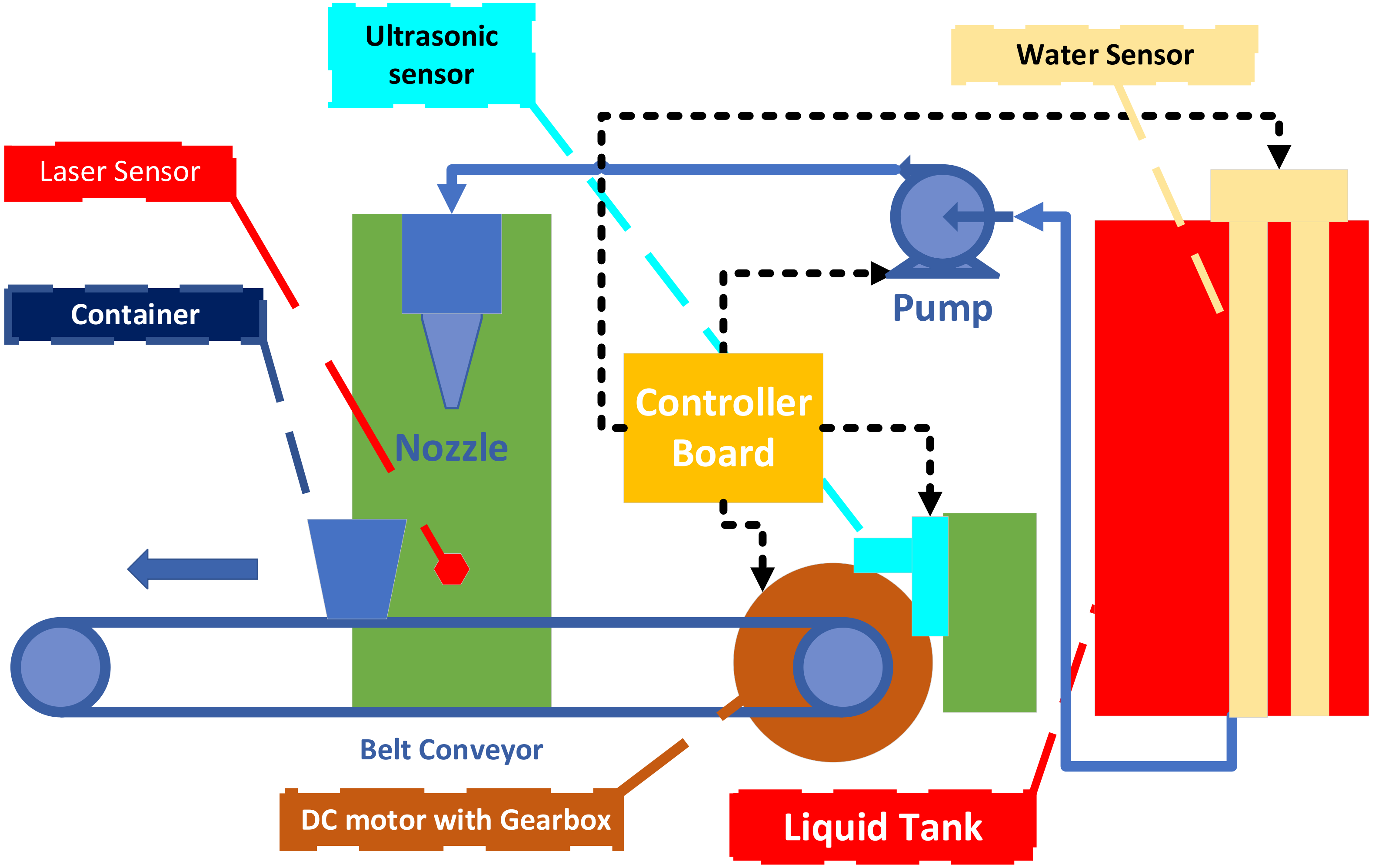
Automatic Filling Machine

Farzad Azizi Zade

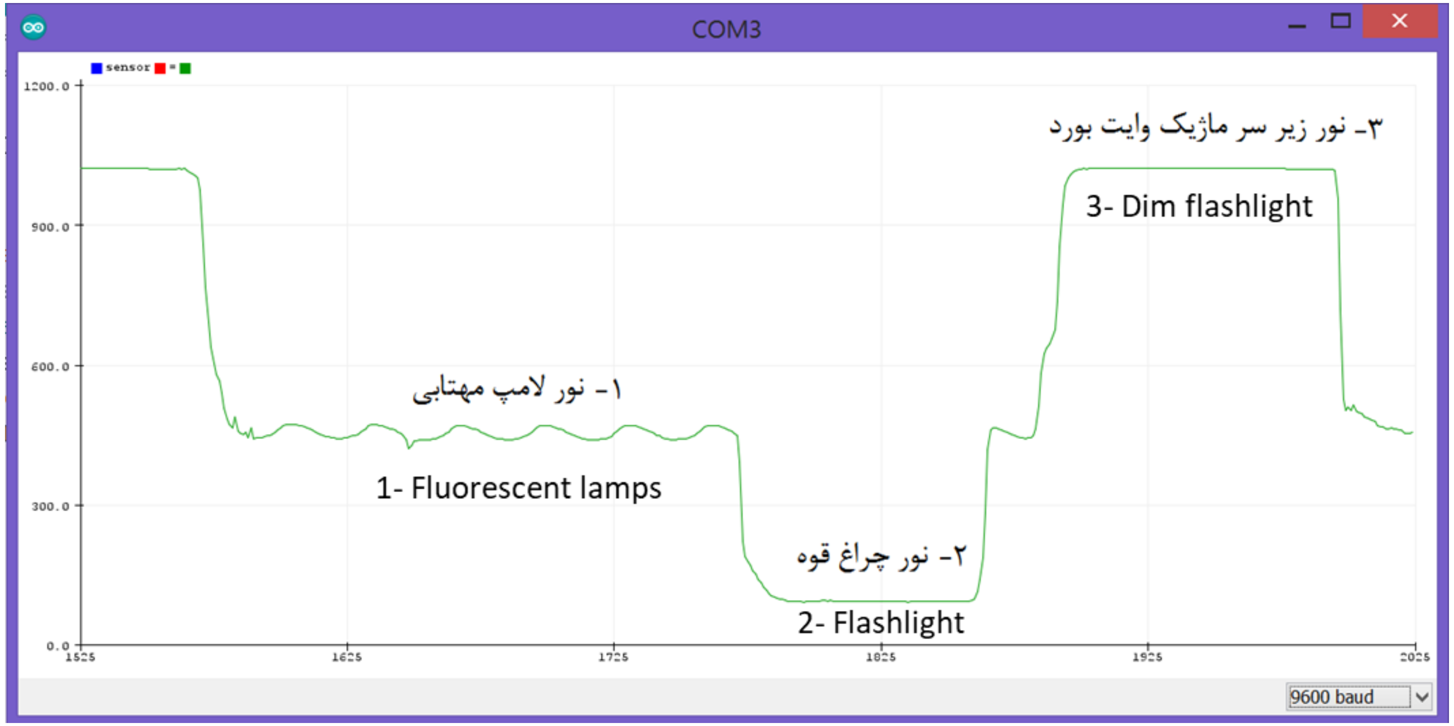
Manufacturing
Automation

Automatic Filling Machine



Photocells are sensors that allow you to detect light. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they often appear in toys, gadgets and appliances. They are often referred to a CdS cells (they are made of Cadmium-Sulfide), light-dependent resistors (LDR), and Photoresistors.

Photocells, Photoresistors,
LDR (light dependent resistor)

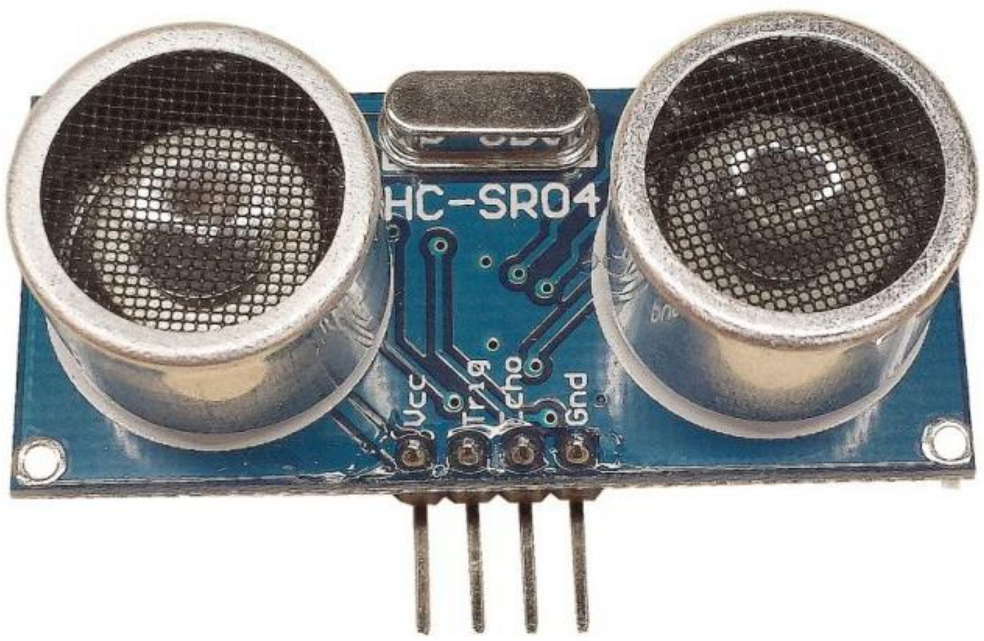


Ultrasonic Ranging Module HC - SR04/SR05 features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

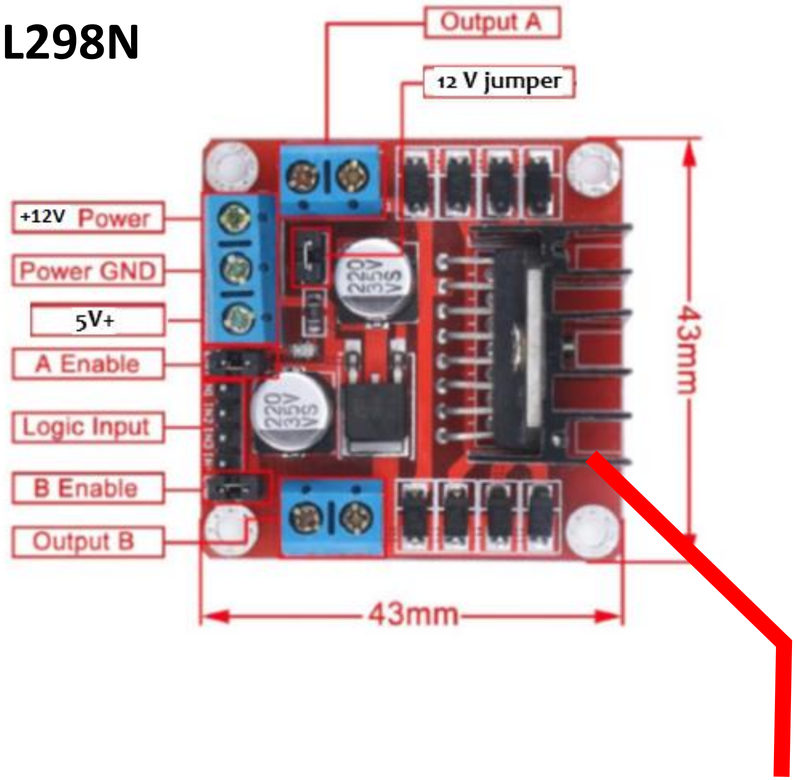
1) Using IO trigger for at least 10us(micro-second) high level signal,
2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance **=** [high level time × velocity of sound (340 m/s)] / 2



Vcc: 5V Supply Trigger
Trig: Pulse Input
Echo: Echo Pulse Output
GND: 0V Ground

L298N



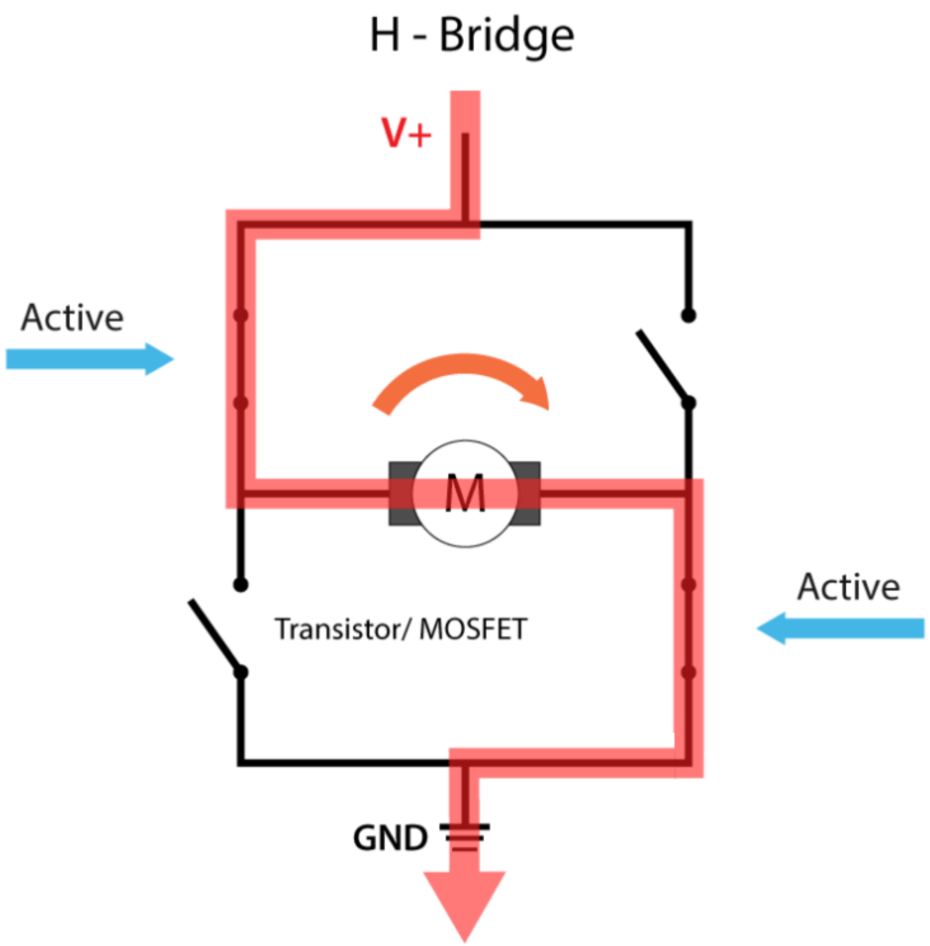
+12V	5 – 35 V power supply
GND	Power supply and Arduino ground
12 V jumper	Remove if motor power > 12 V!
5V+ (optional)	5 V Arduino if 12 V jumper is removed
IN1	Pin 8 Arduino
IN2	Pin 9 Arduino
IN3	Pin 10 Arduino
IN4	Pin 11 Arduino
ENA and ENB jumper	Leave installed
OUT1 + OUT2	Stepper motor coil A
OUT3 + OUT4	Stepper motor coil B

