VASAVI COLLEGE OF ENGINEERING
ECE

SMART WATER TANK SYSTEM

mini project

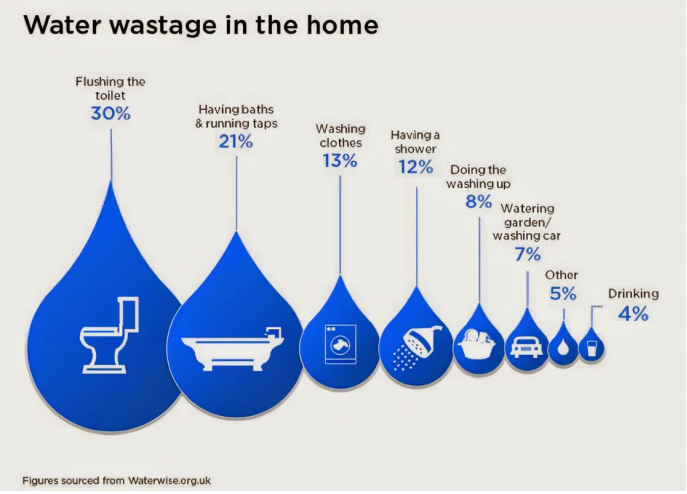
Abstract

Water is most important resource which needs to be managed smartly. Managing house water supply in a society consisting of water tanks, motors and pumps automatically is an important task for efficient consumption of water. It is important for us to have an idea of daily water consumption by our family. Our Smart Water Tank System is responsible for monitoring the water level in tank continuously, to control the motor automatically and gives amount of water consumption.

1 Introduction

Due to global environmental situation , water management and conservation is vital for human survival. The sources of natural water are limited and hence it is important to conserve it and use it smartly. Of all the water on Earth, more than 97 percent of Earth's water is unusable by humans and many other living things. Freshwater is the 3percent and most of that three percent is inaccessible. Now about that 3percent. Over 68 percent of the fresh water on Earth is found in icecaps and glaciers, and just over 30 percent is found in ground water. We need water to fulfil all the activities of life like drinking, eating, bathing, producing crops and we need to save water for the proper supply of water for the future generation.

Knowingly or unknowingly, we waste water every day. We do not understand the wastage while doing small-small things as part of our daily routine. On an average one person wastes about 0-45 liters water per day.Our project is to ensure water management efficiently and economically.



1 Figure 1: water wastage in the household.

1.1 Problem Statement

It is always a difficult task to monitor the water tank is empty or not. If tank gets empty then we have to pump water and then again we have to monitor the tank until it gets fill up and sometimes there may be a wastage of water if pump was turned off late. Nowadays efficient water use is very important but we may not have an idea of our daily water usage On an average household uses 250 liters per day and for Apartments where many families live, it is more and more bigger number.

It is necessary to know each family water usage to take actions for saving water. Many apartments often bundle water charges into maintenance account, for example In locality of 10 apartments irrespective of water usage by individual household, the water bill is charged equal for all.This makes the householders to bare these inappropriate consequences .

1.2 Outcomes

Our project has following outcomes:

1. Our system ensures that No overflow takes place from the tank which means no wastage of water.
2. Our smart water tank solution automatically monitors the water level in the tank and provides real-time updates with the help of incorporated sensors.
3. Provides daily water usage data
4. provides water bill for individual household

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2 Making Process

2.1 Apparatus

1. Nodemcuhttps://www.overleaf.com/project/62978a4814f250e3c500781a
2. Relay Module
3. Flowsensor
4. Pumping motor
5. Water pipes
6. Connecting wires
7. Blynk software
8. Thingspeak
9. 20 liters Water can
10. Water tap

2.2 Flow of solution

We used nodemcu microcontroller board for its advantages which include low cost, reduced size, low energy consumption and also integrated WIFI support. The NodeMCU programming can be as easy as in Arduino. The main difference is in the pinning of the board, ESP8266 Nodemcu has 30 pins described below in the figure1 :

