INTRODUCTION:

Water level Management using Raspberry Pi – Raspberry Pi is programmed by using Python programming. In this project, you will learn to interface an Ultrasonic sensor, Water level sensor, and DC pump with a relay circuit with Raspberry Pi to get the water level value. The water level can be monitored and controlled by using Internet of Things. From this Raspberry Pi beginner project, you will learn to use sensors with Raspberry Pi for various applications. Water is a very essential source for living organisms so we must save water. In this project, we aim to develop a water level management system using raspberry pi. This system prevents wastage of water and it indicates water level by using sensors and Internet of Things.

This water level monitoring system is used in many places like Dams, water tanks at home and also in industries. It mainly detects the level of the fluids in the tank. In dams it detects the level of the river or lake so that we can store the water for our requirements. So, in our project we use Ultrasonic sensor to detect the level of the tank and water pump to pump the water from ground water to the tank.

The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low. Water level Management using Raspberry Pi – Raspberry Pi is a tiny PC that has inbuilt Bluetooth and Wi-Fi, which is programmed by using Python programming. In this project, you will learn to interface an Ultrasonic sensor and DC pump with a relay circuit with Raspberry Pi to get the water level value. The water level can be monitored. From this Raspberry Pi beginner project, you will learn to use sensors with Raspberry Pi for various applications.

BACKGROUND:

At the beginning of this month, we commemorated the end of the Second World War, now 75 years ago. This caused me to look back on the history of water quality monitoring, especially since the end of the Second World War, when a long period of reconstruction began. Water quality problems had occurred well before the two world wars, and in fact date back as far as the early days of the industrial revolution, around 1800. Before the wars, water pollution concerns were mainly related to pathogens such as cholera and typhoid, waterborne diseases that were widespread in densely packed cities where many people used the same (contaminated) water source. Water treatment thus focused on eliminating such pathogens by means of filtration and chlorine disinfection.

Shift in focus from biological to chemical pollution

After the Second World War, the Chemical Revolution came into full swing and led to the production of thousands of synthetic chemical substances, which also found their way into the water environment through (unregulated) industrial discharges and accidents. The focus on microbial water safety caused governments to largely ignore the consequences of chemical pollutants in water for a long time. In the early nineteen sixties, a connection was made between these synthetic organic chemicals and cancer as well as other public health issues, but it took until the nineteen seventies for regulators to include chemical parameters in water regulations. Water treatment technologies also shifted focus to include active carbon treatment methods to remove chemical substances from drinking water.

Development of monitoring technologies

Since the late sixties, water monitoring experts have been engaged in an arms race with the industrial sector to determine the effects of discharges of a wide variety of chemicals into the environment, and to feed regulatory bodies with the necessary information to adequately protect public health. Initially water monitoring efforts were concentrated in laboratories, and they largely reflected the developments in water pollution as described above. For example, the first HPLC-system for monitoring chemical substances was commercialized in 1969. But from the early seventies onwards, more and more field monitoring equipment was developed to monitor water pollution directly on-site. These developments were not only incentivized by the occurrence of certain pollution types in the water environment, but to a large extent also boosted by some technological developments, which at first sight did not seem to have anything to do with water monitoring at all.

PROBLEM DEFINATION:

Appearing on the market in the early '90s, the first electric water controller helped industry professionals track the water levels in boilers, irrigation lakes, cooling towers, wastewater, and water tanks reliably and accurately. However, these units were soon found to be imperfect based on their design. While they did become recognized as the advancement from traditional 'toilet tank' float designs, the engineers soon discovered that the long-term use of these water controllers was not likely. Though more accurate, the new controllers did not provide easy verify operations nor did the units lack the intuitive user interface to enable troubleshooting when problems began.

When a problem arose, there was no built-in function to help identify the source of the failure/malfunction. You couldn't even identify the failing part accurately, so at a considerable expense, the entire unit had to be replaced.

One of the main reasons that the electric water controller showed poor durability would fall on the high 600 volts used in a wet environment. When the environment is wet, electrical parts will fall to failure quite often when using high voltage. Causing inaccurate readings, sensor probes will rust at a fast rate, while high mineral content in the water will likely plate to the probes enforcing failure.

Advantages:

1. Power Saver

Living in an age where we need to be more conscious of the energy that we use, a water level controller is ideal at saving power. Normally, regulating water levels can consume electricity and wastewater. However, with automatic controllers, the electricity usage is limited as well as less water needed to regulate supply.

