Automatic water level controller

by

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BONAFIDE CERTIFICATE

Certified that this project report entitled "Automatic water level controller" is a bonafide work of **M.Akshara -19BPS1061 , Sruthika B-19BPS1112 and Arush T Susikaran-19BPS1094 who** carried out the Project work under my supervision and guidance for **CSE-2006 MICROPROCESSOR AND INTERFACING.**

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ABSTRACT

Water scarcity is one of the major problems which are faced by many cities of the world and wastage during transmission has been identified as a major culprit; this is one of the motivations for this project, to deploy computing techniques in creating a barrier to wastage in order to not only provide more financial gains and energy saving, but also help the environment and water cycle which in turn ensures that we save water for future. The present study involves automatic control system to maintain water level in tank. This system enables to switch ON-OFF pump as per the requirement of water. The system uses micro-controller to automate the process of water pumping in an over-head tank storage system and switch on/off the pump accordingly. The objective of this project is to implement an automatic water level controller by a DC motor using Arduino. The level of water in a tank is controlled by this equipment using micro-controller. Main components are Arduino Uno, motor, sensor etc. The sensors sense the level of water and give indication to the micro-controller. The micro-controller produces control signals to drive the motor. If there is no water then micro-controller gives control signals to start the motor and if there is sufficient water then micro-controller gives control signals to stop the motor. This can prevent water overflowing from the tank, and ensure there is sufficient water available to the home for general use. The purpose is to prevent the wastage of water, minimize the power usage and automatically monitor the motor system. We have implemented in both hardware and software.

ACKNOWLEDGEMENT

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NAME WITH SIGNATURE **NAME WITH SIGNATURE**

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1. INTRODUCTION

1.1 OBJECTIVES AND GOALS

Water is very precious for the living beings and scarcity of the same is gradually increasing. Most of the cities in the county and that of the world are facing this problem. This is one of the motivations for the current work and to deploy techniques in order to save water and help the environment which in turn ensures water for the future. Hence, it is of utmost importance to preserve and save water. In many houses there exists unnecessary wastage of water due to overflow from overhead tanks. Automatic Water Level Controller can provide a solution to this problem. In the "Water Level Control using Arduino" project, the water is being measured by using water level sensors. The DC motor water pump is automatically turned ON when the water level becomes low and turned OFF when the tank is full. The automatic water level controller designed here is on the basis of electro-mechanical system using the digital technology. Here, the electrical probes are used along with power supply and motor. The probes will be inserted inside the tank and motor will pump when the water goes down. The probes will detect the level of water and ON/OFF the motor. The level controller used here is the water sensor which will sense the low and high level of water in the water tank. If the water is low, the motor will pump the water and after the high level is reached it will stop to pump water. There are some objectives that need to be achieved in order to accomplish this project. These objectives will act as a guide and will restrict the system to be implemented for certain situations:

1. To develop water level control system to control the water level in the tank.

2. To check the level of water in the tank. Depending on the water level, the motor switches ON when the water level goes below a predetermined level or the motor switches OFF when the tank is full.

1.2 APPLICATIONS

1. It is used for all household purposes.
2. It can be used in commercial purposes.
3. It will be very much useful to farmers to store large amounts of water.

4. It is helpful to predict floods.
5. Fuel tank level gauging
6. Oil tank level control
7. Pool water level control
8. Cooling tower water level control
9. Sewage pump level control
10. Remote monitoring liquid
11. Stream level monitoring
12. Tsunami warning and sea level monitoring
13. Irrigation control

1.3 FEATURES

1. Easy installation
2. Minimal maintenance
3. Compact design
4. Automatically adjusts water levels
5. Save money by using less electricity and water
6. Can help avoid seepage of roofs and walls due to tanks overflowing
7. Automatic operation saves you manual labor time
8. Consumes a small amount little energy, perfect for on-going operations
9. Indicates water levels in any type of storage tank or body of liquid
10. Increases Pump Life.