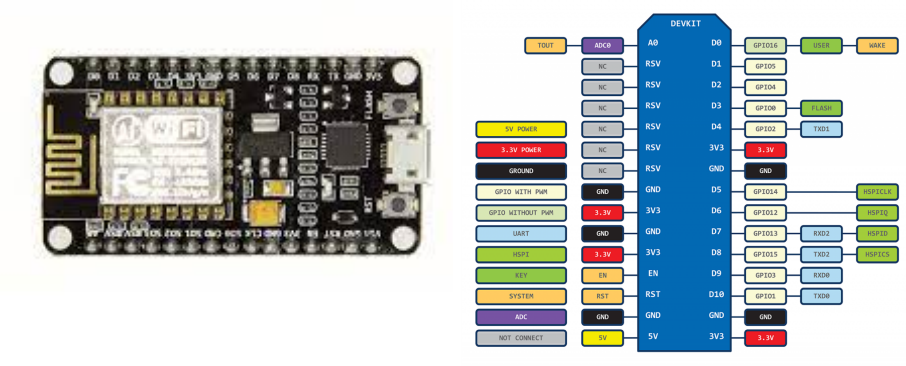

Figure 2: Nodemcu and its pin configuration

Ultrasonic Sensor: An ultrasonic sensor is as sensor which measures the distance of respective object by sending the sound wave of specific frequency. This sound wave is reflected after the collision with respective object and this wave is received by the ultra-sonic receiver. Distance is measured by calculating sending and receiving time of this sound wave. you may also like to read distance measurement using ultrasonic sensor ,Nodemcu and arduino.
Distance is measured by the formula(D) = (Sound speed x time taken) / 2

Sound travels through the air with almost speed 344m/s (1129ft/s) and this speed is mutiplied with the total time (sending and receicving) of sound wave. In this formula because total time is counted therefore ,it is devided by 2 for calculating the totall distacnce of that respective object. May be some obects are not detected by ultrasonic sensors due to their improper shape, positon and too samall size that object

Figure 3: Ultrasonic sensor

FLOW SENSOR :
Water flow sensors are installed at the water source or pipes to measure the rate of flow of water and calculate the amount of water flowed through the pipe. Rate of flow of water is measured as liters per hour or cubic meters.
WORKING PRINCIPLE : Water flow sensor consists of a plastic valve from which water can pass. A water rotor along with a hall effect sensor is present the sense and measure the water flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the hall effect sensor. Thus, the rate of flow of water can be measured. The main working principle behind the working of this sensor is the Hall effect. According to this principle, in this sensor, a voltage difference is induced in the conductor due to the rotation of the rotor. This induced voltage difference is transverse to the electric current. The water flow sensor can be used with hot waters, cold waters, warm waters, clean water, and dirty water also. These sensors are available in different diameters, with different flow rate ranges. DATA SHEET VALIDITY : We can count the number of frequencies produces by the water flow sensor per second. The flow rate pulse char-

Figure 4: Y-S201.

acteristics from the datasheet are given that frequency is 7.5 multiplied by flow rate. So the flow rate is frequency / 7.5. After finding flow rate which is in liters/minute, divide it by 60 to convert it into liter/sec

RELAY MODULE :
The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.
WORKING PRINCIPLE :It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energises the electromagnetic field which produces the temporary magnetic field.This magnetic field moves the relay armature for opening or closing the connections. TYPES : Generally there are two types of relays; 1)Normally Closed Relay.
2)Normally open Relay.

BLYNK SOFTWARE:
The Blynk app is is really an app editor.
It allows you to create one or more projects.
Each project can contain graphical widgets, like virtual LEDs, buttons, value displays and even a text terminal, and can interact with one or more devices. With the help of the Blynk library, it is possible to control Arduino or ESP8266 pins directly from your phone, without having to write any code at all. It is also possible to share a project with friends and even customers so that they can access the connected devices but not be able to modify the project. Imagine a scenario where you build a smartphone application where you can control lights, window blinds and room temperature from your phone. You can share the project with other family members so that they can also access the

Figure 5: Relay Module.

THINGSPEAK

Figure 6: IOT software.

ThingSpeak is an open data platform for the Internet of Things. Your device or application can communicate with ThingSpeak using a RESTful API, and you can either keep your data private, or make it public. In addition, use ThingSpeak to analyze and act on your data. ThingSpeak provides an online text editor to perform data analysis and visualization using MATLAB. You can also perform actions such as running regularly scheduled MATLAB code or sending a tweet when your data passes a defined threshold. ThingSpeak is used for diverse applications ranging from weather data collection and analysis, to synchronizing the color of lights across the world.
At the heart of ThingSpeak is a time-series database. ThingSpeak provides users with free time-series data storage in channels. Each channel can include up to eight data fields. This tutorial provides an introduction to some of the applications of ThingSpeak, a conceptual overview of how ThingSpeak stores time-series data, and how MATLAB analysis is incorporated in ThingSpeak.
Capabilities of ThingSpeak? Some of the key capabilities of ThingSpeak include the ability to: Easily configure devices to send data to ThingSpeak using popular IoT protocols. Visualize your sensor data in real-time. Aggregate data on-demand from third-party sources.