2. Money Saver

A water level controller helps save money by limiting the waste of water and electricity. These devices accurately regulate how much energy is used to protect against any unnecessary water/electricity usage. Over time, the money saved is quite substantial.

3. Automatic

Another notable advantage with these devices is that they regulate on their own. Eliminating manual operations with a timer switch, the frustrations of manual monitoring water tanks are minimized. Water levels are maintained at the appropriate levels thanks to the automatic operations of these devices.

4. Water Maximization

On average, water pumps are used more during midday. A water level controller can maximize the water usage provided during midday while automatically lessening the water usage at night. This results in an appropriate level of water at all times being maintained, while providing you with the maximum use of your water at the appropriate times.

5. Reliable Electronic Design

Addressing the durability problems found in earlier designs, the solid-state electronics in the newer models help to eliminate them. Not only do they help to eliminate the durability issues, but they also create considerable savings of the life span of the unit with an advanced modular design. In order to minimize problem areas of these designs, the only moving parts are the relays. These relays are easily replaced and tested by any skilled operator or electrician while being an inexpensive part.

6. New Control Minimize Fouling & Deterioration

Proving to be less costly, over time, than the original float design for the 'toilet tank'. The solid-state electronics are designed to minimize volt usage (less than 1 volt). This directly minimizes the mineral fouling, plating, rusting, and deterioration of probes, proving to be safer and more efficient. These factors extend the life span of the controllers significantly, which saves money and energy.

7. Easy Installation with LED Monitoring

These new solid-state electronics and integrated electronics offer superior performance, hassle-free installation, and lower cost to operate over time when compared to the lifespan of the original design. For continuous monitoring, the integrated firmware and digital dry-contact circuitry easily and quickly connect to the automation systems of a building. Each function of the integrated electronics and relays use LED lights to offer operators the ability to visually scan them in order to verify proper operations.

Disadvantages:

- Water level controls need to be replaced every 3 years.
- The rust, foul and deteriorate
- Electronics are usually built separately

- More difficult installation
- Most float switches are outdated
- No LED indicator lights
- No Warranty or Guarantee

<u>Objectives</u>:

MATERIALS REQUIRED:

- Raspberry pi model 3
- Ultrasonic Sensor
- Jumper wires
- Electro Peak OLED 64 x 128 display module
- Water Jug
- Bucket
- DC water pump

<u>Procedure</u>:

Connections:

Now let’s talk about the connections of the raspberry pi, ultrasonic sensor and Buzzer. Please follow the circuit diagram as given

Connections:

Ultrasonic sensor vcc to 5v of Raspberry Pi

Ultrasonic sensor Gnd to Gnd of Raspberry Pi

Trigger to GPIO 2

Echo to GPIO 3

Structure:

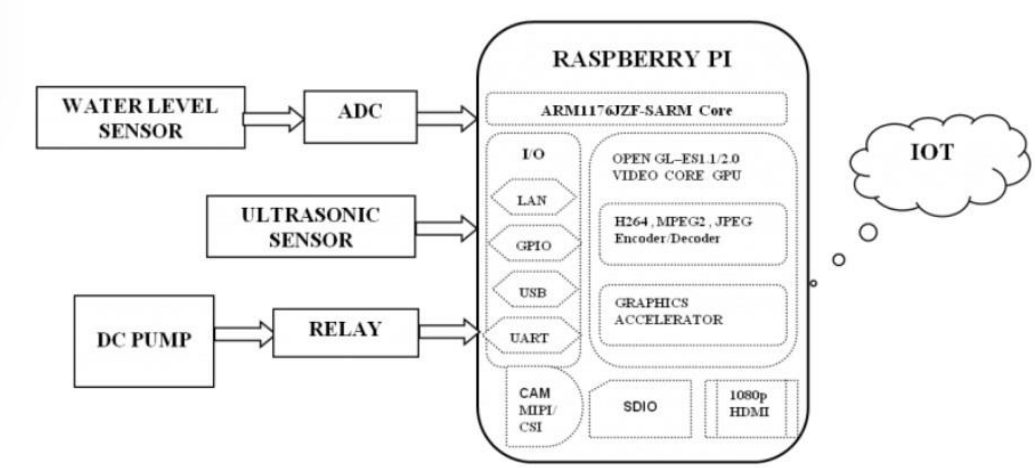
· Attach a scale to the bucket.

