep a track of the water usage or wastage through mobile with an internet connection.

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[III] The paper proposes a water level monitoring as well as controlling by using IoT and Android application. Using IoT, with which, the user can directly monitor and control the working of the tank through the Smartphone and from any place in the world. This system helps the users to check the water level of the tank and turn the pump ON and OFF from remotely using the android application. Hence reduces human effort.

A basic model of the android application is proposed in paper [IV] which states that water pumps can be switched ON and OFF with the assistance of radio transmitters and a Wi-Fi router. The wastage of water and wastage of electricity can be avoided by this system. User can check the water level of the tank and turn the pump ON and OFF from remotely using the android application

Paper [V] propose Water Management System (WMS) is an automated system for water to make daily life easy and comfortable through the use of mobile application.WMS is providing a system that can observe the water tank and take action if the water surface is high or low, it can automatically turn ON/OFF motor and also if any user wants to change water temperature then user can also do it. By using mobile messaging users get a notification before cut off his/her line and also show how much mater he/she already used.

III. SYSTEM ARCHITECTURE AND DESIGN

To overcome the issue of water wastage and water scarcity, we have researched the following architecture for Water Monitoring and Controlling using IoT. The system will comprise two parts the Hardware Part and the Software Part.

The Hardware and Software part will include all the sensors. The software part will include all the API's (Application Programming Interface) and the protocol necessary for communication of different hardware components. The software part also includes Android for User-Interface and communication.

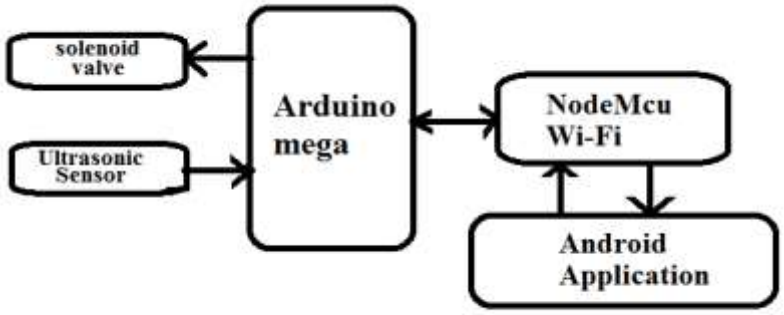

FIGURE 1: Block diagram

The Architecture consist of following hardware components.

3.1 Arduino Mega:

The Mega 2560 is a microcontroller based on the ATmega 2560. It has 54 digital I/O pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator. It is a open source hardware platform which is able to work with various sensors and communication technology.

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3.2 Nodemcu ESP8266 Wi-Fi:

NodeMCU is an open-source progress board and firmware based in the widely used ESP8266 -12E Wi-Fi module. It allows you to program the ESP8266 Wi-Fi module with the Arduino IDE.

With just a few lines of code, we can establish a Wi-Fi connection and define I/O pins according to your needs exactly like Arduino, turning your ESP8266 into a web server and a lot more.

3.3 Ultrasonic Sensor:

The ultrasonic sensor is used to generate ultrasonic sound waves that are bombarded on the surface of the water. Ultrasonic sensor operate by generating a high-frequency pulse of sound and then receiving and evaluating the properties of the echo pulse. It is used to detect the water level present in the tank.

3.4 Solenoid Valve:

A solenoid valve is an electromechanically operated valve. Solenoid valves are the most frequently used to control the flow of water. Their tasks are to shut off, and release water.

3.5 Android Application:

The working of these hardware components of the system in coordination with Android application is as described as follows: Ultrasonic Sensor will identify the water level present in the tank. This data then will be sent to Arduino. After the data collected on the Arduino board will be sent to Cloud by Wireless Module using PHP files for analysis and calculation of the data.

The data analyzed on Cloud is given to users depending upon the queries which will be given by users with the help of the android app interfaced with the help of Wi-Fi module. Regular updates of the water tank will be given to the members on their registered cellphones with the help of Wi-Fi module. Solenoid Valve will be used for closing the water supply. The water flow can be cut-off with the help of Solenoid Valve.