1.3.1 DISADVANTAGES

1. Water level sensors need to be replaced every 3 years as they rust, foul and deteriorate.

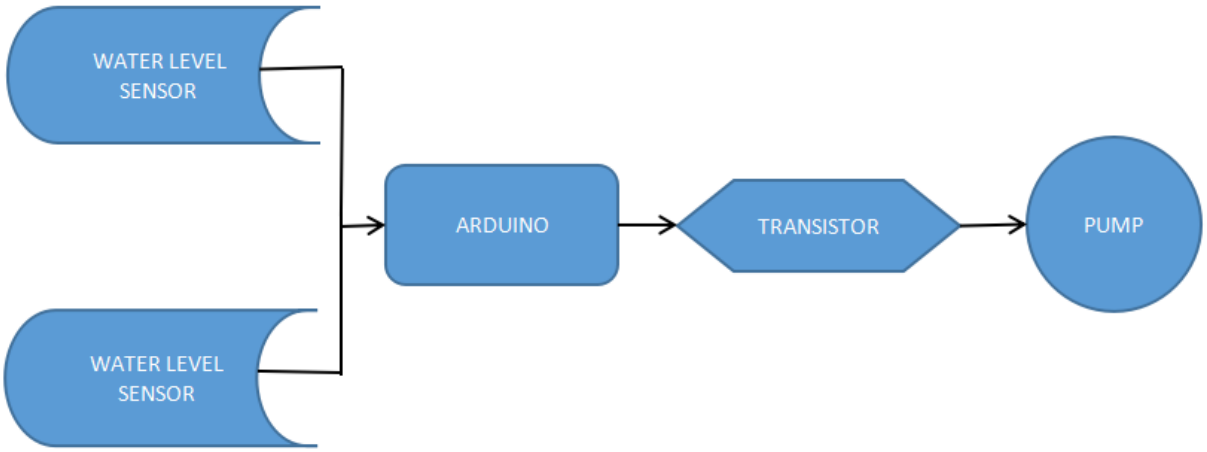
2. This project may not be able to handle high power.

3. The components used in this are sensitive and may damage easily.

4. We need to insert the wire in accordance with the level of water.

2. DESIGN

2.1 BLOCK DIAGRAM



2.2 HARDWARE ANALYSIS

Hardware requirement analysis is to define and analyze a complete set of functional, operational, performance, interface, quality factors, design, criticality and test requirements.

HARDWARE COMPONENTS NEEDED

1. Arduino IDE
2. Breadboard
3. Jumper wires
4. Water level sensors
5. DC water pump
6. Resistors
7. Transistors

SOFTWARE NEEDED

Proteus

Used to simulate and test the circuit before physical construction

ARDUINO

Arduino UNO has the ATmega328p micro-controller embedded in it. It has 14 digital I/O pins out of which 6 can provide PWM output. It is an open-source and provides prototype platform. It has a 16MHz crystal oscillator for the clock signal. In addition to the above features, it also has an USB connection, a power jack, an ICSP, header and reset button. It has everything to support a micro-controller. It can simply be connected to a computer using an USB cable or power it with an AC to DC adapter or a battery. All these features makes it the ideal board for prototyping.

CONNECTING WIRES

In any electronic circuitry wires are the conductive connections between the elements in contact. Ideally, they have zero resistance and provide perfect connections. On the breadboard, we used coloured jumper wires.

WATER LEVEL SENSOR

Level sensors are used to detect the level of substances that can flow. Such substances include liquids, slurries, granular material and powders. Level measurements can be done inside containers or it can be the level of a river or lake. Such measurements can be used to determine the amount of fluid within a closed container or the flow of water in open channels.

When completely immersed in water, the sensor has a tendency to overheat, which increases power consumption. To alleviate this issue, the voltage provided is reduced to 3.3V as opposed to 5.0V

RESISTORS

These are connected between the Arduino's digital Output and the Gate of the Transistor. Transistors are current-driven devices, so such resistors are mandatory to keep the current within acceptable limits. One resistor is connected to each transistor; this is so that, if one transistor were to take more current than the other, it's corresponding resistor would heat up more. This would increase its resistance, and reduce the current. This leads to a self-correcting circuit whereby each transistor will carry as close to 50% of the current as possible.

