1st YEAR DIY LABORATORY GROUP PROJECT

IIT KHARAGPUR

AUTOMATIC WATER PUMP SYSTEM USING ARDUINO & ULTRASONIC SENSOR

- **Group No. 9 (Section 17)**

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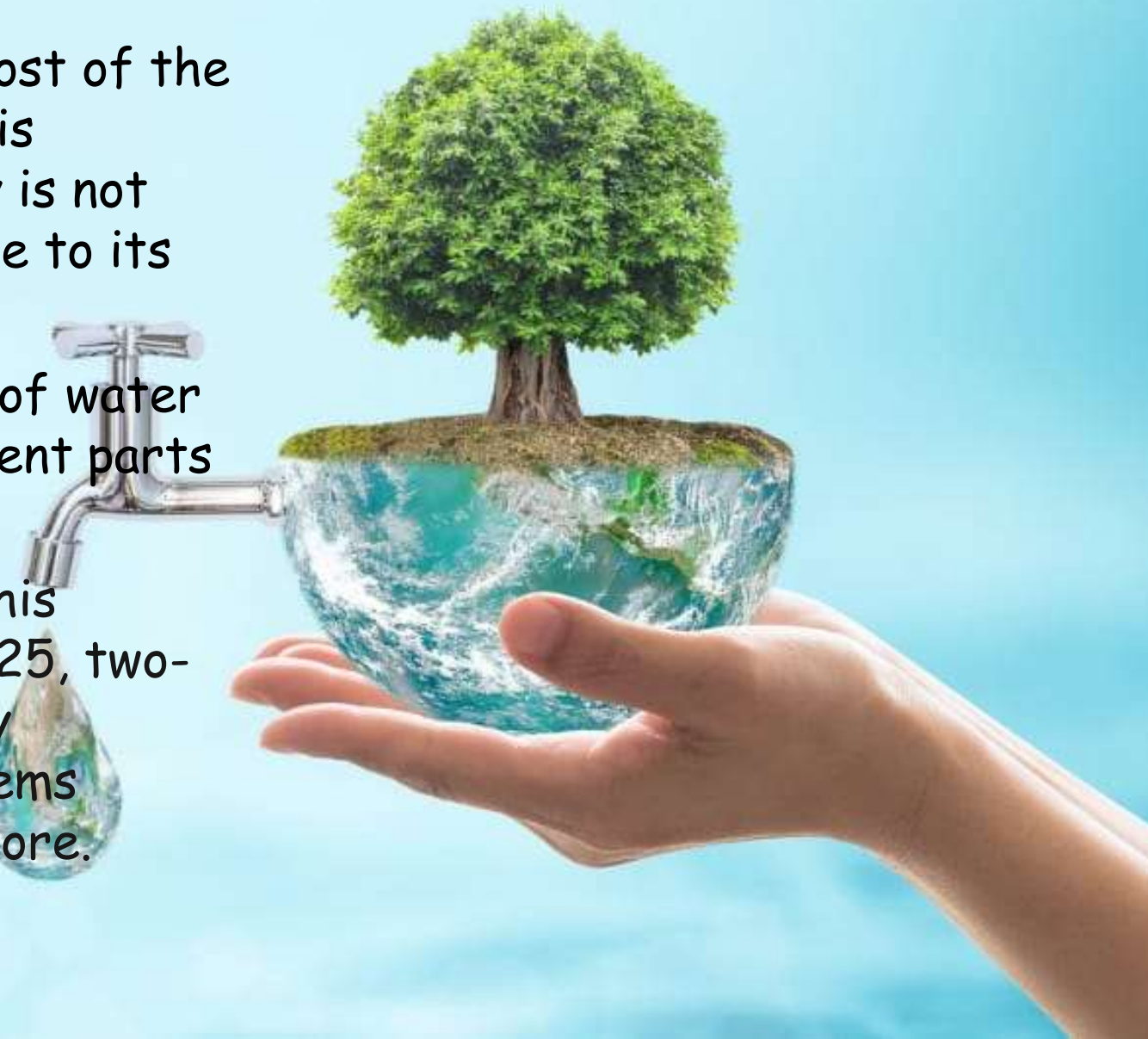
Importance of Water

- The scarcity of water is gripping most of the countries in the world. However, it is important to note that the scarcity is not due to water's unavailability, but due to its undue wastage.
- This kind of overwhelming wastage of water resulted in water scarcity in different parts of the world.
- At the current consumption rate, this situation will even get worse. By 2025, two-thirds of the world's population may face water shortages. And ecosystems around the world will suffer even more.



ABOUT THE PROJECT

- The project is Automatic Water Pump System which works on the basis of level of water present in a Tank/Container by detecting the Lower/Upper limit of water level which is fixed by the user, once reached; instantly Turns ON/OFF accordingly without any Man power and the wastage of the water. This makes the method an efficient way for preventing from water being wasted and makes our daily life easy and comfortable.