2.3 Working process :

We inserted 6 widgets in Blynk Software,

1. First one is the Notification widget which is at the top right corner in the figure 6. It is to get notify when water in tank gets empty or full.
2. Push button which is at the top-left on the interface to Turn on the Motor Pump.
3. Level Horizontal widget to show the water level in the Tank.
4. Two Labeled Value widgets to display the water flow level and the water bill.

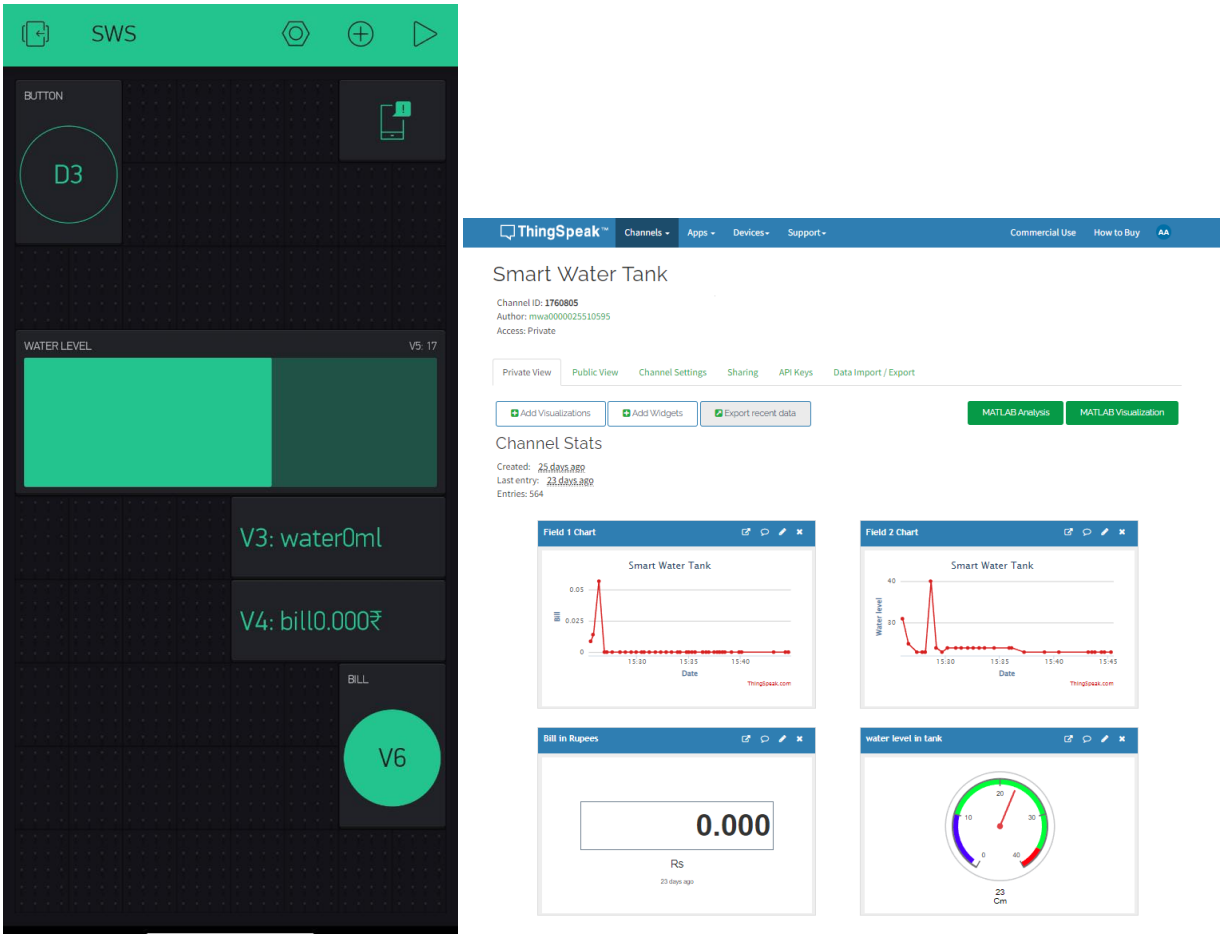

Figure 7: Blynk and ThingSpeak Interface

5. And another Push Button to reset the Bill.

We prefered ThingSpeak for analytical data point of view. With the help of thingspeak iot cloud we can visualize data in the form of graphs and at the same time we can also transfer the all the data from the sensors to the google sheets.