TRANSISTORS

These are used to amplify the current output of the Arduino's digital pins. This amplification is necessary to provide sufficient current to run the motor. In order to ensure reliability, two transistors are connected in parallel with their own current-limiting resistors. This halves the current through each resistor and transistor, which reduces temperatures and prevents damage.

WATER PUMP

An immersible centrifugal pump is used. It uses centrifugal forces to pump the water from the intake port located at the front of the motor, to the output port located on top of the motor. It is an inductive load, so a flyback diode must be connected appropriately to prevent high-voltage spikes from damaging the transistor upon turning it off.

DIODE

The diode redirects high voltage spikes from the Transistor's collector to the Arduino's +5V pin. The 5V pin is capable of sinking a lot of current without sustaining damage. This prevents those voltage spikes from reaching and damaging the transistor. A diode used for such a purpose is called a "flyback diode".

2.2.1 CIRCUIT DIAGRAM

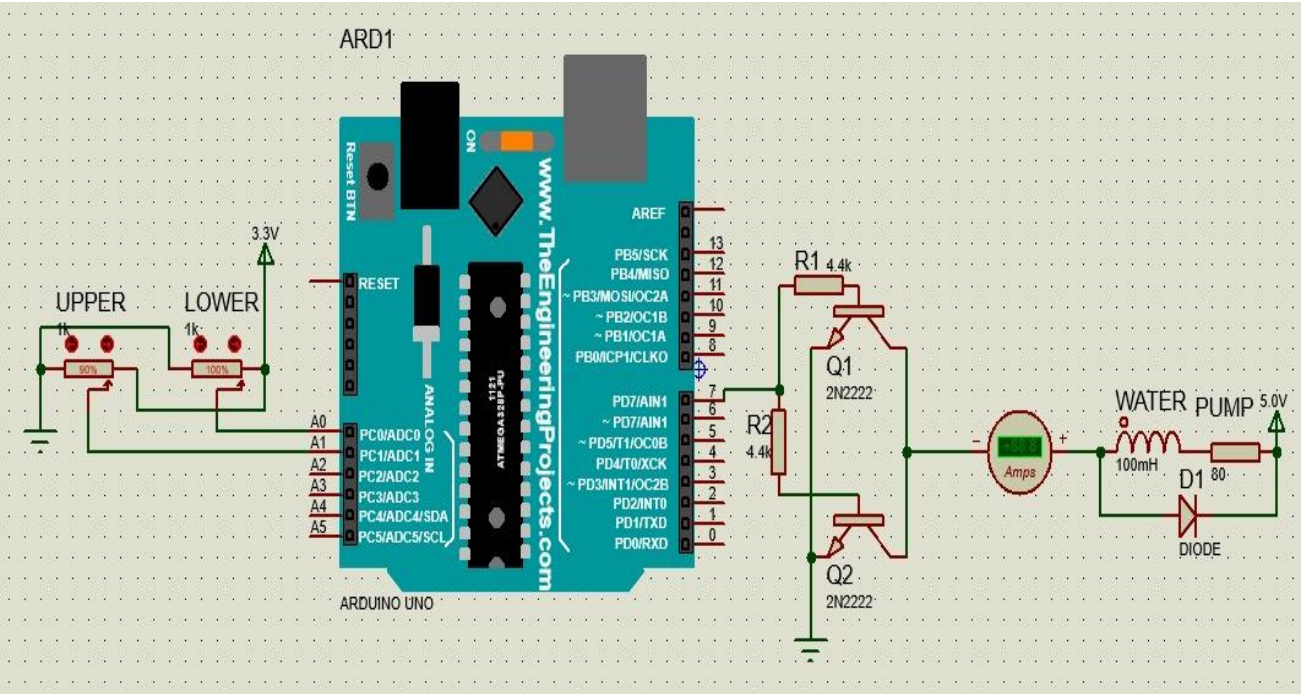


FIG 2.2.1(a) The above is the circuit diagram of the project

2.2.2 HARDWARE SNAPSHOTS

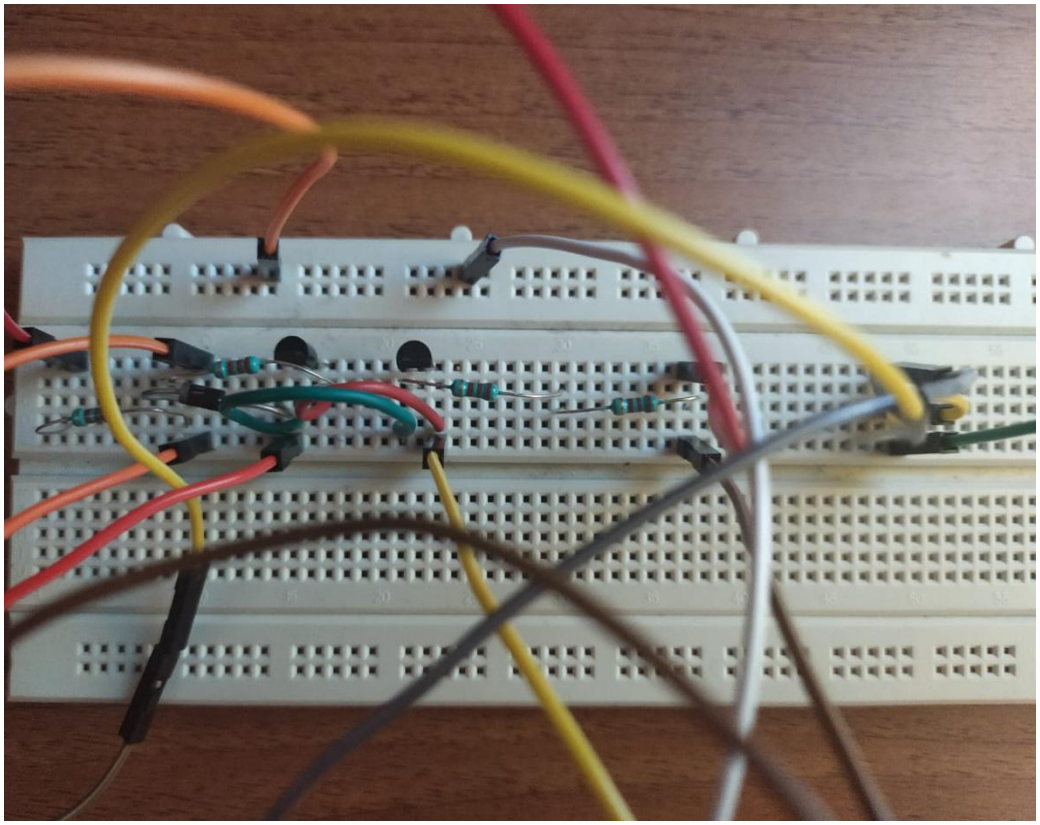


FIG 2.2.2(a) Breadboard connections

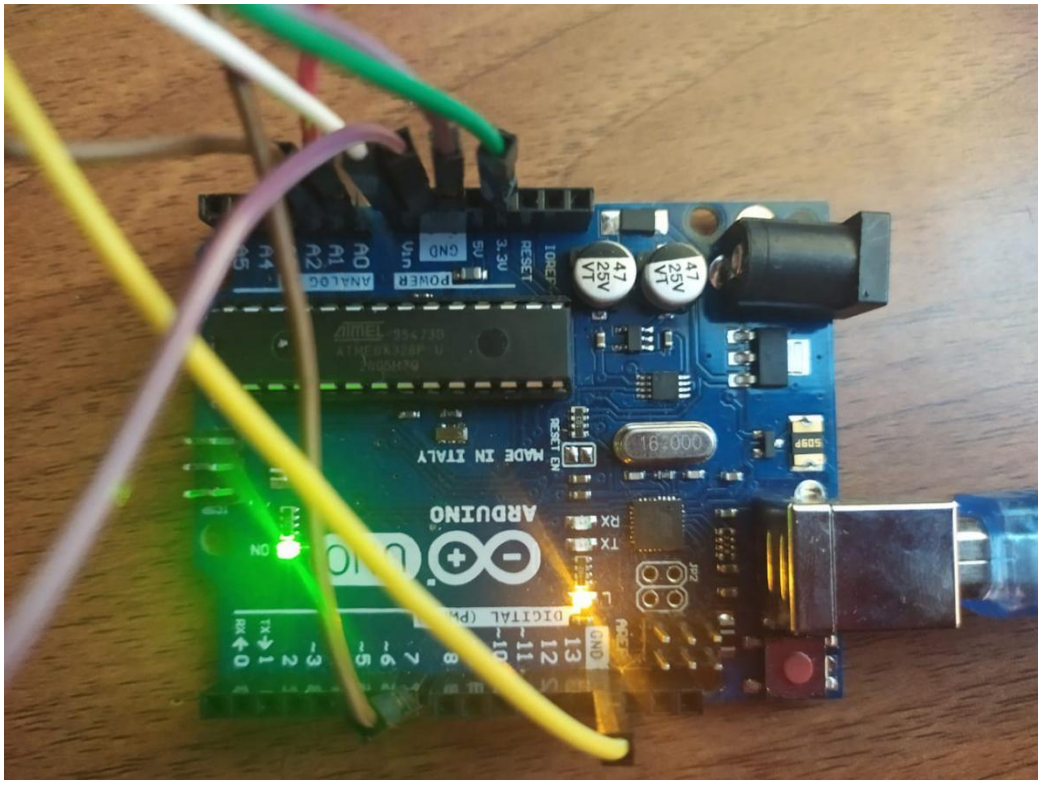


FIG 2.2.2(b) Arduino connections

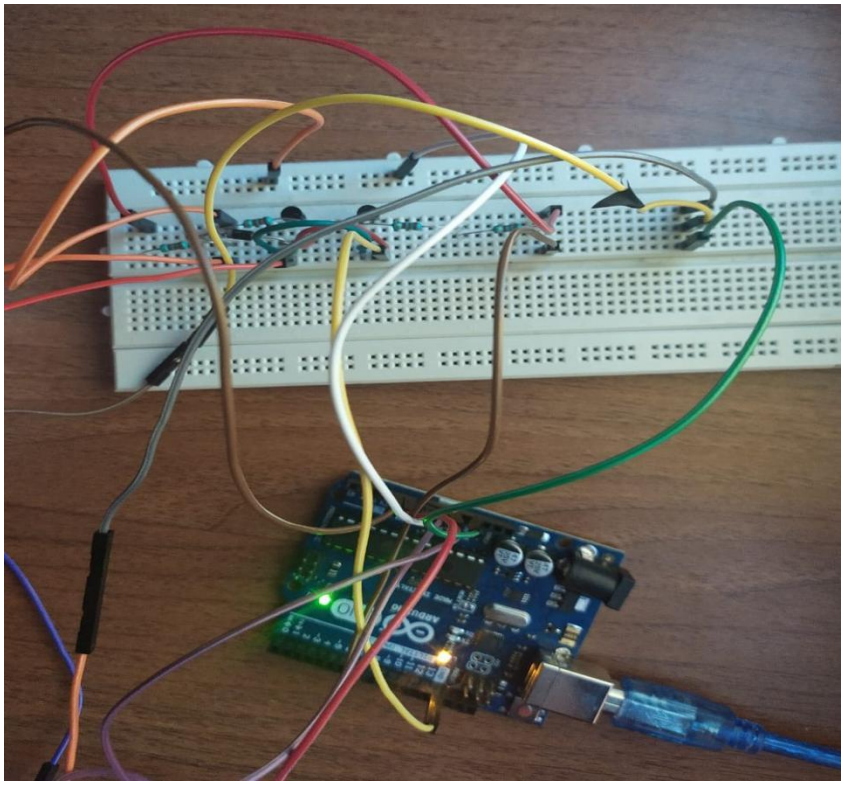


FIG 2.2.2(c) Arduino and breadboard connections

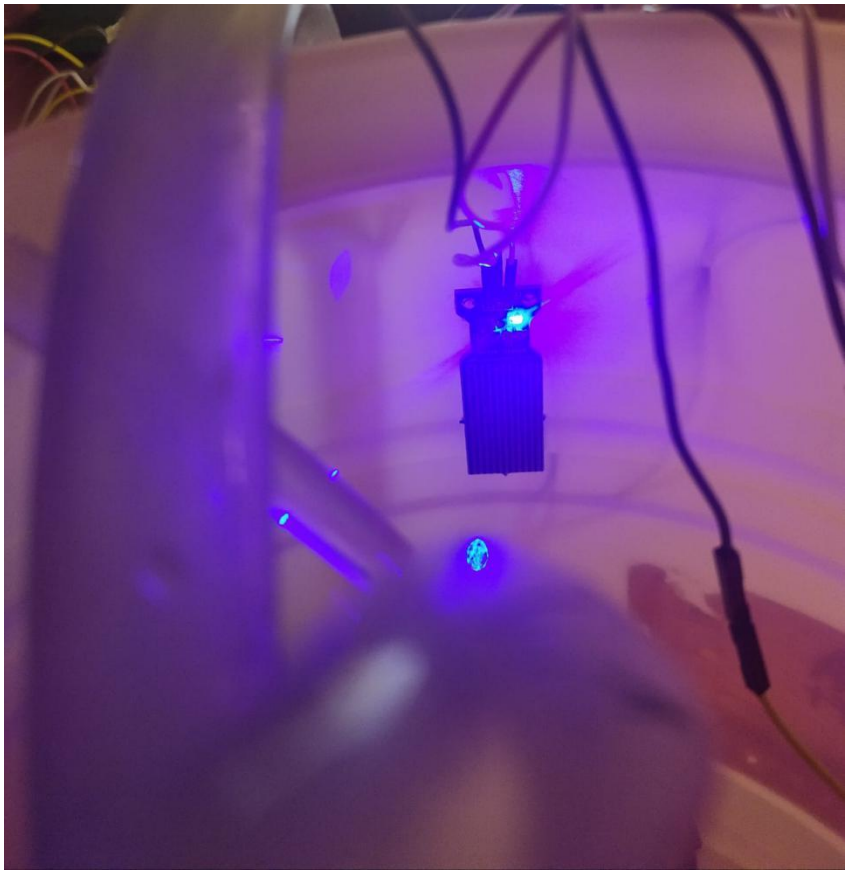


FIG 2.2.2(d)Water level sensors

3. SOFTWARE

3.1 CODING

CSE2006 | Arduino 1.8.13