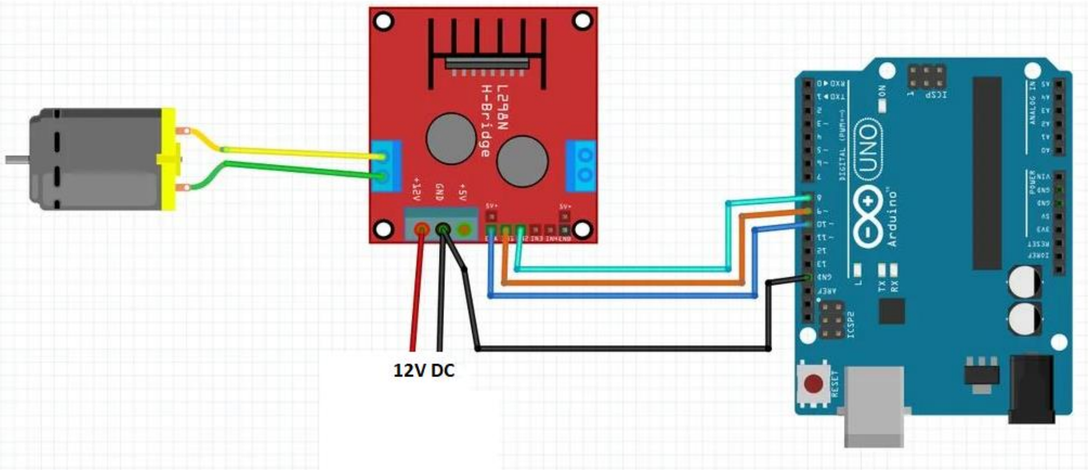
It is highly recommended to use a cooling fan on the heatsink

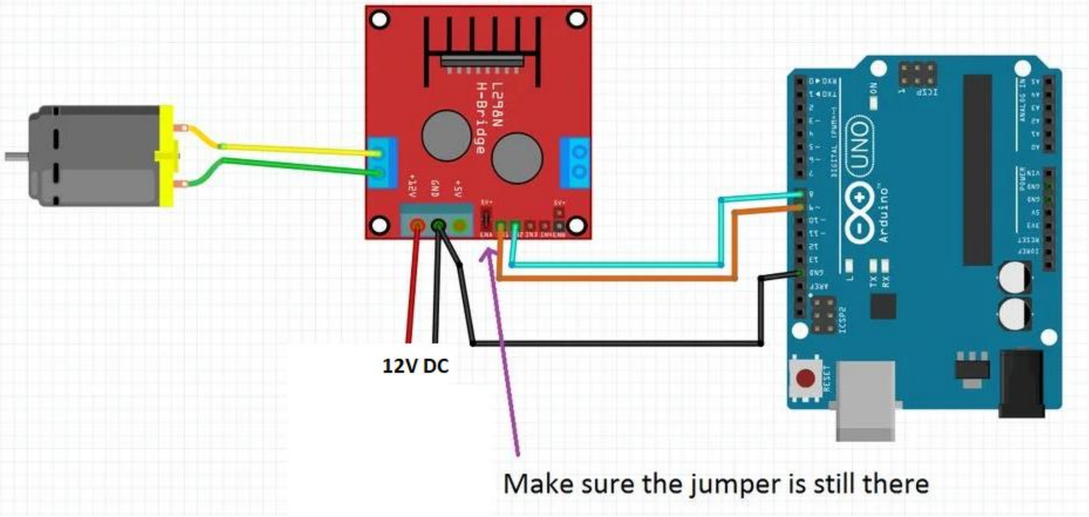
H-Bridge

for controlling rotation direction, we just need to inverse the direction of current flow through the motor, and the most common method is by using an H-Bridge.

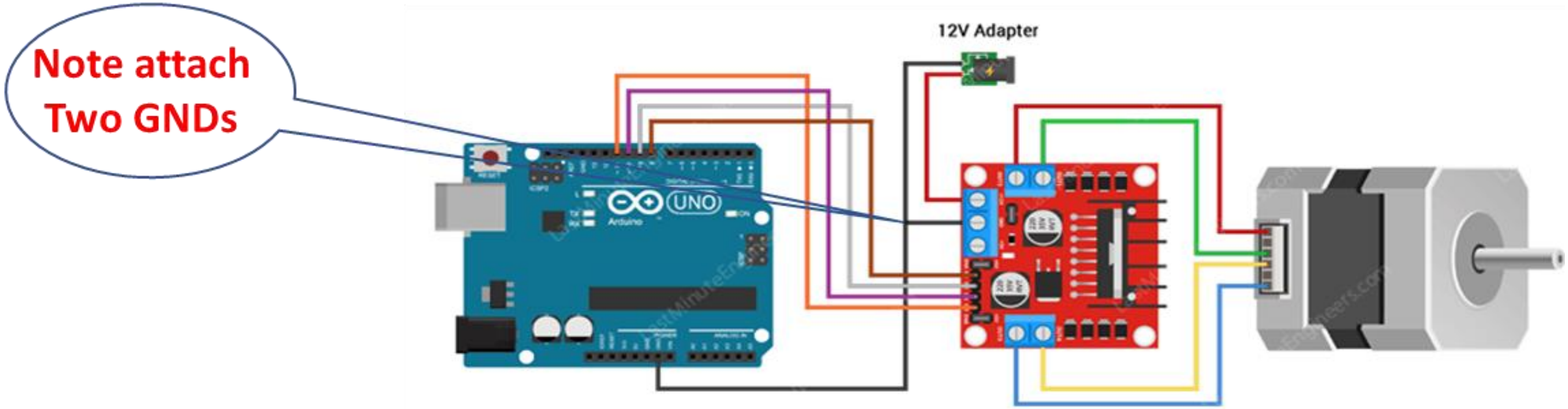
An H-Bridge circuit contains four switching elements, transistors or MOSFETs, with the motor at the center forming an H-like configuration. By activating two particular switches at the same time we can change the direction of the current flow, thus change the rotation direction of the motor.