MOTIVE OF THE PROJECT

- Usually people turn on the Motor, as it takes a while to fill the Tank they forget to switch off the Motor after certain time and leads to water runs off unnecessarily (in turn water wastage). The Main motive is to prevent these kinds of water wastage. This projects solves the issue by automatically turning off/on the motor in accord with the water level(One of the benefits of Automation).
- In most of the houses, there is unnecessary wastage of water due to overflow in overhead tanks. This problem can be solved with the help of automatic water level controllers.
- It also save the time for us by without having a thought of water level, and we can carry out our other works(reduces manual efforts).

PROJECT OVERVIEW

- The project is Structured, designed and simulated in TinkerCAD Software.

1. The Arduino Uno Circuit Layout is sketched and assembled with various elements on TinkerCAD in symbiosis with the code required to run the project(code is installed through USB Cable into Arduino IDE).

WEEK WISE DISTRIBUTION

Week1

- Selection of Topic for our Project(Automation).
- Gathered Information related to our project.
- Presentation making.

Week 2

- Circuit making in Tinkercad and Simulation along with the coding part.
- Studied L293D IC, Worked on the challenges mentioned by Sir.
- We received the components for Hardware assembly.

Week 3

- Worked on the Hardware assembly and made an Explanation video.
- Made a Simulation Video and covered challenges mentioned by sir.
- Presented the Final PPT.

SCHEMATIC WORKING FLOWCHART

The ultrasonic distance sensors will detect the water level in the tank

The Arduino will compare the water level with the upper/lower limit set by the user and instructs as follows

If it is reaching the lower limit the motor will be ON

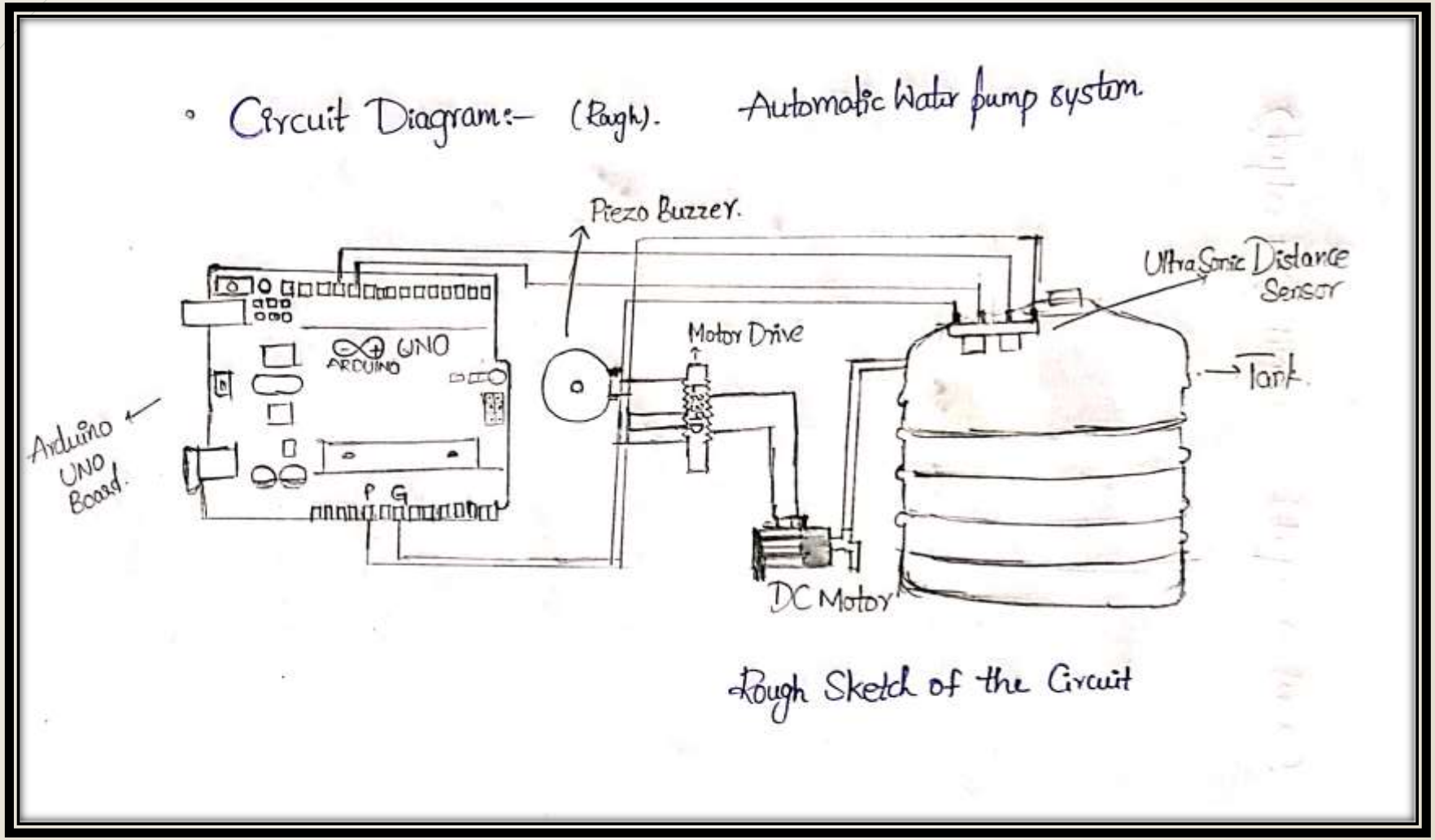
The moment when the water level reaches the upper limit The motor will turn off automatically