· Next attach the ultrasonic sensor to the scale

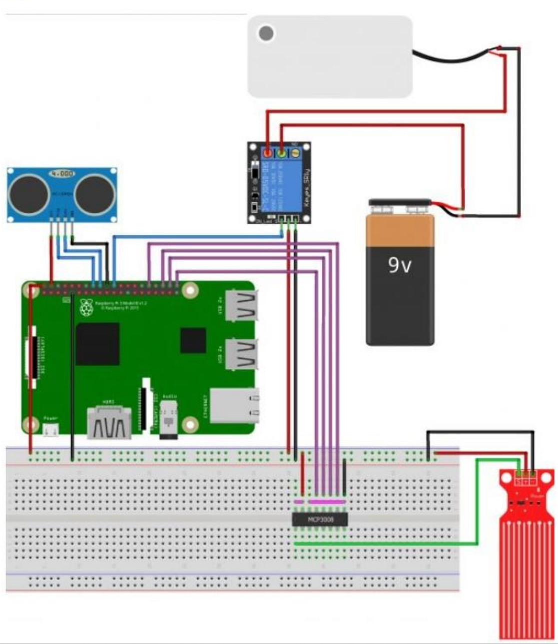
Testing:

Fill water in the bucket. When the distance of ultrasonic sensor from the water is around 4 centimeter, by that it will automatically off the water pump.