Make sure the jumper is still there



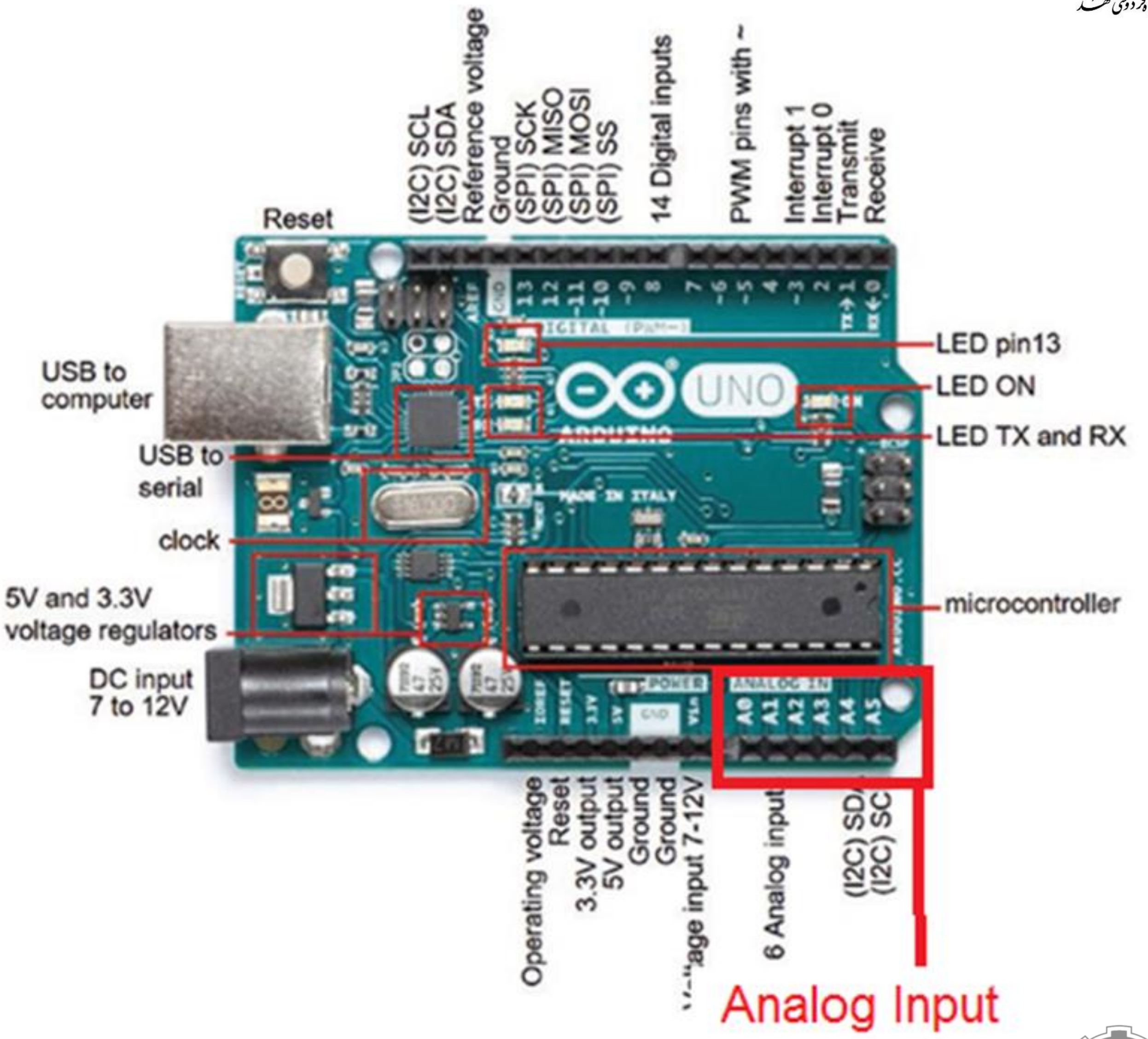
Note attach Two GNDs

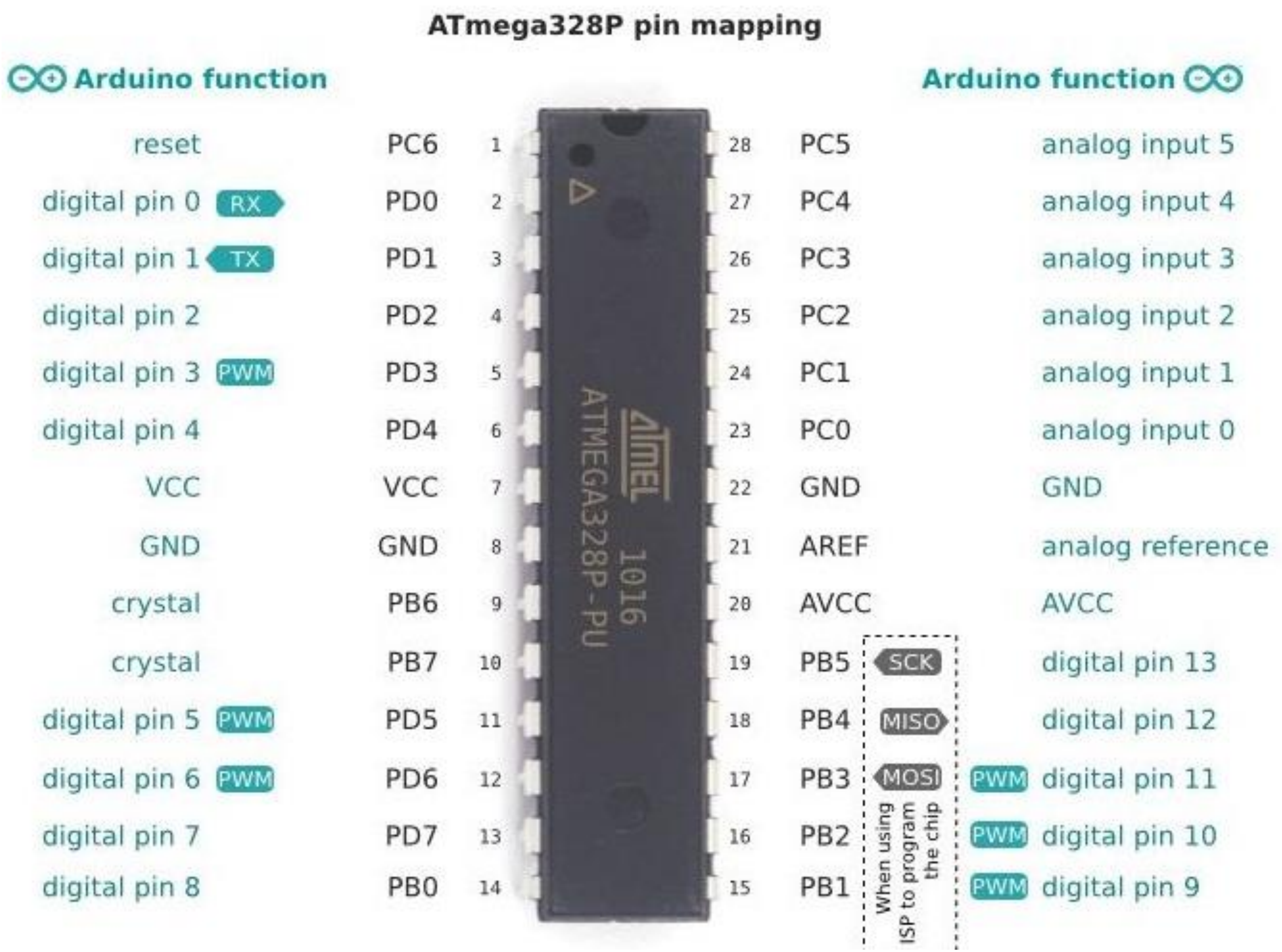
Arduino Uno R3

ATmega328P microcontroller

- USB connection
  - DC input
  - upload instructions
  - Communicate with PC

- Arduino C is not standard C. Rather, a robust ***subset*** of standard C.
  - A few standard C features are missing.



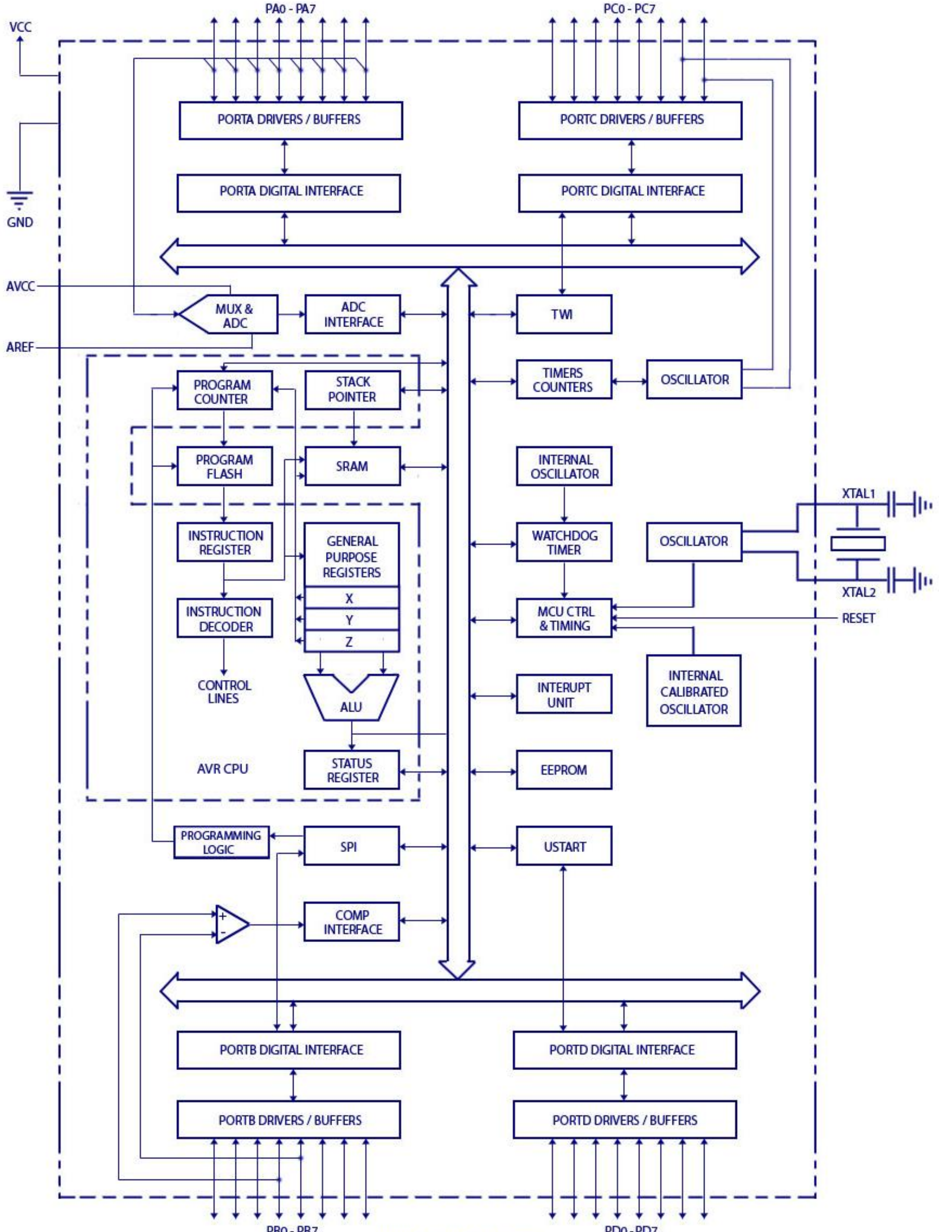


ATmega328P pin mapping

Arduino function						Arduino function
reset	PC6	1	28	PC5		analog input 5
digital pin 0 RX	PD0	2	27	PC4		analog input 4
digital pin 1 TX	PD1	3	26	PC3		analog input 3
digital pin 2	PD2	4	25	PC2		analog input 2
digital pin 3 PWM	PD3	5	24	PC1		analog input 1
digital pin 4	PD4	6	23	PC0		analog input 0
VCC	VCC	7	22	GND		GND
GND	GND	8	21	AREF		analog reference
crystal	PB6	9	20	AVCC		AVCC
crystal	PB7	10	19	PB5	SCK	digital pin 13
digital pin 5 PWM	PD5	11	18	PB4	MISO	digital pin 12
digital pin 6 PWM	PD6	12	17	PB3	MOSI	PWM digital pin 11
digital pin 7	PD7	13	16	PB2		PWM digital pin 10
digital pin 8	PB0	14	15	PB1		PWM digital pin 9

When using ISP to program the chip

Block Diagram - ATmega32(AVR) - 8-bit Microcontroller



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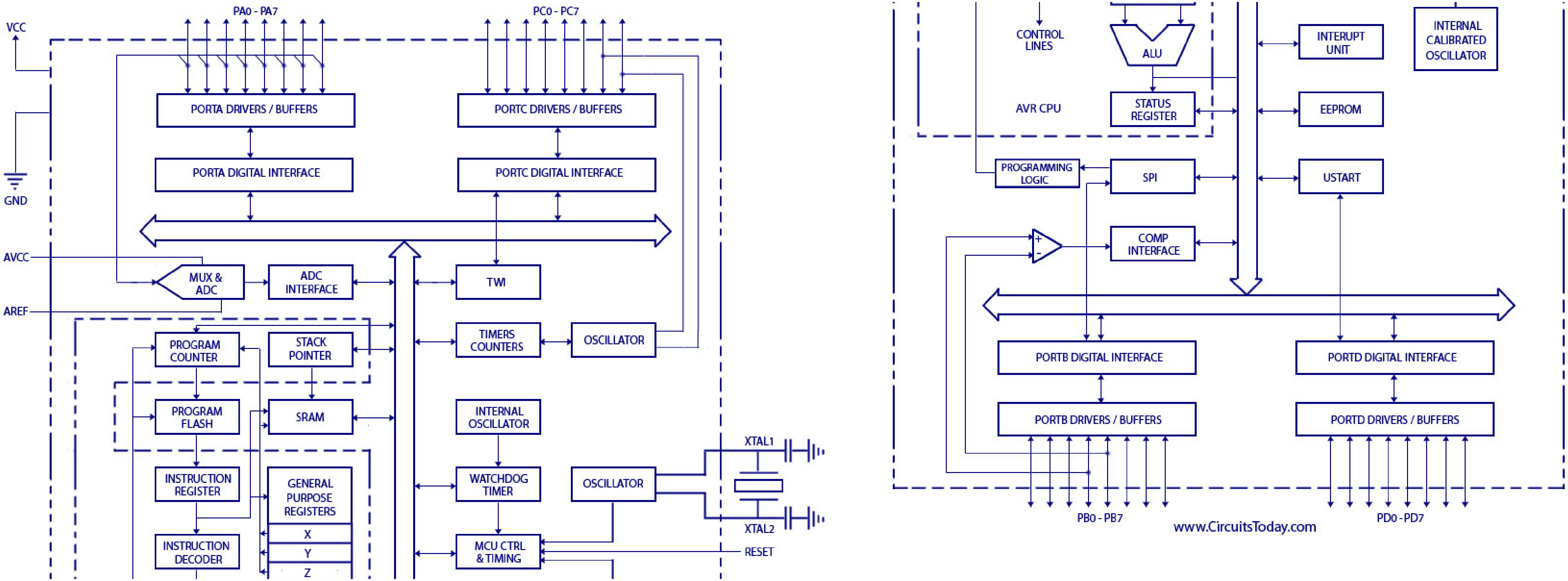
Block Diagram - ATmega32(AVR) - 8-bit Microcontroller