The power source must be given for all time for automation

Applications of this Project

- These systems are extensively used to prevent water loss, which saves manual labor by switching the motor on and off as per the varying water level in the tank.
- The motor power is switched on when the overhead tank becomes empty and switches off automatically when the underground tank is empty or the overhead tank becomes full. In this way it becomes easy to ensure 24 hours water supply without any kind of interruption.
- So it obviously requires no human intervention which is why it is in great demand. The level control devices also include sensors which are specially designed to monitor the water level in the tanks. Most of these sensors are safe, electrically conducive and plastic moulded. It is also non corrosive so it lasts longer.

Rough Sketch of our Circuit

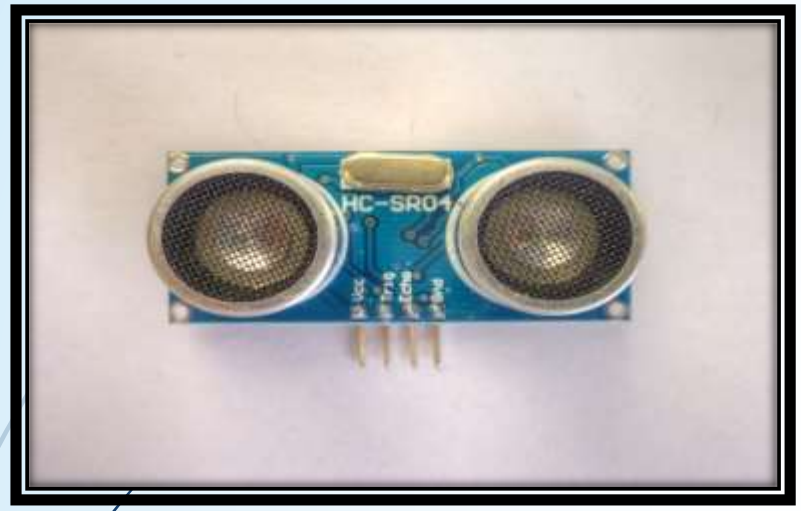


CIRCUIT DESIGNING IN TINKERCAD

- **Components of the Circuit**

1. Arduino UNO
2. Small Breadboard
3. 5V DC Motor
4. Ultrasonic Distance Sensor
5. L293D Motor Drive
6. Solar Panel
7. Piezo Buzzer
8. Jumper wires(male-male, female-female, male-female)

Working principle of Individual Parts

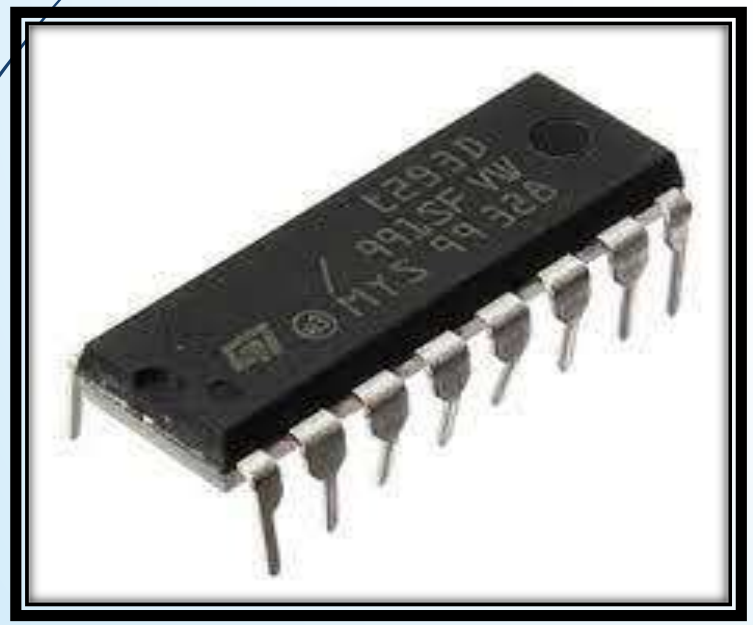


- **ULTRASONIC DISTANCE SENSOR**

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear)

- **Arduino UNO**

The Arduino Uno is a microcontroller board. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.