File Edit Sketch Tools Help

CSE2006

```
const int SL=A0;  //for lower water sensor
const int SU=A1;  //for upper water sensor
const int pump=7; //for pump control

void setup()
{
  Serial.begin(9600);
  pinMode(SL, INPUT);   //set sensors as inputs
  pinMode(SU, INPUT);
  pinMode(pump, OUTPUT);  //set pump as output
  digitalWrite(pump, LOW);  //set initial value of pump to OFF
}

void loop()
{
  while(analogRead(SL)>=150)  //while tank has sufficient water, wait
  {
    delay(1000);
    Serial.print(analogRead(SL));
    Serial.print(",");
    Serial.println(analogRead(SU));
  }
  digitalWrite(pump,HIGH);  //turn on when insufficient water
  Serial.println("Motor ON ");

  while(analogRead(SU)<=150)  //while tank not full, wait
  {
    delay(1000);
    Serial.print(analogRead(SL));
    Serial.print(",");
    Serial.println(analogRead(SU));
  }
  digitalWrite(pump,LOW);   //turn off when sufficient water
  Serial.println("Motor OFF ");
}
```

3.1(a) Arduino code

3.2 ANALYSIS

The code starts with declaring required global variables: The pins used in the program.

The setup() is used to configure the inputs and outputs correctly. The pump is given an initial safe-state of OFF

The loop() performs the bulk of the logic.

While the lower sensor reads more than 0.73 volts, we know there is sufficient water in the tank, and the motor is kept off. When this is no longer the case, the motor is turned on

While the upper sensor reads less than 0.73 volts, we know the tank is not full, and the motor is kept on. When this is no longer the case, the motor is turned off.