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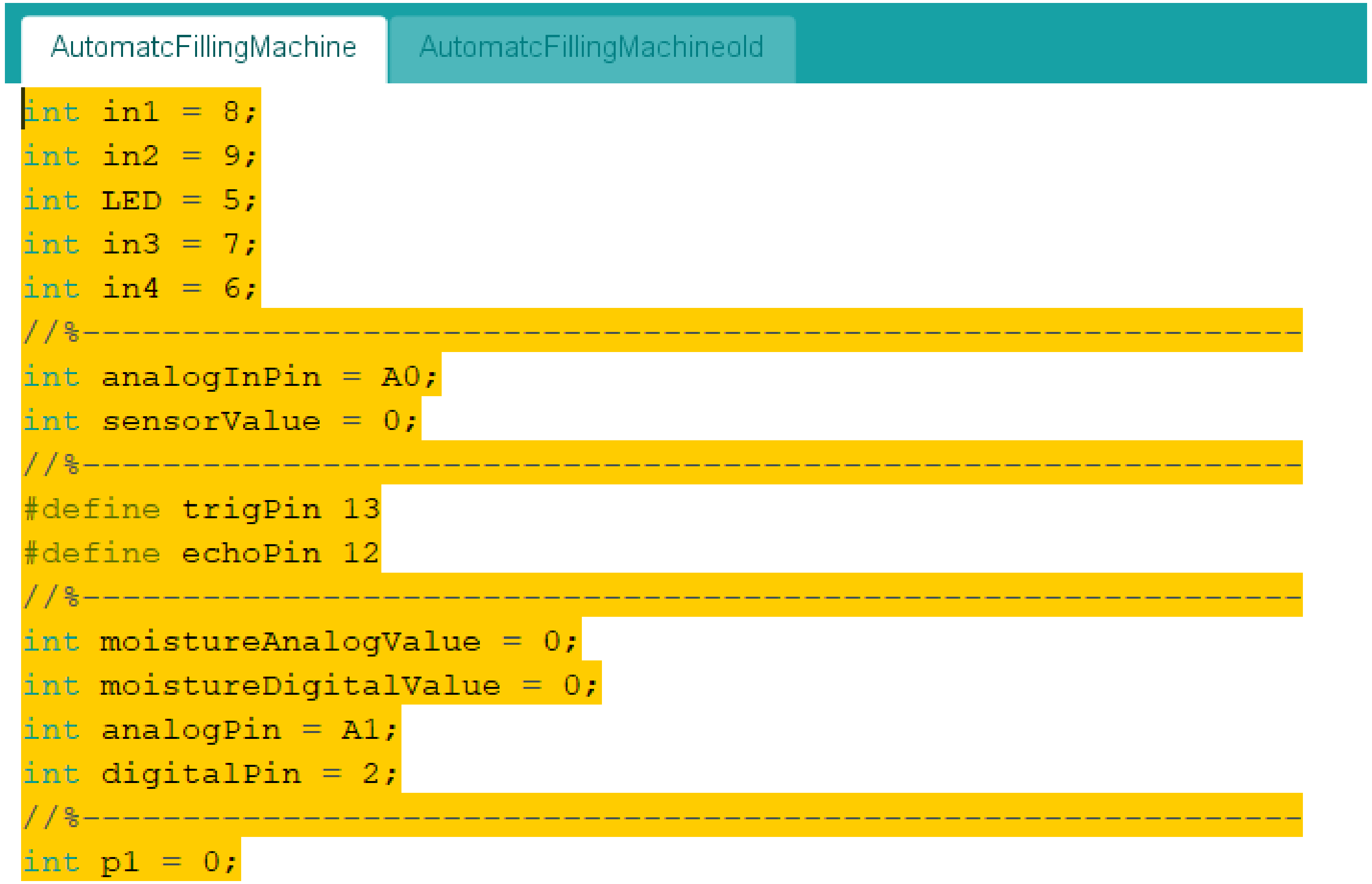
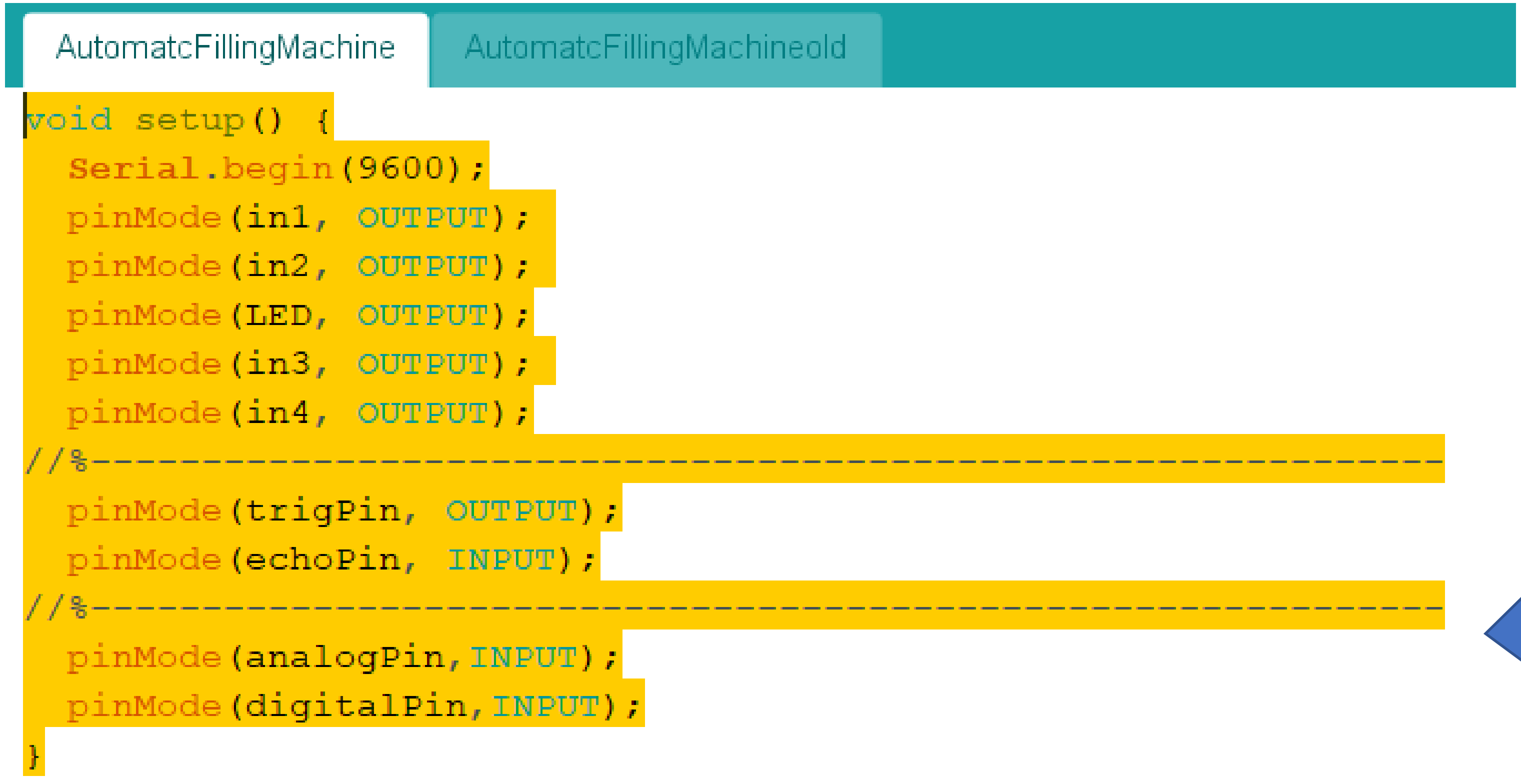


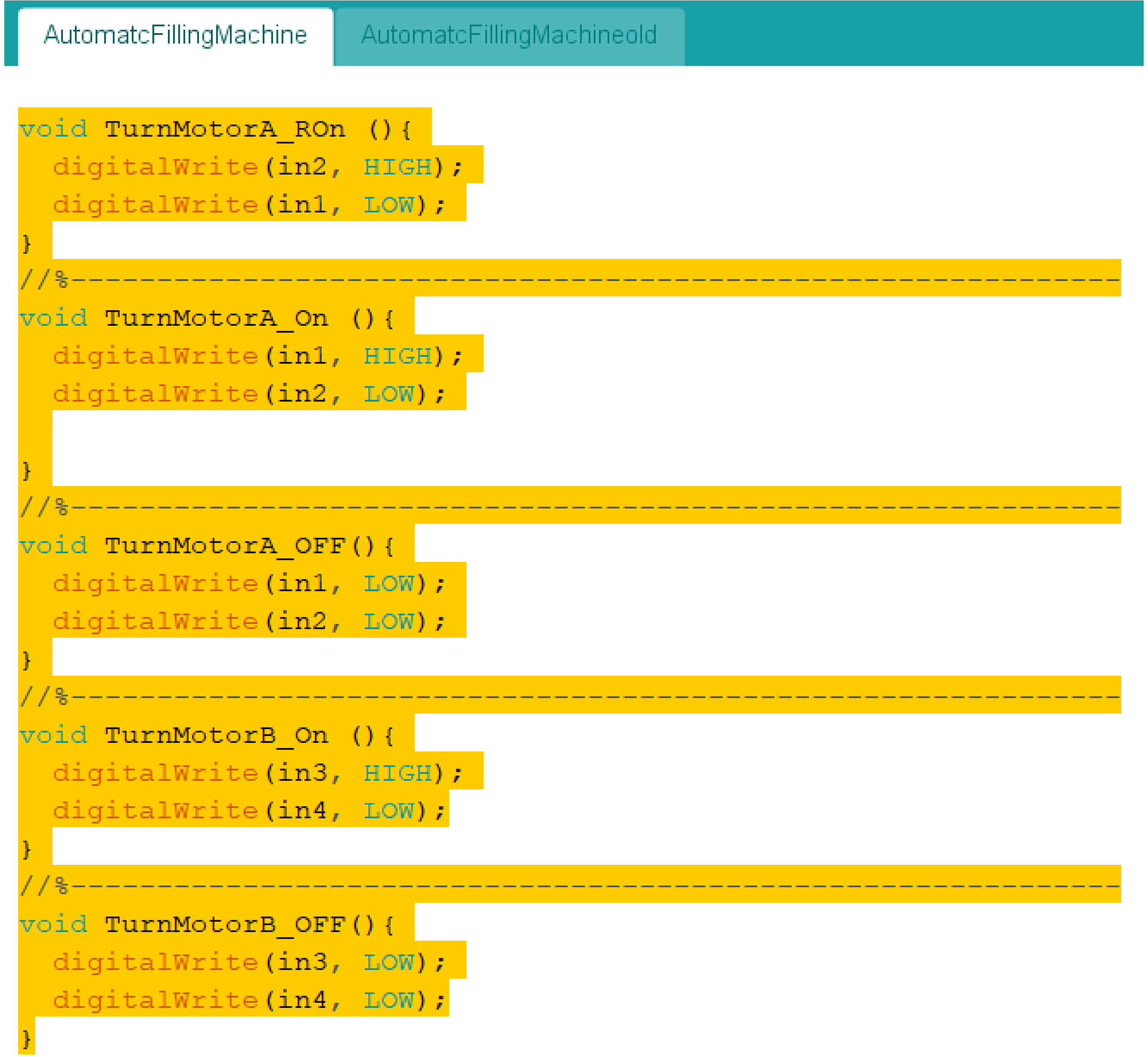
```
int in1 = 8;
int in2 = 9;
int LED = 5;
int in3 = 7;
int in4 = 6;
//%-------------------------------------------------------------
int analogInPin = A0;
int sensorValue = 0;
//%-------------------------------------------------------------
#define trigPin 13
#define echoPin 12
//%-------------------------------------------------------------
int moistureAnalogValue = 0;
int moistureDigitalValue = 0;
int analogPin = A1;
int digitalPin = 2;
//%-------------------------------------------------------------
int p1 = 0;
```

Variables and parameters have been defined.



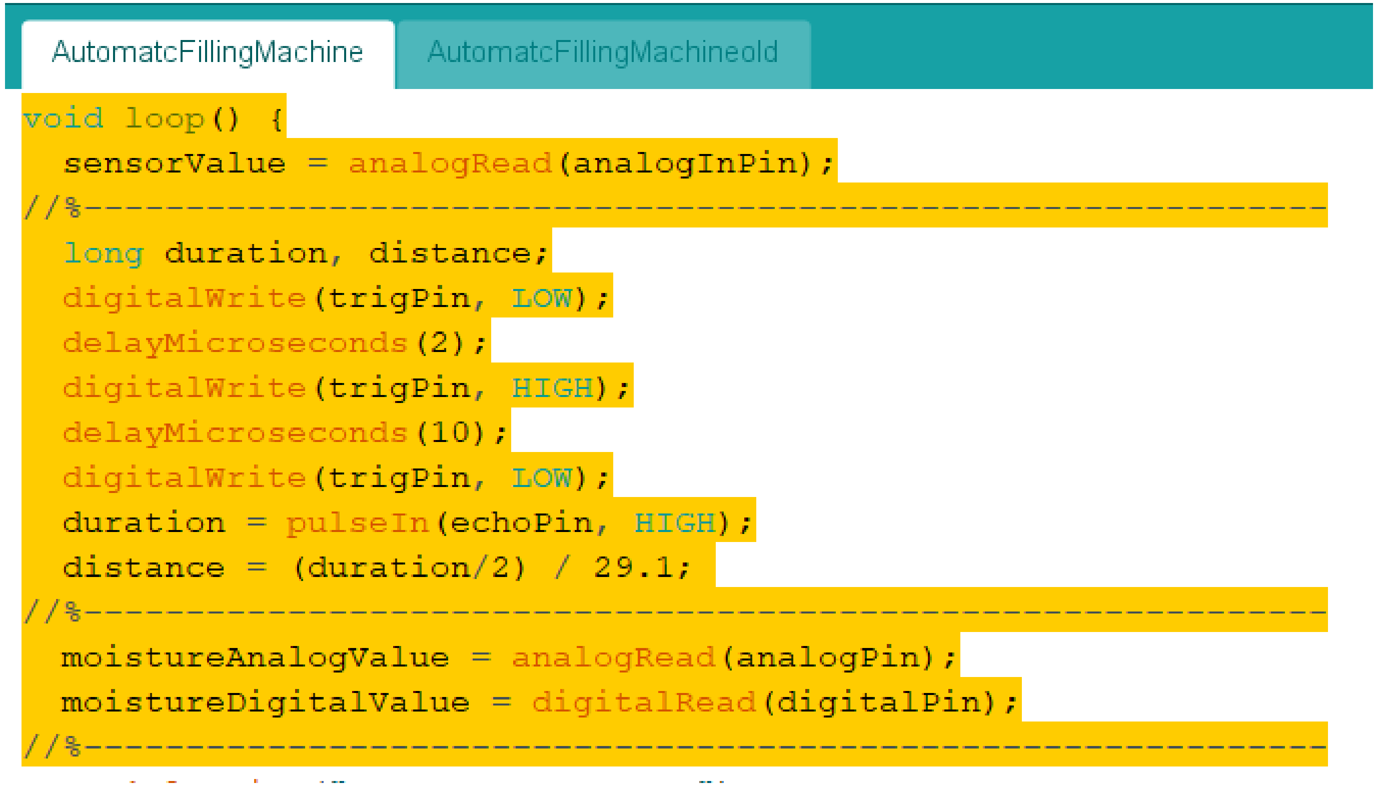
```
void setup() {
  Serial.begin(9600);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(LED, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
//%-------------------------------------------------------------
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
//%-------------------------------------------------------------
  pinMode(analogPin,INPUT);
  pinMode(digitalPin,INPUT);
}
```

The modes of the pins have been set.