5V DC Pump

The pump is used to deliver the water required to the Tank(DC powered pumps use direct current from Power source, to move fluid from water source to Tank)

L293D Motor Drive

The L293D is a 16-pin Motor Driver IC which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive currents of up to 600 mA (per channel) at voltages from 4.5 V to 36 V (at pin 8!). You can use it to control small dc motors - toy motors.

Sources of Power

In our project there are two possible sources of power to the circuit.

- Default Electric current used for the household Appliances with the help of suitable adapter is used to power the Arduino uno Board.
- The Solar Power source using a solar panel.(5V Solar panel can be used to power the Arduino Board)

We can use this Alternative for saving electricity because automation projects require power source most of the time(can be implemented if the weather is sunny)

Assumptions

- We assumed that desired water level from distance sensor is greater than 100cm and less than 200cm.
- The water level in the tanks or any objects are measured by ultrasonic distance sensor only.
- Voltage applied at the input terminals of dc pump is around 12V.

Some of the drawbacks are:-

Normally, any automatic mechanism requires maintenance and replacement frequently. You may bring down these costs by getting your water level indicator system from the top water level controller and Indicator Company that warrants a long life of the equipment.

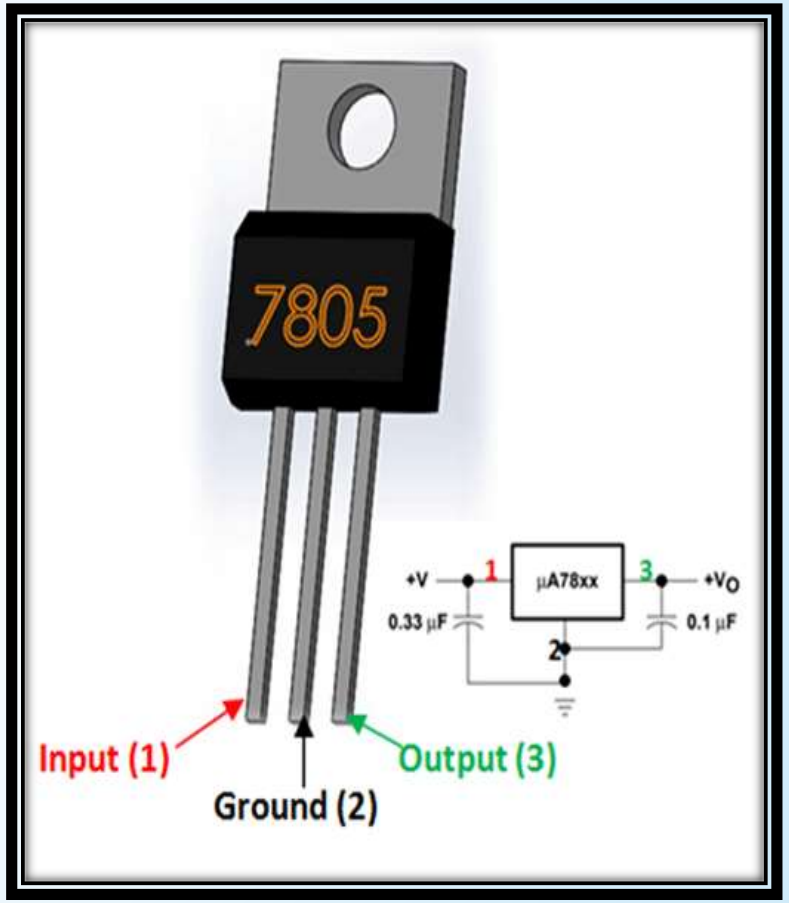
Even if you have purchased an expensive and modern water level indicator system, getting it installed perfectly is crucial. Only the top manufacturer of water level controllers will be having the essential resources and skilled technicians to ensure a successful installation