BLOCK DIAGRAM

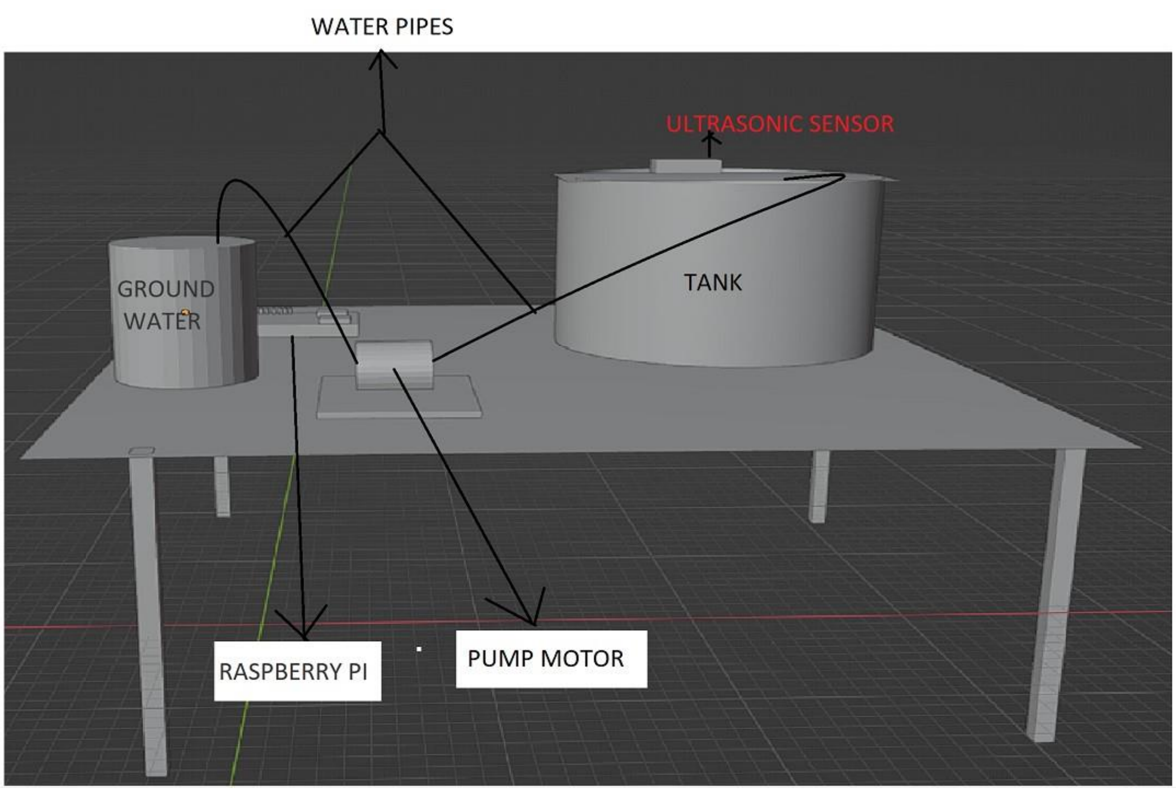


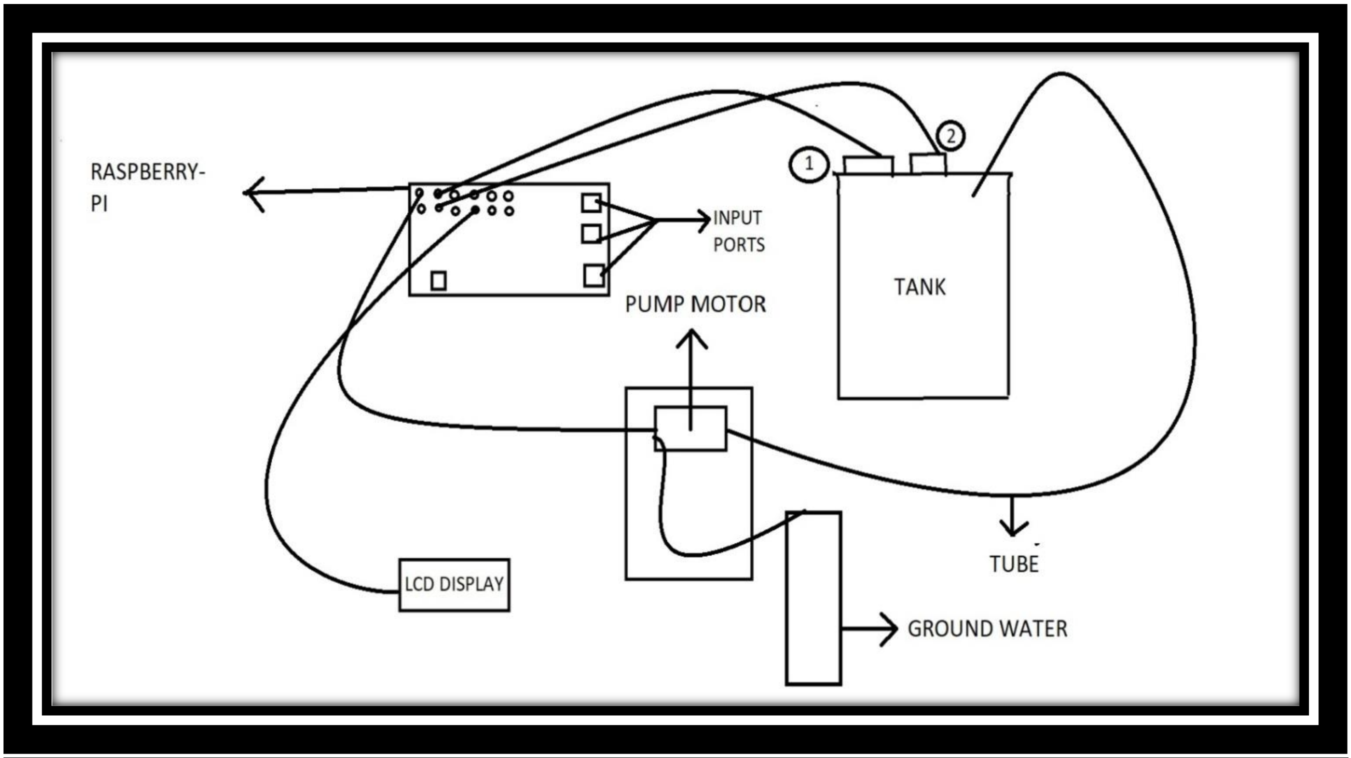
CIRCUIT DIAGRAM



RESULT AND DISCUSSION:

- Easy to install
- Very little maintenance
- Compact design
- Automatic water level indicators ensure no overflows or running of dry pumps
- Saves money by using less water and electricity
- Can help avoid seepage of walls and roofs due to tanks overflowing
- Automatic save you can save manual labor time
- Consumes very little energy, perfect for continuous operation
- Shows incitation of water levels in any type of tank





Conclusion and Future scope:

As the world's water resources become increasingly stressed, effective systems for management become more important. Several water monitor systems are available but most of them are either expensive or requires manpower. Since wired technology is used in our proposed system there is scope to further modify it by using wireless RF technology. Thus, the communication between the controller and the driving element can be established wirelessly. Improvements can be made with minor changes in this model by eliminating the operator and providing the complete control to microcontroller (automatic level control). It can be used for level monitoring and control in industries. The system can also be extended to efficient functioning of dams. Therefore, a major future work can be possible in which a centralized control of all the dams in a state using GPRS or other wireless technology under central government can be beneficial to the whole country. On a local level, the control of all the water storage tanks in a society using wireless technology under a trusted authority can be beneficial as well.