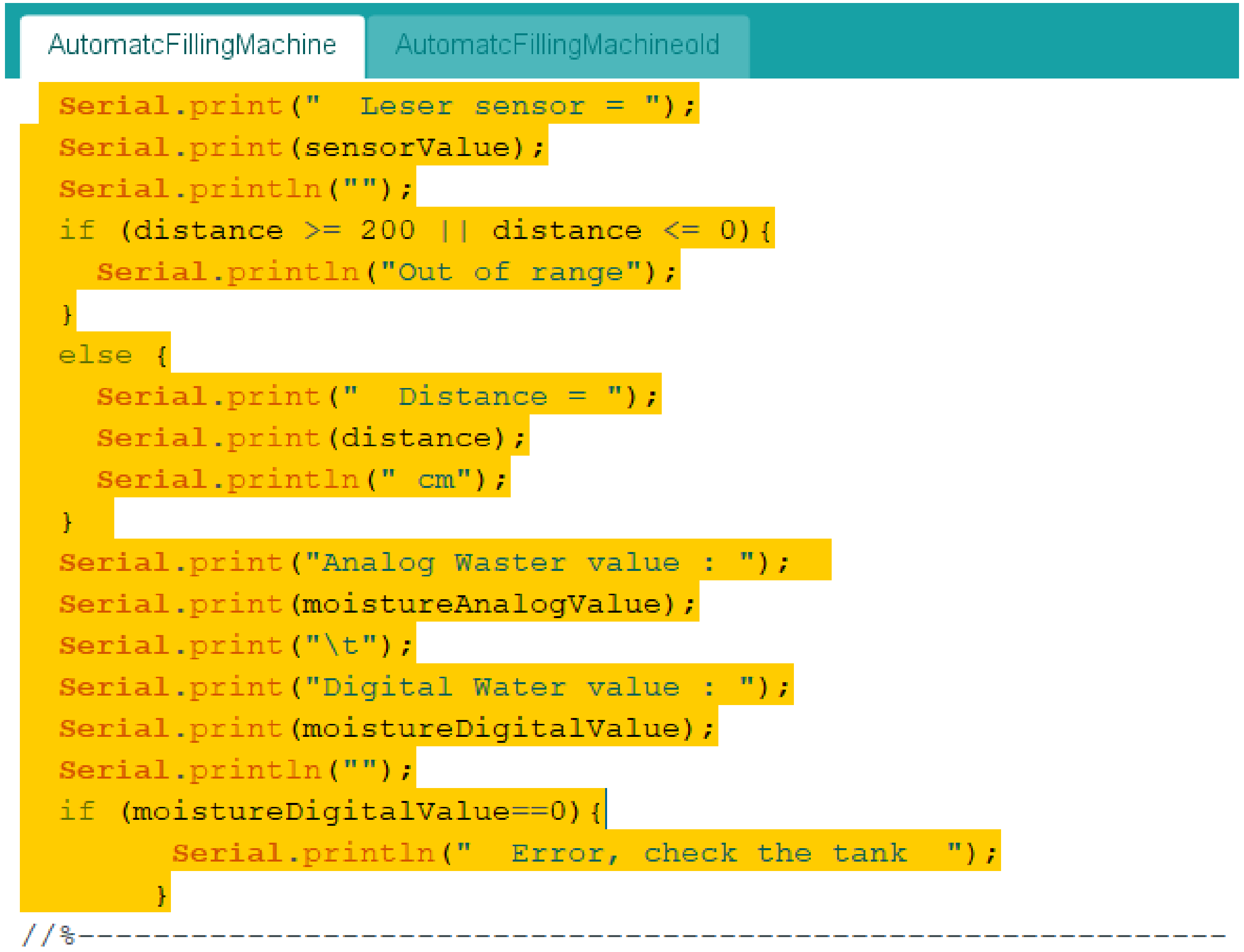
```
void TurnMotorA_ROn (){
  digitalWrite(in2, HIGH);
  digitalWrite(in1, LOW);
}
//%-------------------------------------------------------------
void TurnMotorA_On (){
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);

}
//%-------------------------------------------------------------
void TurnMotorA_OFF(){
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
}
//%-------------------------------------------------------------
void TurnMotorB_On (){
  digitalWrite(in3, HIGH);
  digitalWrite(in4, LOW);
}
//%-------------------------------------------------------------
void TurnMotorB_OFF(){
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
}
```

The functions of both the driver and the pump DC motor have been defined.



```
void loop() {
  sensorValue = analogRead(analogInPin);
//%-------------------------------------------------------------
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration/2) / 29.1;
//%-------------------------------------------------------------
  moistureAnalogValue = analogRead(analogPin);
  moistureDigitalValue = digitalRead(digitalPin);
//%-------------------------------------------------------------
```

Sensors values, are read and the distance of the container from the start point has been calculated.



```
  Serial.print("  Leser sensor = ");
  Serial.print(sensorValue);
  Serial.println("");
  if (distance >= 200 || distance <= 0){
    Serial.println("Out of range");
  }
  else {
    Serial.print("  Distance = ");
    Serial.print(distance);
    Serial.println(" cm");
  }
  Serial.print("Analog Waster value : ");
  Serial.print(moistureAnalogValue);
  Serial.print("\t");
  Serial.print("Digital Water value : ");
  Serial.print(moistureDigitalValue);
  Serial.println("");
  if (moistureDigitalValue==0){
        Serial.println("  Error, check the tank  ");
       }
//%-------------------------------------------------------------
```

Sensors values and the distance of the container from the start point has been printed.

```
//%------------------------------------------------------------
  if (distance <=4) {
   delay(500);
   Serial.print("  Leser sensor = ");
   Serial.print(sensorValue);
   Serial.println("");
   if (distance >= 200 || distance <= 0){
   Serial.println("Out of range");
   }
   else {
   Serial.print("  Distance = ");
   Serial.print(distance);
   Serial.println(" cm");
   }
   Serial.print("Analog Waster value : ");
   Serial.print(moistureAnalogValue);
   Serial.print("\t");
   Serial.print("Digital Water value : ");
   Serial.print(moistureDigitalValue);
   Serial.println("");
   if (moistureDigitalValue==0){
    Serial.println("  Error, check the tank  ");
   }
   if (p1==0){
   delay(6000);
 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);
 distance = (duration/2) / 29.1;
   if (distance <=4) {
   TurnMotorA_On();
   p1 = 1;
   }
```

```
  }
 }
   if (p1==1){
  digitalWrite(LED, HIGH);
 }
 else{
  digitalWrite(LED, LOW);
 }

digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;

 if (distance >= 13 && distance <= 23) {
  delay(500);
  Serial.print("  Leser sensor = ");
  Serial.print(sensorValue);
  Serial.println("");
  if (distance >= 200 || distance <= 0){
  Serial.println("Out of range");
  }
  else {
  Serial.print("  Distance = ");
  Serial.print(distance);
  Serial.println(" cm");
  }
  Serial.print("Analog Waster value : ");
  Serial.print(moistureAnalogValue);
  Serial.print("\t");
  Serial.print("Digital Water value : ");
  Serial.print(moistureDigitalValue);
  Serial.println("");
```

```
  TurnMotorA_OFF();

  if (p1==1){
  delay(3000);
   if (moistureDigitalValue==1) {
    TurnMotorB_On();
    delay(3000);
    TurnMotorB_OFF();
    delay(2000);
   }
   else if (moistureDigitalValue==0){
    Serial.println("  Error, check the tank  ");
   }
   p1=0;
    TurnMotorA_ROn();
    delay(1250);
    TurnMotorA_OFF();
  }
 }
}
```

The automation algorithm has been Implemented.

```
if (distance <=4) {
    delay(500);
    Serial.print("  Leser sensor = ");
    Serial.print(sensorValue);
    Serial.println("");
    if (distance >= 200 || distance <= 0){
    Serial.println("Out of range");
    }
    else {
    Serial.print("  Distance = ");
    Serial.print(distance);
    Serial.println(" cm");
    }
    Serial.print("Analog Waster value : ");
    Serial.print(moistureAnalogValue);
    Serial.print("\t");
    Serial.print("Digital Water value : ");
    Serial.print(moistureDigitalValue);
    Serial.println("");
    if (moistureDigitalValue==0){
     Serial.println("  Error, check the tank  ");
    }
    if (p1==0){
```

```
   delay(6000);
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
   if (distance <=4) {
   TurnMotorA_On();
   p1 = 1;
   }
   }
  }
```

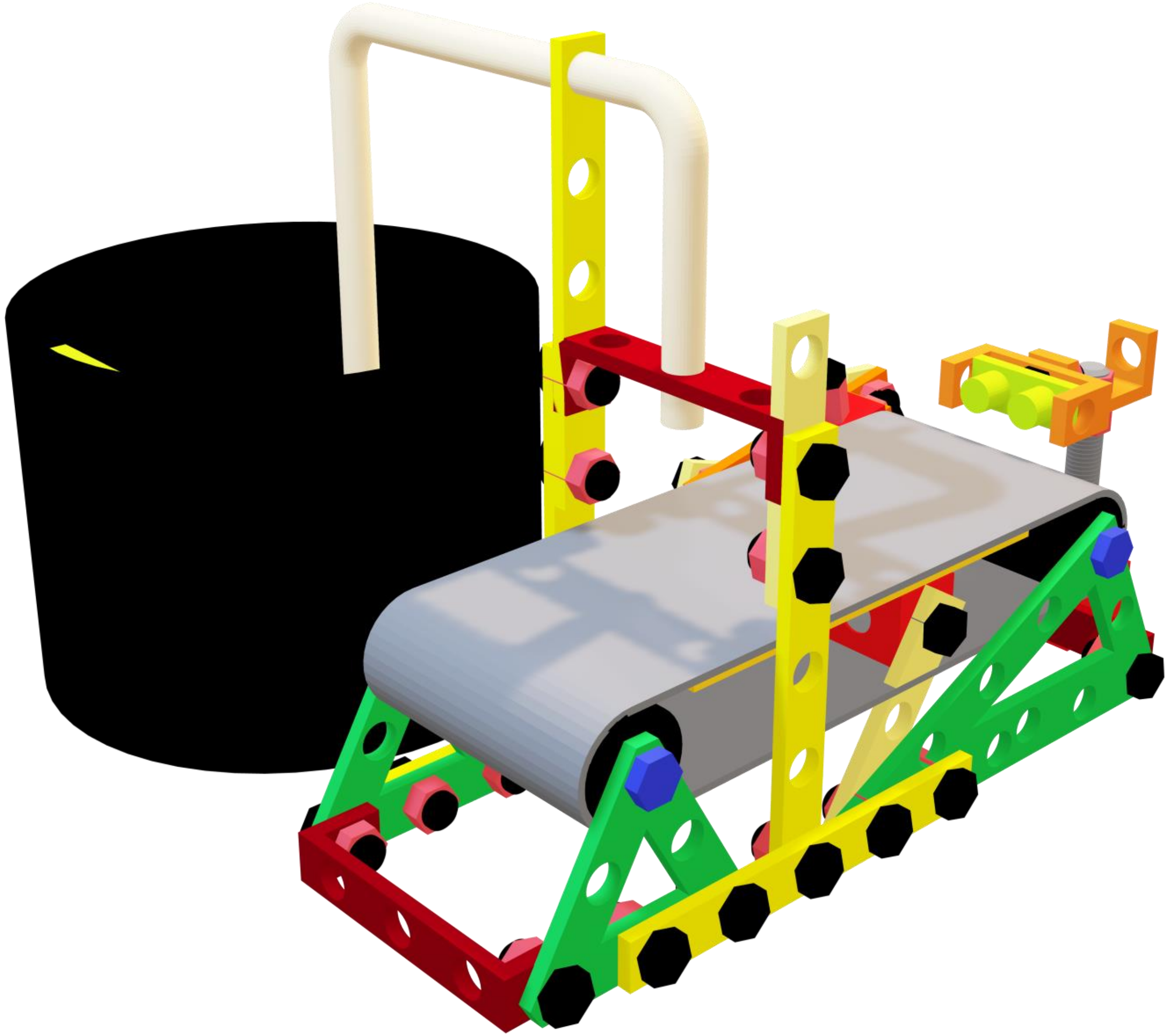
In the first part of the algorithm, if the distance between the container and the start point is less than 4 cm the driver dc motor will turn on.

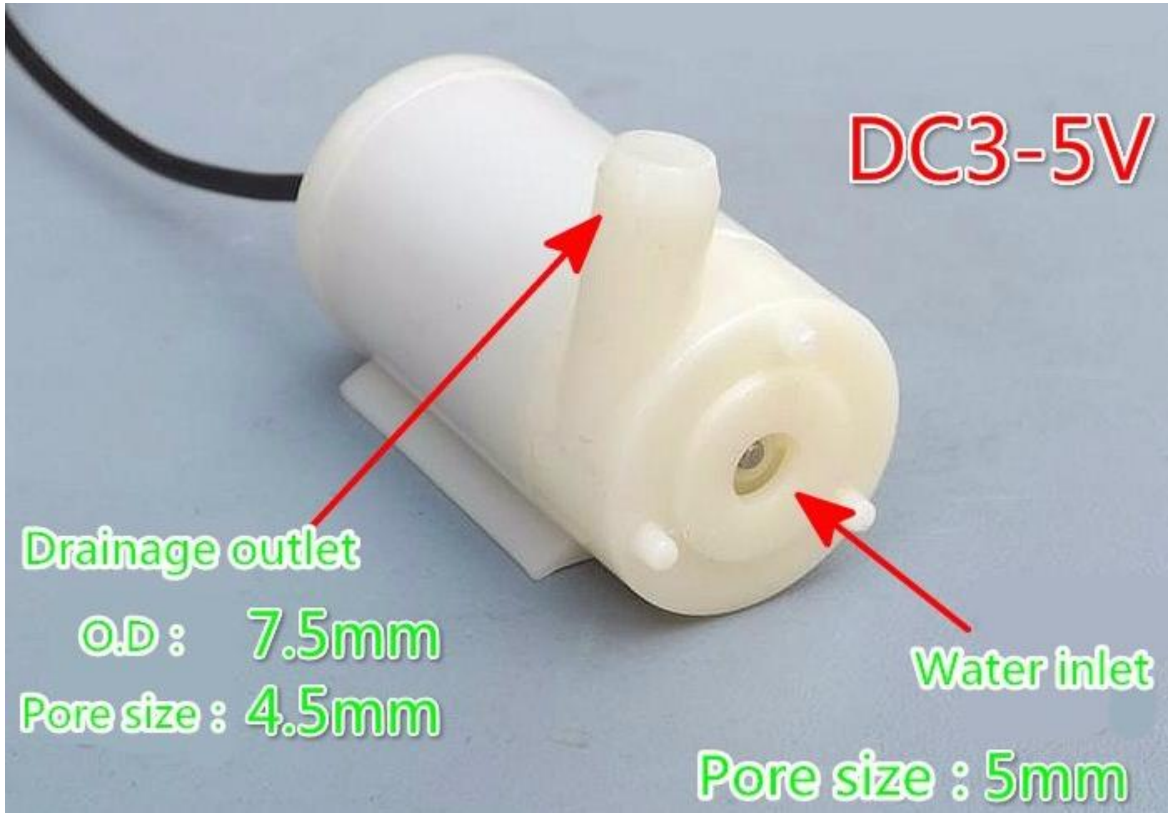
```
if (p1==1){
   digitalWrite(LED, HIGH);
  }
  else{
   digitalWrite(LED, LOW);
  }

 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);
 distance = (duration/2) / 29.1;
```