Limitations

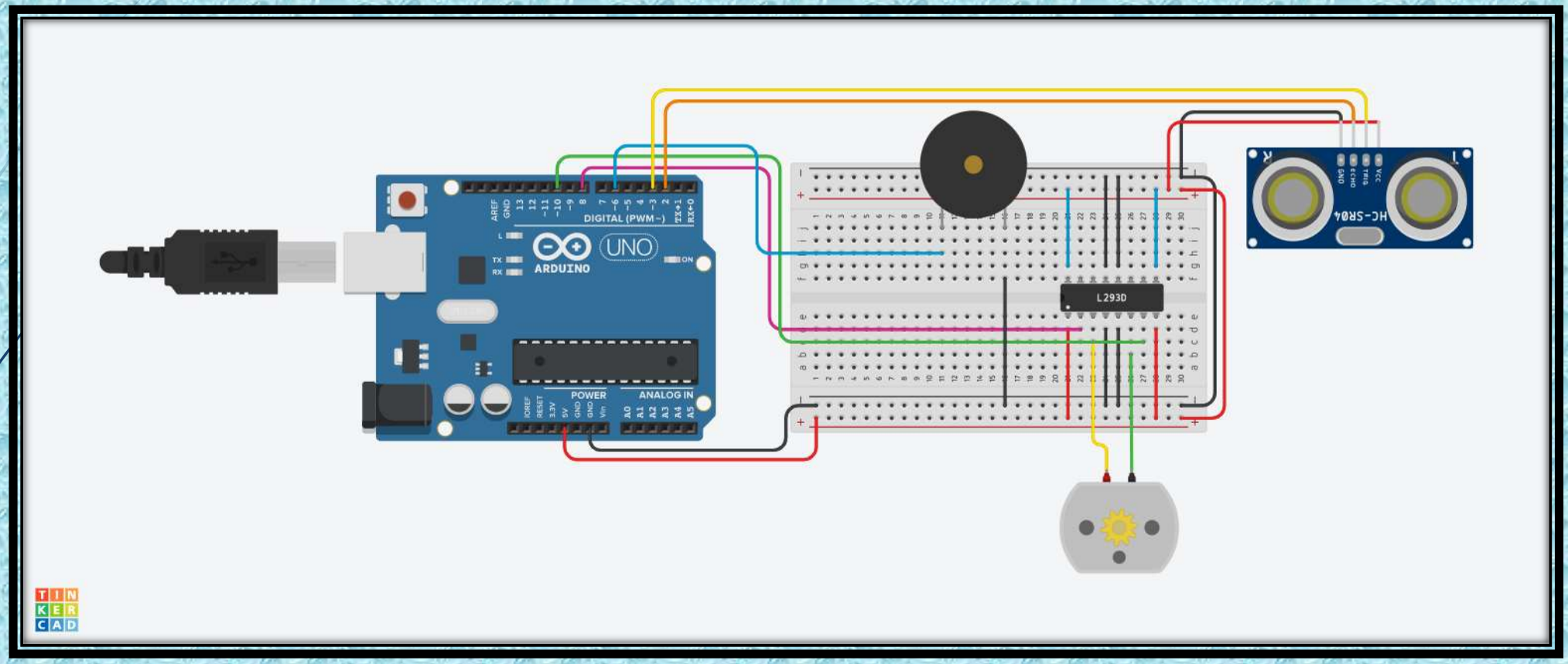
- Our prototype is only for demonstration and can't be implemented for practical purposes. If it is to be extended to household purpose we need high power ratings and some changes are required.
- In the pursuit of saving water, individuals and organizations have to spend money on water level indicator system. They may not get a guaranty on the system or spares.
- The indicator and controller parts may be built separately If you go in for assembling a water level indicator and controller system by procuring the parts from varied vendors, you may have to face the challenges of incompatibility. Buying your system from reputed and professional manufacturers of water tank level controller and indicators ensures a smooth installation and a seamless functioning of the entire system.
- The best way to get the most out of your water level indicator and controller system is to check it frequently and replace the required parts.