The proposed mechanism of water control reduces the water wastage, ensures efficient use of available water resources and generates more precise and accurate results. There is no requirement of human laborer for monitoring the level, just one operator is sufficient for opening and closing the gate according to sensor output.

Due to the number of sensors being more we can open or close the gate whenever necessary knowing the accurate level of water. Also, operation execution time is less. Because of its cost efficiency this system can be installed in various rural areas where the water problems are on a rise.

References:

These are the references that I have refered

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3. L293D datasheet, SLRS008D-SEPTEMBER 1986- REVISED JANUARY 2016, http://www.ti.com/lit/ds/symlink/l293.pdf

4. https://www.pantechelearning.com/product/water-level-management-using-raspberry-pi-2/

5. https://www.hackster.io/Shafin-Kothia/water-level-monitor-with-raspberry-pi-d509a2

Codes in Appendix:

Coding for ultrasonic sensor:

```
#! / usr / bin / python3

# File ultrasound.py

import time
import RPi. GPIO as GPIO

GPIO. setmode (GPIO. BOARD)

trig = 11       # GPIO pin numbers
echo = 13

GPIO. setup (echo, GPIO .IN)
GPIO. setup (trig, GPIO. OUT)
```

```
while True:
GPIO. output (trig, True)
time. sleep (0.00001) # 10 microseconds

GPIO. output (trig, False)
while GPIO. input (echo) == 0:

pass
start = time. time ()
while GPIO. input (echo) == 1:

  pass
  end = time. time ()
  distance = ((end - start) * 34300) / 2
  print ("distance:", distance, "cm"
 time. sleep (0.5)
```

coding for LCD display:

```
import RPi.GPIO as GPIO
import time

#Define GPIO to LCD mapping
LCD_RS = 7
LCD_E  = 8
LCD_D4 = 25
LCD_D5 = 24
LCD_D6 = 23
LCD_D7 = 18
LED_ON = 15

#Define some device constants
LCD_WIDTH = 16
LCD_CHR = True
LCD_CMD = False

LCD_LINE_1 = 0x80 # LCD RAM address for the 1st line
LCD_LINE_2 = 0xC0 # LCD RAM address for the 2nd line


#Timing constants
E_PULSE = 0.00005
E_DELAY = 0.00005
```

```
def main():
   #Main program block

   # Initialise display
   lcd_init()

   # Toggle backlight on-off-on
   GPIO.output(LED_ON, True)
   time.sleep(1)
   GPIO.output(LED_ON, False)
   time.sleep(1)
   GPIO.output(LED_ON, True)
   time.sleep(1)

   #Send some centred test
if:
   water level(high)
   print('The water level of the tank is full')
else:
   water level(low)
   print('The water level of the tank is low and refilling')
```

Coding for pump motor:

Pump.py

```
import  RPi.GPIO as GPIO #Allows us to use GPIO pins in raspberry-pi

 import time



PIN = 14 # The GPIO pin used for our pump relay



GPIO.setmode(GPIO.BCM) #Defines what system we are using to label pins (GPIO.BCM or
GPIO.BOARD)
```

```
GPIO.setup(PIN, GPIO.OUT) # Sets up our pin as an output


GPIO.output(PIN, GPIO.LOW) # Starts our pump as off


def manage_pump():
    '''
    This function contains a loop which manages the pump
    '''
    while True:
        GPIO.output(PIN, GPIO.HIGH) # Turns on pump
        time.sleep(60*5) # Sleeps for 5 minutes, So pump is on for 5 minutes
        GPIO.output(PIN, GPIO.LOW) # Turns off pump


        time.sleep(60*60*4)
        # Sleeps for 4 hours, causing the 3 lines above to execute once every 4 hours
```

main.py

```
from pump import manage_pump


manage_pump()
```