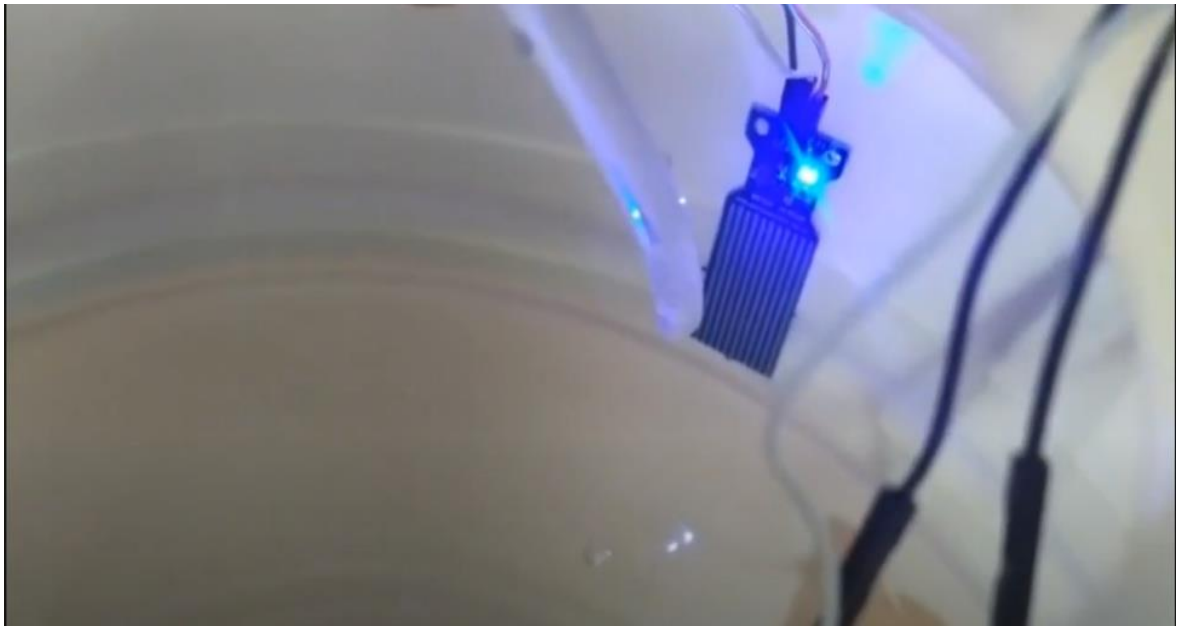
Debugging messages are printed via the serial monitor. In the case where the system does not work as expected, a laptop can be connected to the Arduino to identify the problem.

The algorithm is observed to work as expected, in a consistent and reliable manner. The system has been tested extensively without error.

4. CONCLUSION AND FUTURE WORK

4.1 WORKING OF THE PROJECT

4.1(a) The whole setup



4.1(b) When motor is turned off

For the working video of the project use the link:

https://youtu.be/1k4fyqzXaSQ

4.2 CONCLUSION

Automation of the various components around us has been widely increased to reduce human intervention and save time. The water tank overflows as the height of water in the tank cannot be randomly guessed. This leads to extra energy consumption, which is a high concern in the present. People also need to wait and stop doing their other activities until the tank is full. Hence, here is an idea which senses and indicates the water level(either low or high) so that the pump can be switched off on appropriate time and save water, electricity and time as well. Therefore "Automatic Water Level Controller Using Arduino" project can definitely be useful on a large scale basis due to minimum requirement of man power and also the installation process being easier making more compatible for everyone to use.The experimental set-up for controlling the liquid level is designed and developed successfully. The system was designed successfully using Arduino-Uno microcontroller for two level. Automatic control system has been introduced to control water level (low level and high level)in a tank.

4.3 FUTURE WORK

The automatic water level indicator and controller using Arduino project can also be installed with pH sensors which will help to regulate the acidity or alkalinity of the water. This project could be linked to a WiFi module to receive the water level on the mobile. Other additions could be to indicate the fuel consumption in vehicles. There could be buzzer attached to this system so that it can indicate when motor is turning off and turning on. LED display could be attached to the system to indicate the level of water in the tank.

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