Challenges faced in making our project practically possible so far

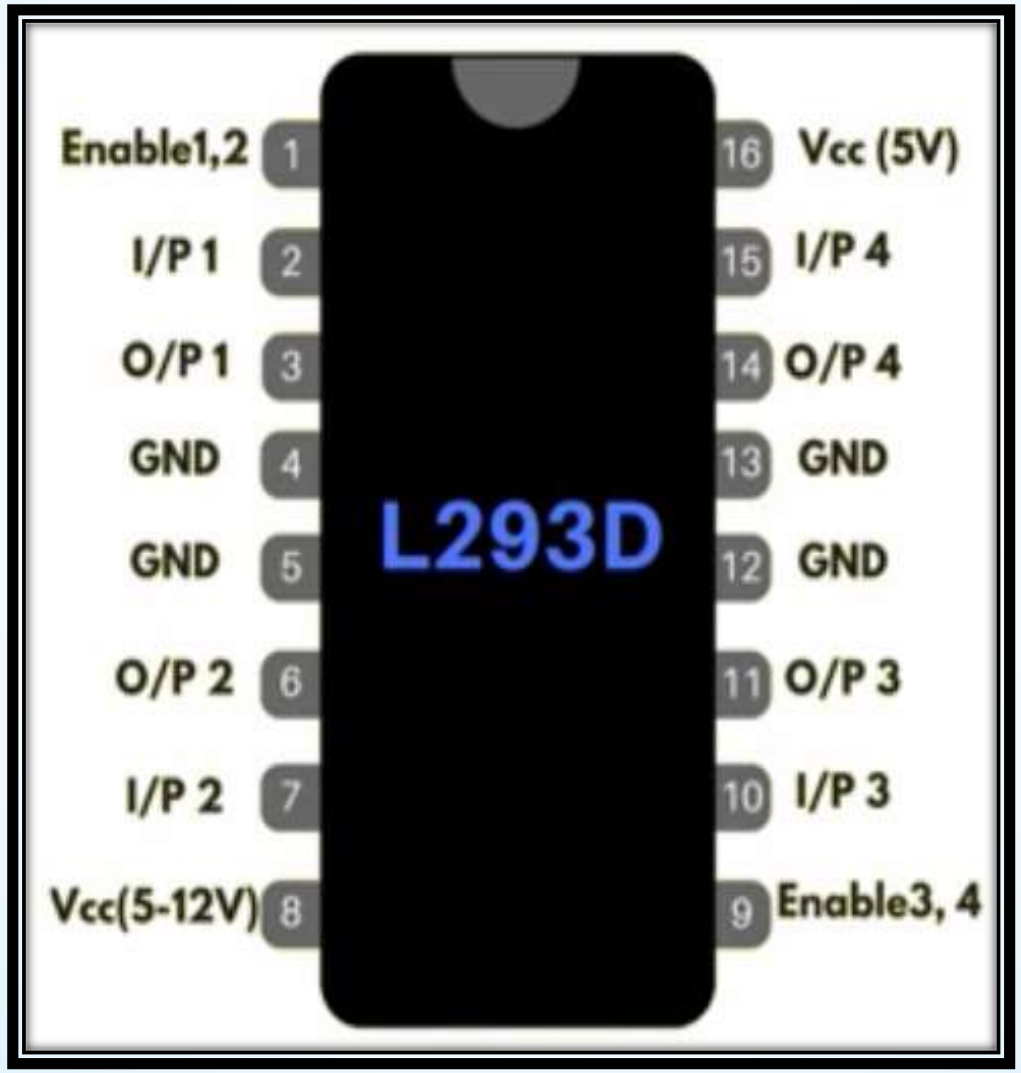
- Our prototype which is working in 5V conditions it won't be suitable to implement to the tanks in general which we use in our daily life.
- So, we need to use a step down transformer which converts 220V AC input to 12V AC output, then we use Rectifier to convert to 12V DC and then finally we use voltage regulator such as LM 7805 IC .
- Which is a 5V Voltage Regulator that restricts the output voltage to 5V output for various ranges of input voltage. It acts as an excellent component against input voltage fluctuations for circuits, and adds an additional safety to our circuitry.