Figure 8 is our Smart water tank system prototype, In that plastic container attached to the tank contains the Nodemcu and the relay module, we placed the Ultrasonic sensor at the top of the tank and flow sensor to the pipe which is connected to the tap, it sends the water flow rate information to the nodemcu.

Figure 8: water tank setup

3 BENIFITS OF SMART WATER TANK SYSTEM :

1. Easy installation
2. Minimal maintenance
3. Sends an alert to let you know water is too high or too low
4. Compact design
5. Automatically adjusts water levels

6. Saves money by using less electricity and water
7. Prevents overflow of water and saves infrastructure
8. Saves manual labor time
9. Uses little energy for functioning
10. caluclates water bill
11. It can be implement in Houses, Apartments, Hotels, Hostels, Factories etc..

4 VALIDATIONS:

1. When there is a glitch in power supply
   If there is sudden change in power supply from OFF condition to ON condition or vice versa, then our system has no any impact on the components.Because of the relay module used in the circuit ,it deviates the transisent responce in the circuit and perform the task when there is constant supply of current.
2. When external Power supply to Nodmcu Stops
   As the relay module is Normally closed relay, when external power supply to Nodemcu stops ,the circuit becomes closed and there is no any further issue for motor pump functionality .
3. If Ultrasonic Sensor stops working?
   If there is a deflection in the functionality of ultrasonic sensor , then by default the water level is treated as Full and hence the motor won't turn on .This indicates that there are two issues : -¿Ultrasonic sensor problem . -¿Motor pump damage.
4. To check whether motor pump working or not
   we have to connect a water flow sensor for the input to the tank.If flow sensor reading is zero then we can notify that there is an issue in the motor although there is a supply of power.Else if there is a change in reading of water flow ,we could know that pump is running.
5. When there is a short delay in wifi signal
   There is no any impact to the IOT system .The notifications run without any wifi connection until the input hotspot turns off.
6. Temperature efffect
   Temperature fluctuation affects the speed of an ultrasonic sensors pulse or sound waves. As temperature increases, sound waves travel faster to and from the

target. Even though the target has not likely moved or shifted, it will appear that the target is closer.Sensing accuracy affected by changes in temperature of 5-10 degrees or more have a limited detection range

7. Cost Comparission

Figure 9: Online Water Monitering product

Our project cost is almost equal to 1200 rupees and our project has more feauters than amazon product which makes our project more economical and we can make cost down even more if we can make it in large scale.

5 FURTHER EXTENTIONS

1. 1.ph sensor to know pH value
2. water limit notification and restrict mode
3. more optimization
4. bill payment with upi id

5. water purity/quality checking

6 IMPLIMENTATION OF OUR PROJECT FOR 5 STORED APARTMENT(Theoretical calculations)

Considering 1hp motor pump to lift water up (Crompton SP mini Champ) costs 4500 rupees.

Flow sensor 1 inches costs 900 rupees 2inch costs 1500 rupees
For 5 floors 3*5=15 costs 15,000
Nodemceu 300 rupees
TF-Luna micro lidar distance sensor 1900 rupees
Relay Module 200
Total Amount=22,000 Without considering motor=17,500/-

7 CONCLUSIONS:

1.Huge amount of water is being wasted because of uncontrolled use and exploitation of water resources

2.We tried to overcome these problems and implemented an efficient automated water level monitoring and controlling system

3.This project doesn't require special different tank for it, existing water tanks can be used .

8 LITERATURE SURVEY:

1. https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet
   From this website we collected the information of Nodemcu, pin configuration of nodemcu,and significance of each pins.This page provides the data sheet for the Nodemcu Esp8266.
2. https://www.researchgate.net/publication/3487778
   This is journal issued by the International Journal of Engineering Reasearch Technology (IJERT) it gives an overall idea of water monitering system should be and the problems related to the water tank at home.

3. https://iotbyhvm.ooo/blynk-tutorials-blynk-iot-platform-how-to-use-blynk/
   From this we watched tutorials to understand what is a blynk and how it works, and about how to acess the widgets in the blynk, we learned how to create a interface in the app.
4. https://youtu.be/wc4EGb0as
   This is a youtube link fron which we managed to know how to link blynk and nodemcu.
5. https://how2electronics.com/iot-water-flow-meter-using-esp8266-water-flow-sensor/
   we gathered information for how to connect and write code for flow sensor and also about getting data in ThingSpeak from Nodemcu.
6. https://www.roboticapp.com thingspeakaccountcreation.html

9 TEAM MEMBERS:

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