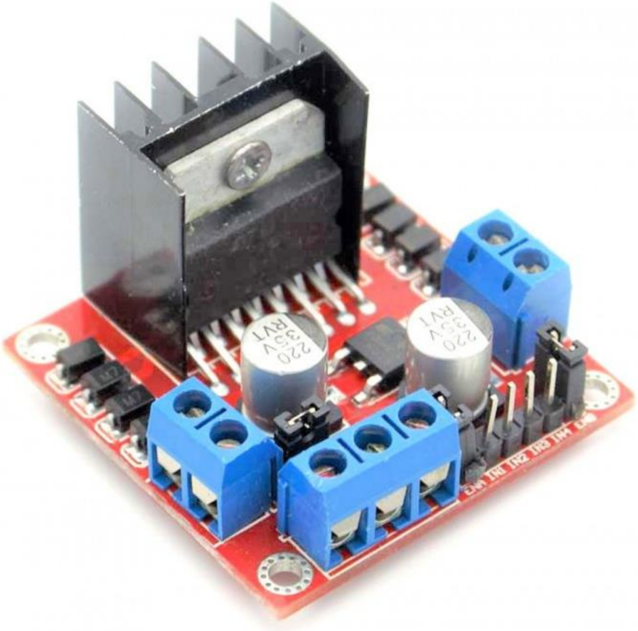
In this tiny part, the indicating LED will turn on provided that the P variable is equal to 1, which means the container shouldn’t be relocated on the belt, and the driver dc motor will turn on soon.

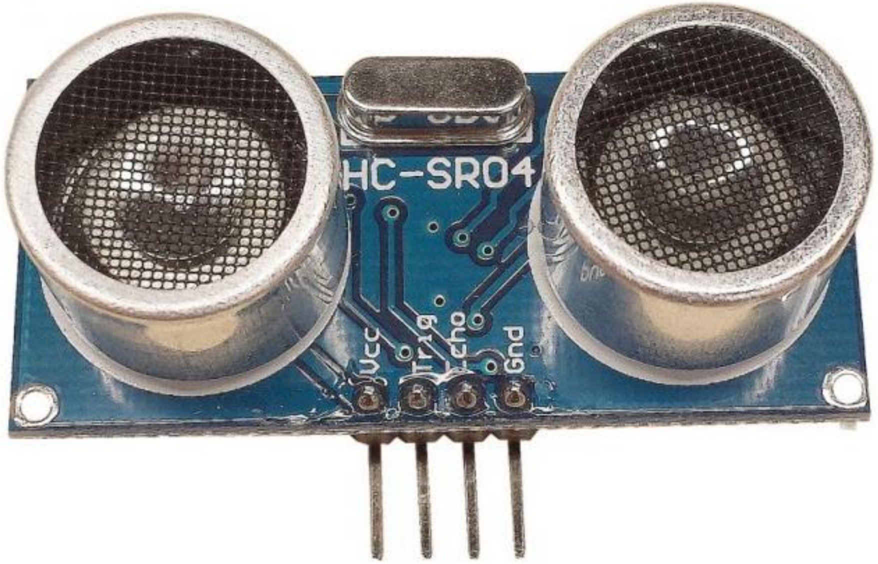
```
if (distance >= 13 && distance <= 23) {
    delay(500);
    Serial.print("  Leser sensor = ");
    Serial.print(sensorValue);
    Serial.println("");
    if (distance >= 200 || distance <= 0){
    Serial.println("Out of range");
    }
    else {
    Serial.print("  Distance = ");
    Serial.print(distance);
    Serial.println(" cm");
    }
    Serial.print("Analog Waster value : ");
    Serial.print(moistureAnalogValue);
    Serial.print("\t");
    Serial.print("Digital Water value : ");
    Serial.print(moistureDigitalValue);
    Serial.println("");

    TurnMotorA_OFF();

    if (p1==1){
    delay(3000);
     if (moistureDigitalValue==1) {
      TurnMotorB_On();
      delay(3000);
      TurnMotorB_OFF();
      delay(2000);
     }
     else if (moistureDigitalValue==0){
      Serial.println("  Error, check the tank
");
     }
     p1=0;
      TurnMotorA_ROn();
      delay(1250);
      TurnMotorA_OFF();
    }
  }
```

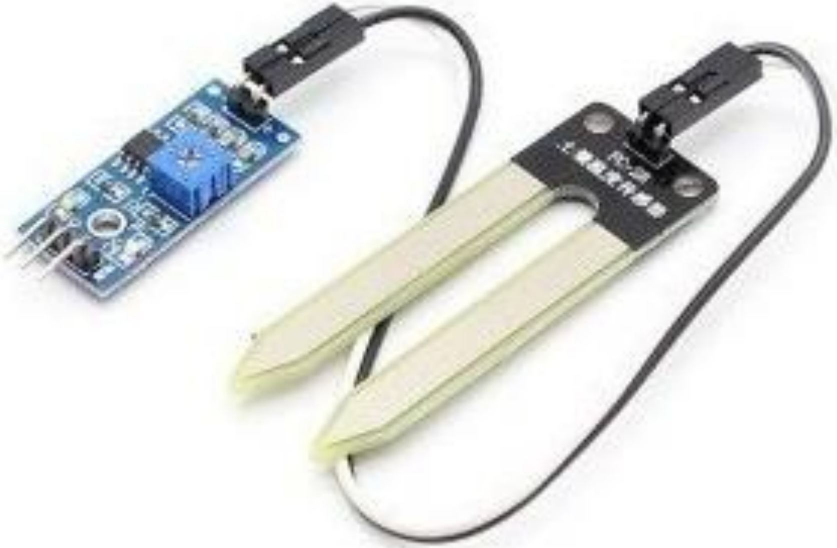
In the last part, if the distance between the container and the start point is simultaneously more than 13 cm and less than 23 cm, the driver dc motor will turn off before the pump starting to work.

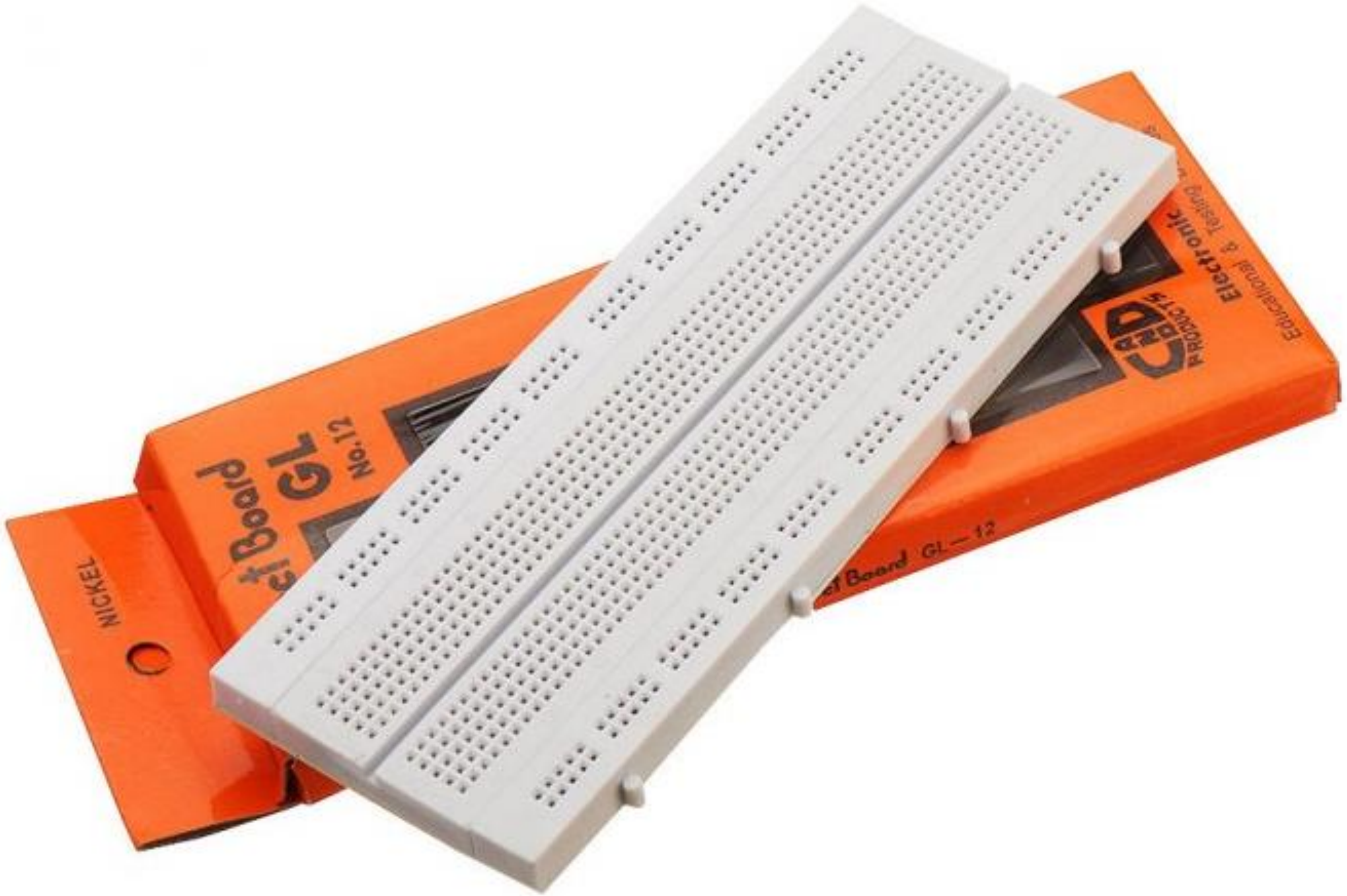


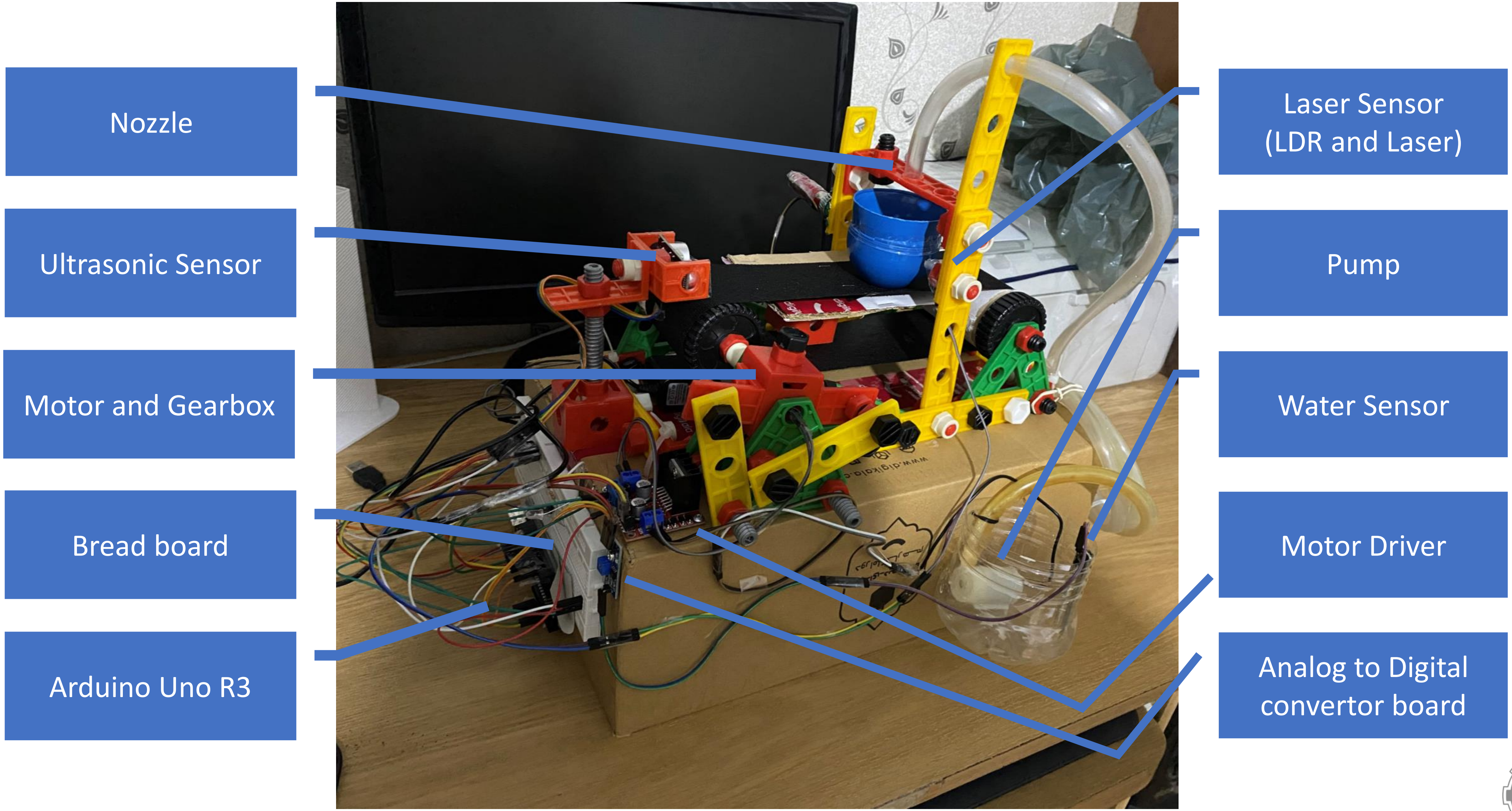

DC3-5V
Drainage outlet
O.D : 7.5mm
Pore size : 4.5mm
Water inlet
Pore size : 5mm




HC-SR04
Vcc
Trig
Echo
Gnd




t Board GL
No.12
NICKEL
Electronic
Educational & Testing
CAD
PRODUCTS
t Board GL – 12