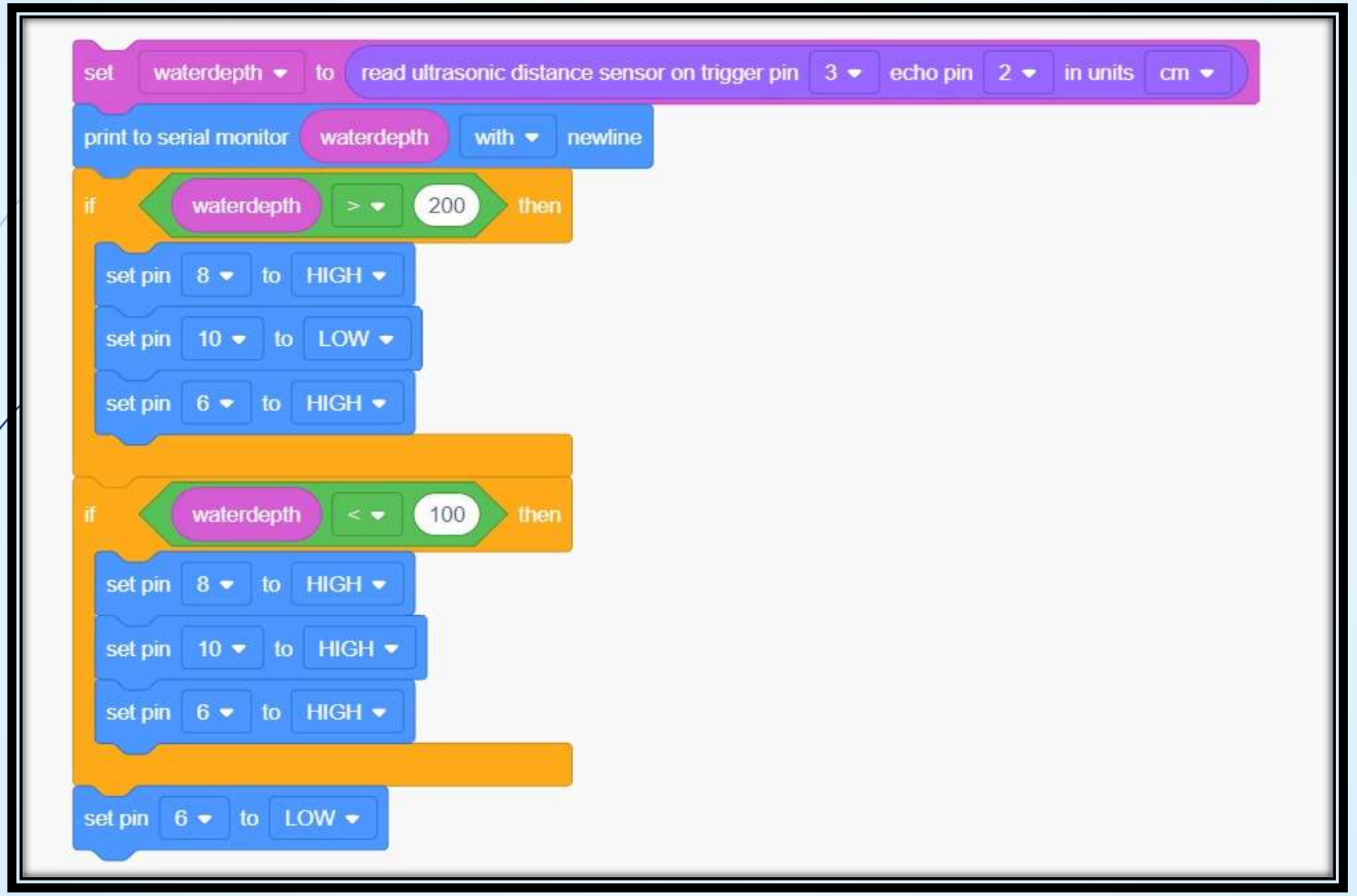
Circuit Designing in TinkerCAD



L293D Integrated Circuit



Code for the circuit in Tinkercad

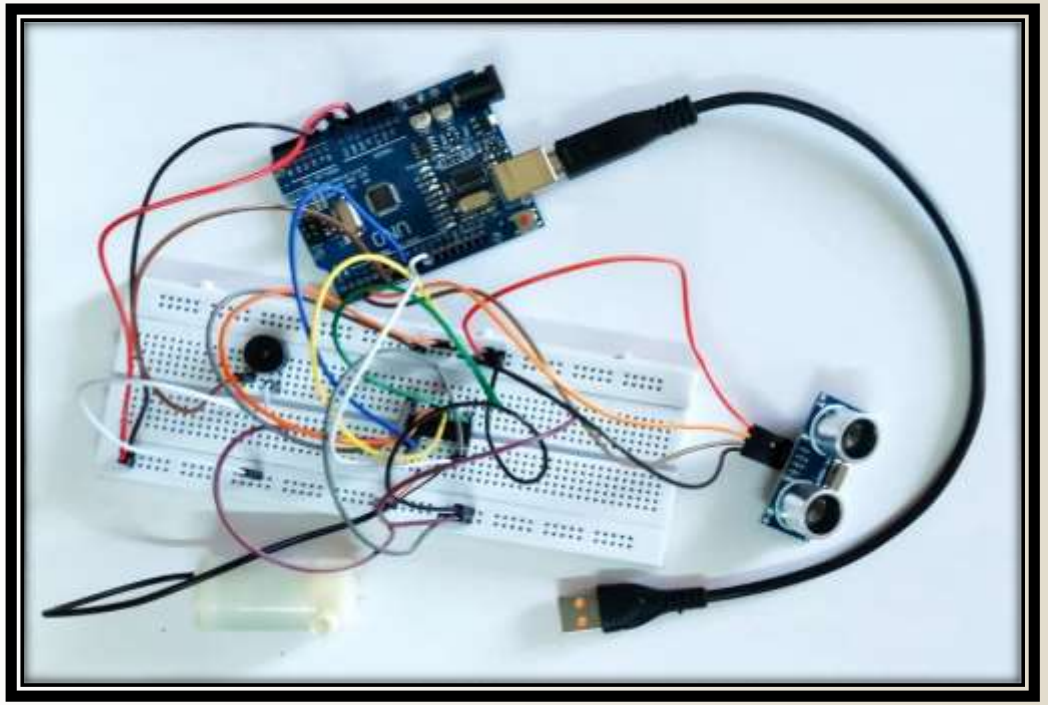


The Conversion of Block code to text code in Tinkercad

```
// C++ code
//
int waterdepth = 0;

long readUltrasonicDistance(int triggerPin, int echoPin)
{
  pinMode(triggerPin, OUTPUT);  // Clear the trigger
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  // Sets the trigger pin to HIGH state for 10 microseconds
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  // Reads the echo pin, and returns the sound wave travel time in microseconds
  return pulseIn(echoPin, HIGH);
}

void setup()
{
  Serial.begin(9600);

  pinMode(8, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(6, OUTPUT);
}

void loop()
{
  waterdepth = 0.01723 * readUltrasonicDistance(3, 2);
  Serial.println(waterdepth);
  if (waterdepth > 200) {
    digitalWrite(8, HIGH);
    digitalWrite(10, LOW);
    digitalWrite(6, HIGH);
  }
  if (waterdepth < 100) {
    digitalWrite(8, HIGH);
    digitalWrite(10, HIGH);
    digitalWrite(6, HIGH);
  }
  digitalWrite(6, LOW);
  delay(10); // Delay a little bit to improve simulation performance
}
```