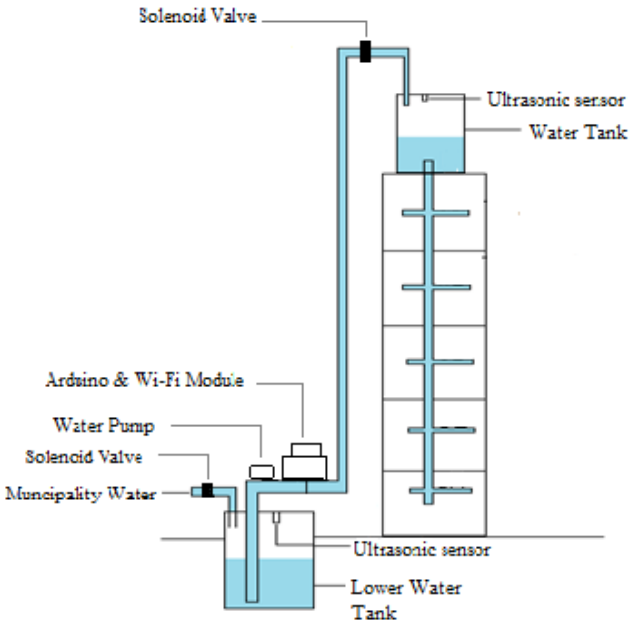

FIGURE 2: System design

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IV. DESCRIPTION

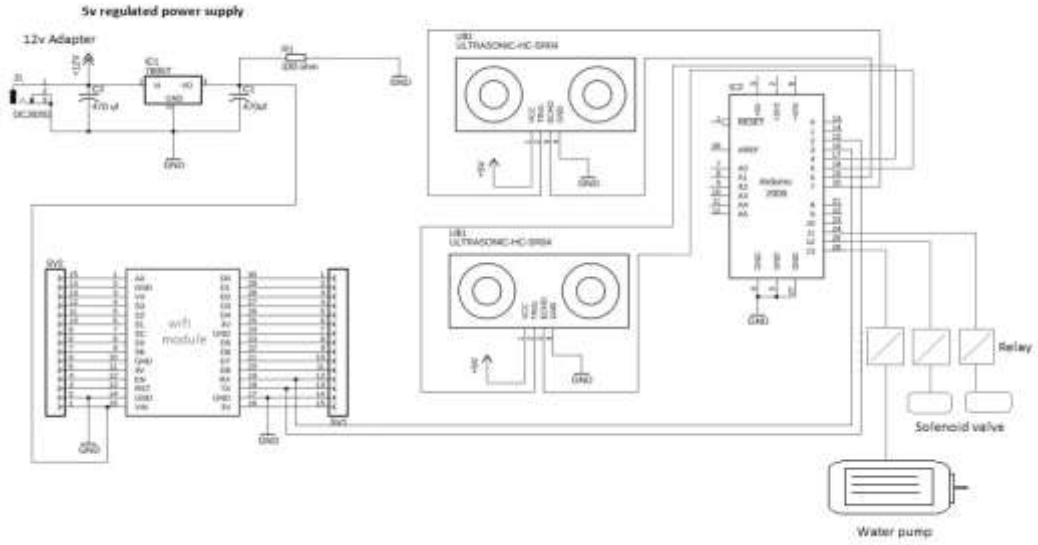

FIGURE 3 : Circuit diagram

The trigger pin of the ultrasonic sensor is connected with Arduino PIN 7. While the echo pin of the Ultrasonic sensor is connected with PIN 6 of the Arduino. The Vcc and Gnd pins of the ultrasonic sensor are connected with the Ardiuno's 5v and ground pins. The circuit in the left corner is the 5v regulated power supply based on the lm7805 voltage regulator. This 5v power supply will be used to power up the Nodemcu esp8266 wifi module.J1 is the DC female power jack where we can connect a 12v adaptor or battery. A wire from the output of the voltage regulator is connected with the pin of the NodeMcu module. The Tx and Rx pin's of the Nodemcu are connected with pin 2 and 3 of the Arduino. So the Nodemcu will communicate serially with the Arduino through pin 2 and 3. Pin 2 is the Rx and pin 3 is Tx. A 12v SPDT type relay is used to control the water pump

ADVANTAGES

1. Reduces Human Effort
2. Easily Monitored and Control
3. Saves wastage of water
4. Saves the time
5. The system can work without any personnel in charge for maintenance of water tank.
6. We can monitor and control the system from anywhere

DISADVANTAGES

1. System requires Internet
2. To monitor and control the system we require android app

APPLICATIONS

This project has enormous applications. It can be installed in the following areas:

1. Private houses or Bungalows
2. Housing societies
3. Apartments
4. Institutions like school and colleges, hostels

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5. Hospitals
6. Offices
7. Municipal overhead Tank

V. CONCLUSION

Water is the most important basic needs of all living beings. But unfortunately, a huge amount of water is being wasted because of the uncontrolled use and exploitation of water resources. We try to overcome these problems and implemented an efficient automated water level monitoring and controlling system. Our objective of this research was to develop flexible, economical, easily configurable and most importantly, a compact system that can solve our water wastage problem. This system helps to monitor and control the usage of water and people can use water in an efficient way. Water wastage can be avoided using the Android app by cutting off the water supply using the solenoid valve. This automation helps to reduce human efforts and helps to manage water carefully and will also reduce the problem of water scarcity.

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