Nozzle

Ultrasonic Sensor

Motor and Gearbox

Bread board

Arduino Uno R3

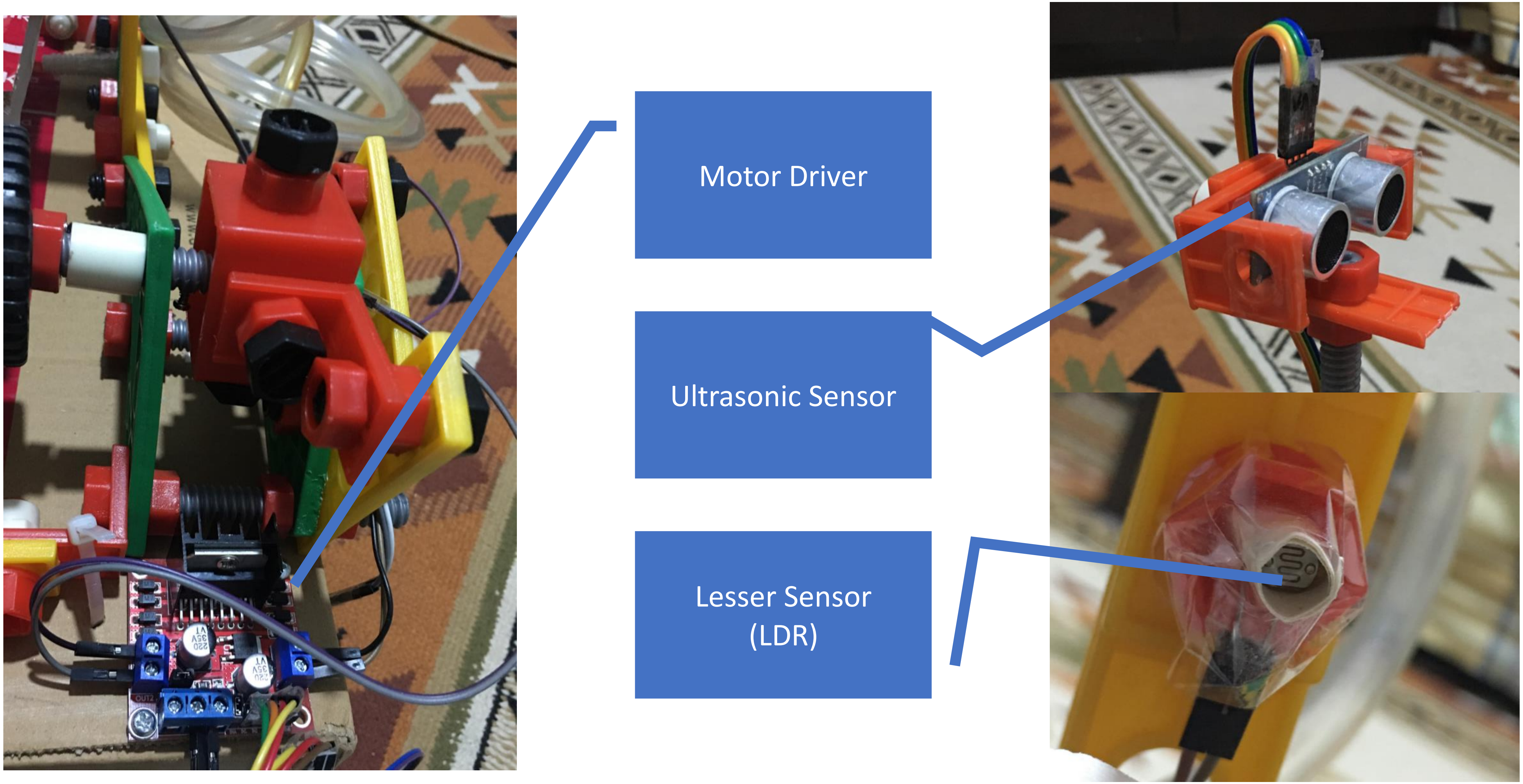
Laser Sensor (LDR and Laser)

Pump

Water Sensor

Motor Driver

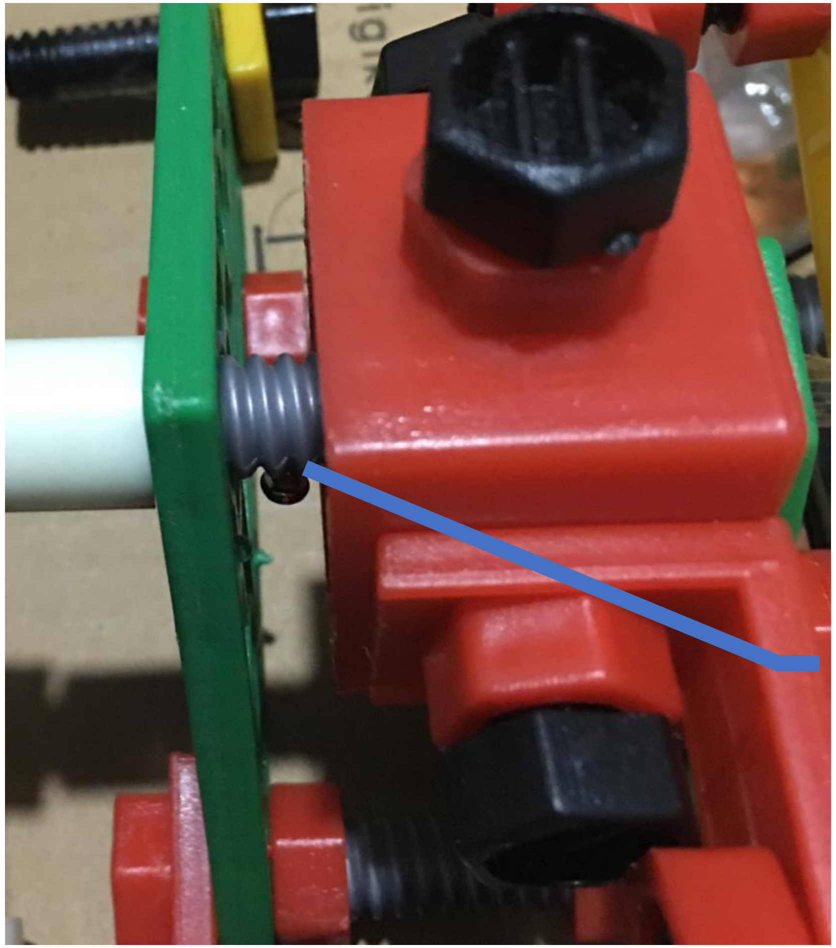
Analog to Digital convertor board



Motor Driver

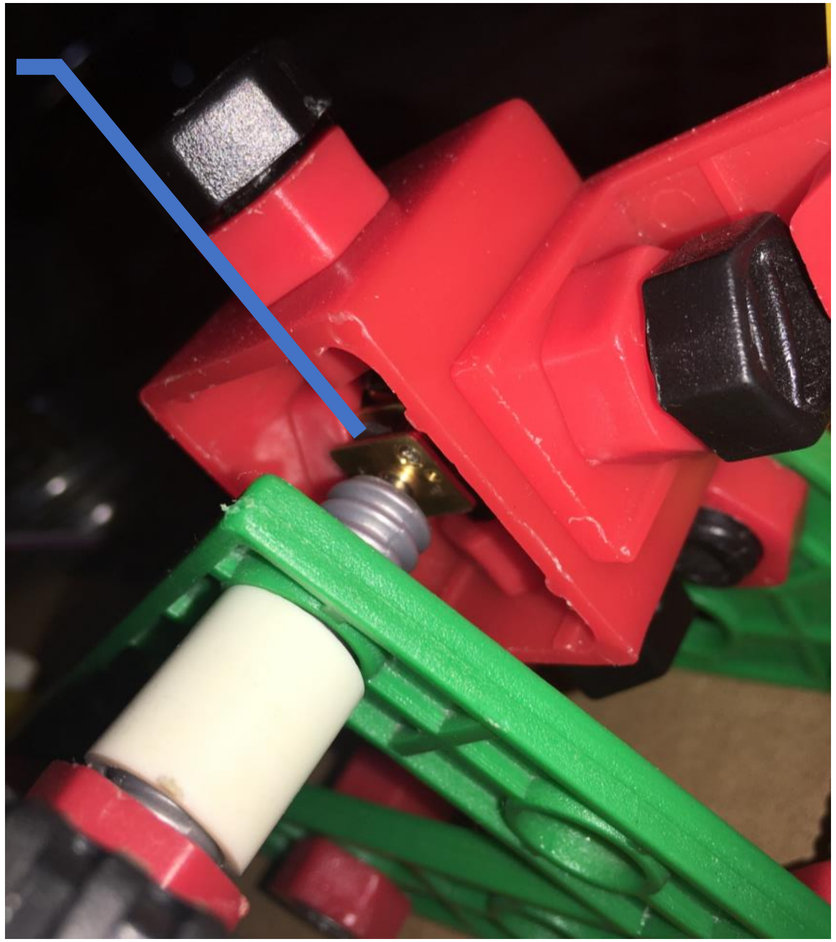
Ultrasonic Sensor

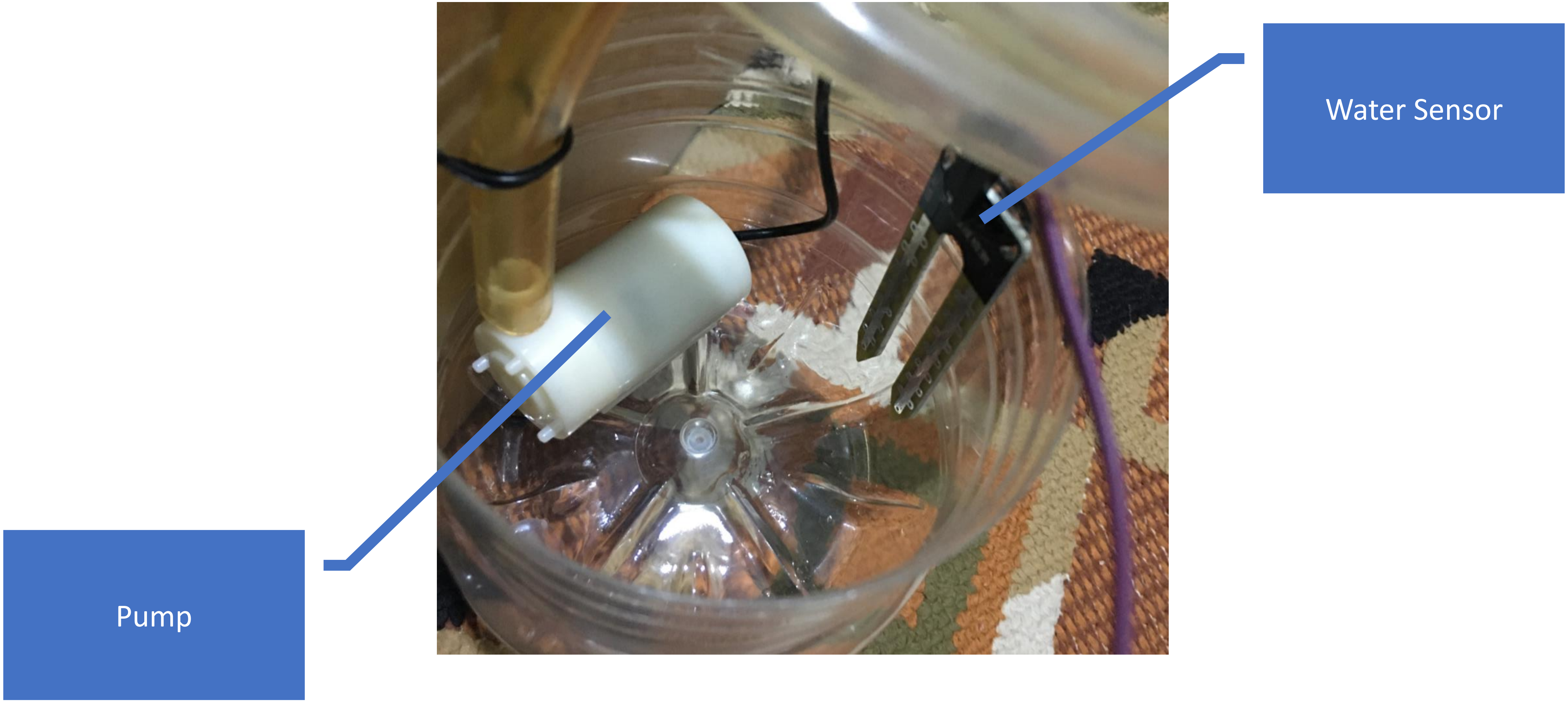
Lesser Sensor
(LDR)