Overall Status of the project

- We have received all the needed components for the project such as USD Sensor, Piezo Buzzer, L293D Motor, Arduino board
- Circuit has been designed in Tinkercad
- Coding part has been completed
- Hardware assembly (Currently We have encountered problem in Hardware assembly)



Prototype

New things we have learnt while we making the project

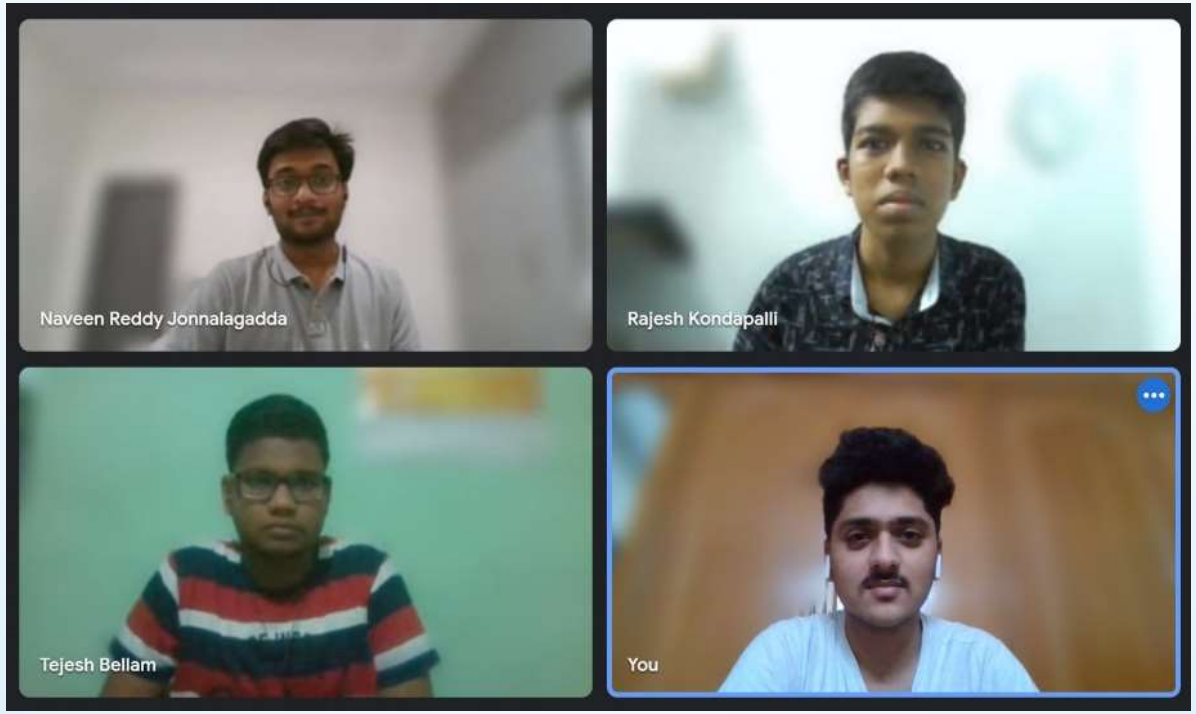
1. Learnt to make custom Arduino Circuits.
2. We dealt with the electric circuits practically(circuit making & soldering)

Team Work

- Every week we organized three to four Google meets and discussed our views
- We discussed how to do the tasks for the following week.
- Mutually we arrived at a final conclusion.
- On Whatsapp group we share our work.

WORK DISTRIBUTION

- **Boppudi Aarsha Sai :** Hardware Parts Assembling(Prototype)
- **Kondapalli Rajesh :** Circuit Designing, Arduino Coding, Simulation on Tinker CAD
- **Naveen Reddy & Bellam Tejesh :** Studied L293D IC , Presentation and Data Collection and Compilation.



Referral Links used

1. https://www.youtube.com/watch?v=fDOTESgnnAI (L293D usage, Circuit and code explanation)
2. https://www.youtube.com/watch?v=duCusheBm8w&t=240s

(for understanding voltage regulator functioning)

Conclusion

- ✓ This project can be a crucial part of Homo Automation. This makes our daily lives easy and enables a fresh start for our day.

THANK YOU ☺