Motor and Gearbox

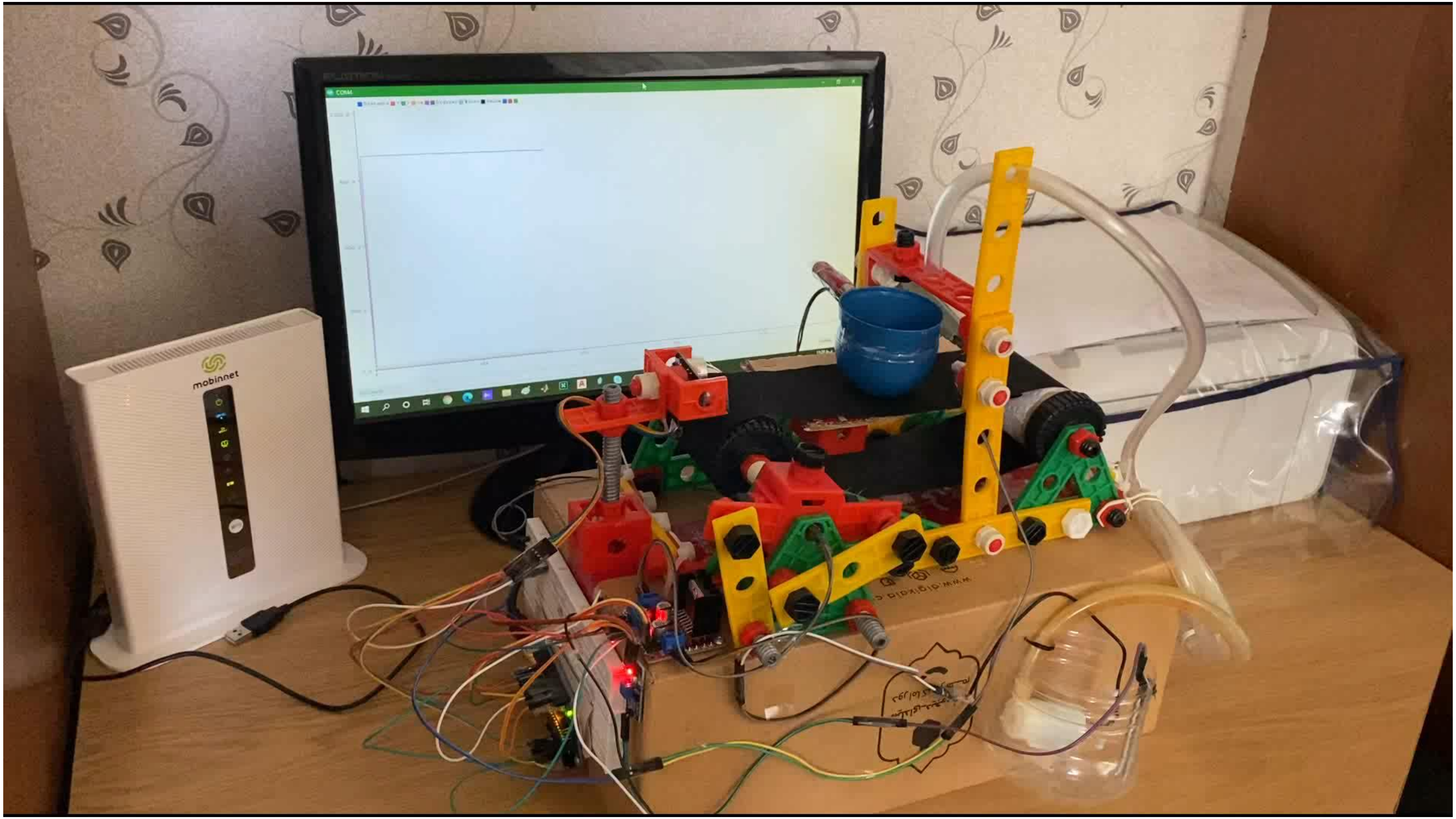
Power Axle

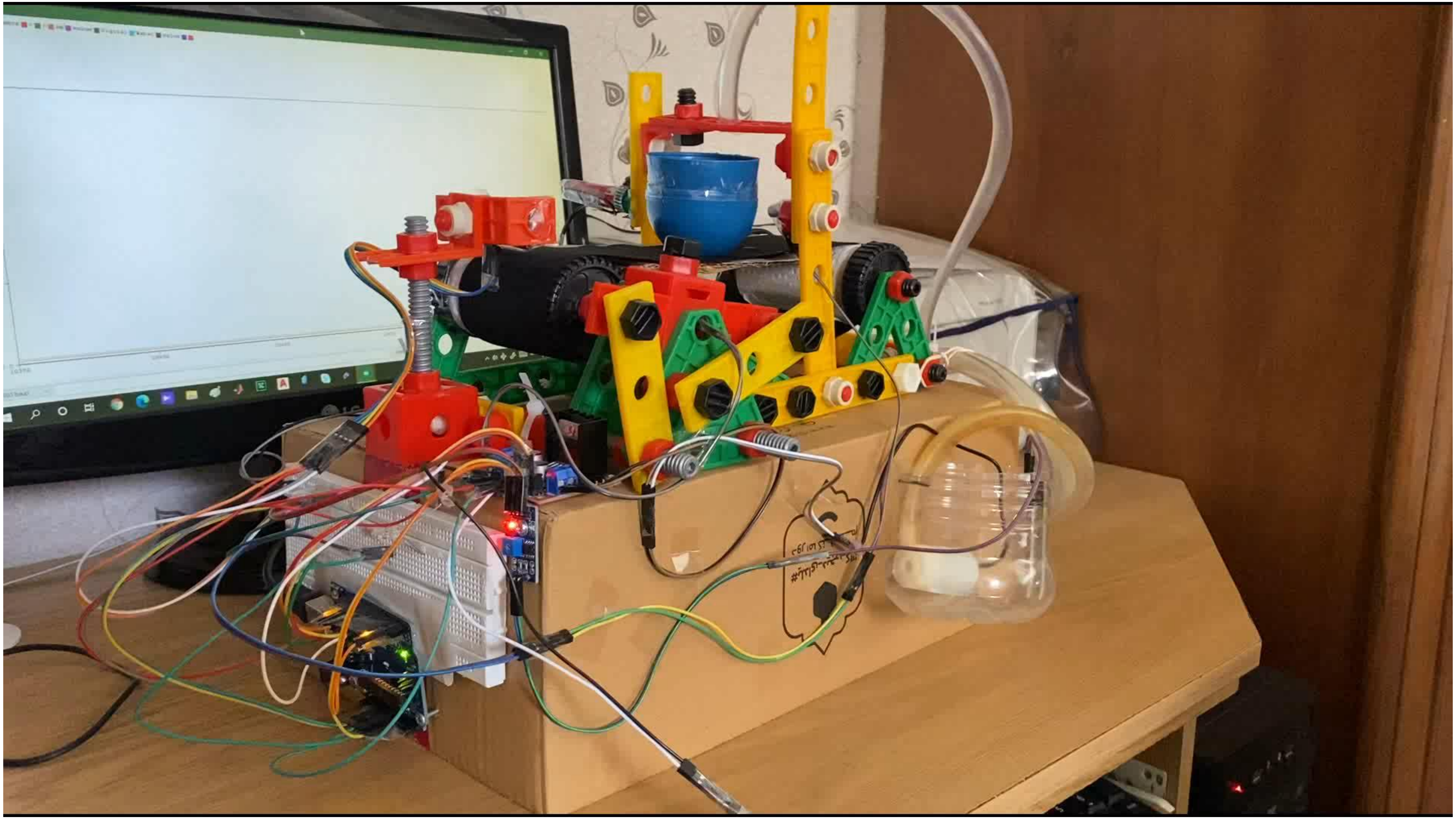


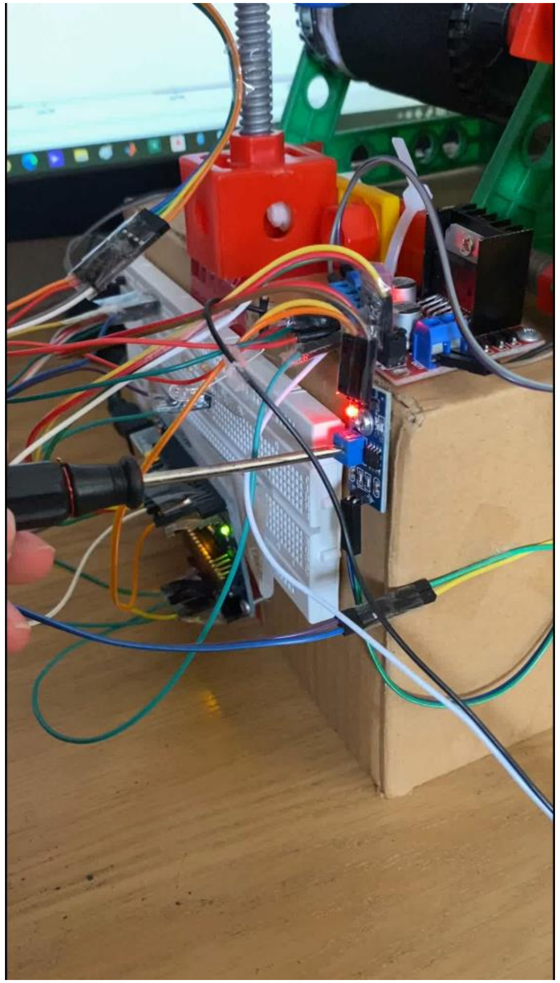


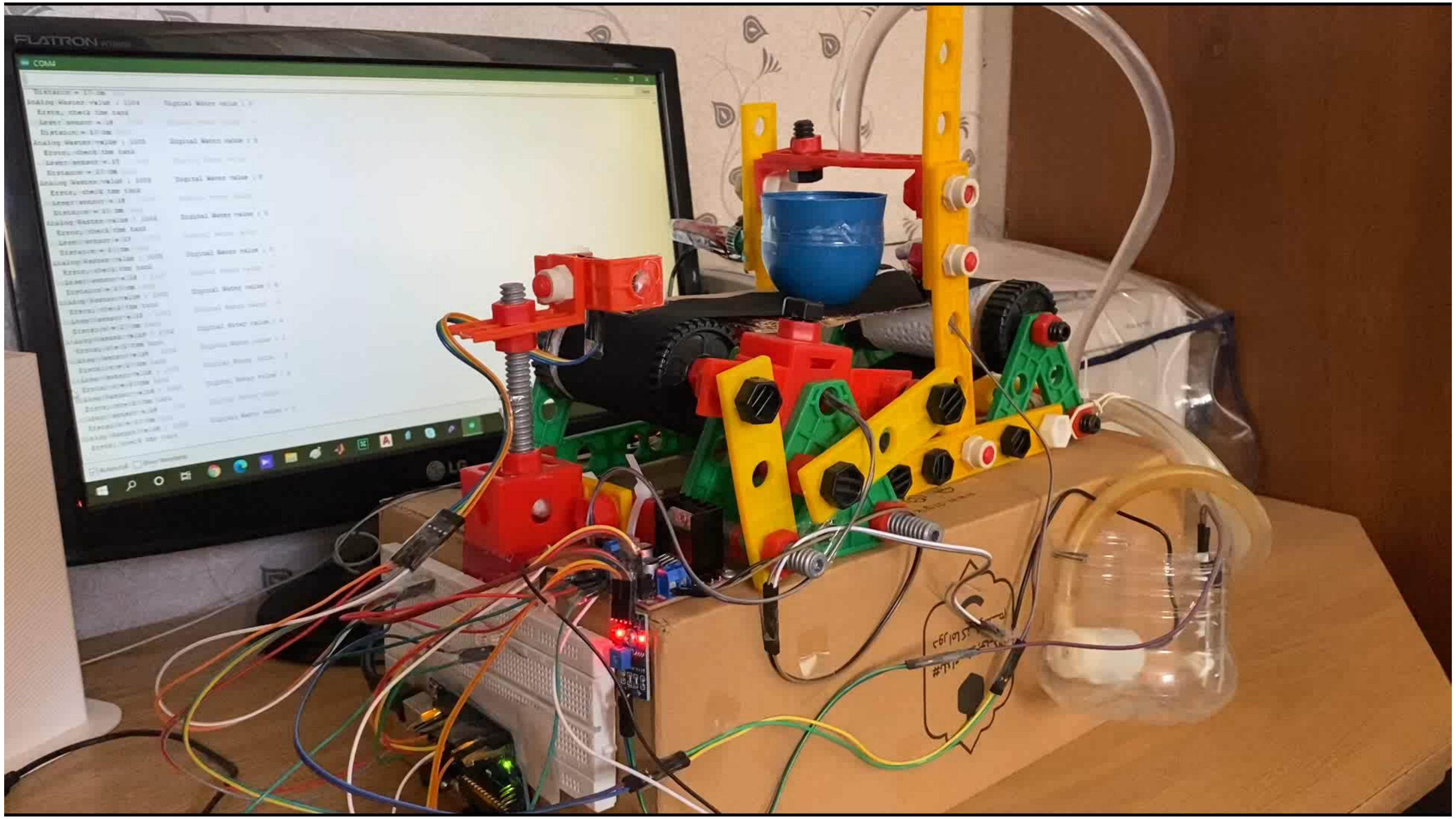
Water Sensor

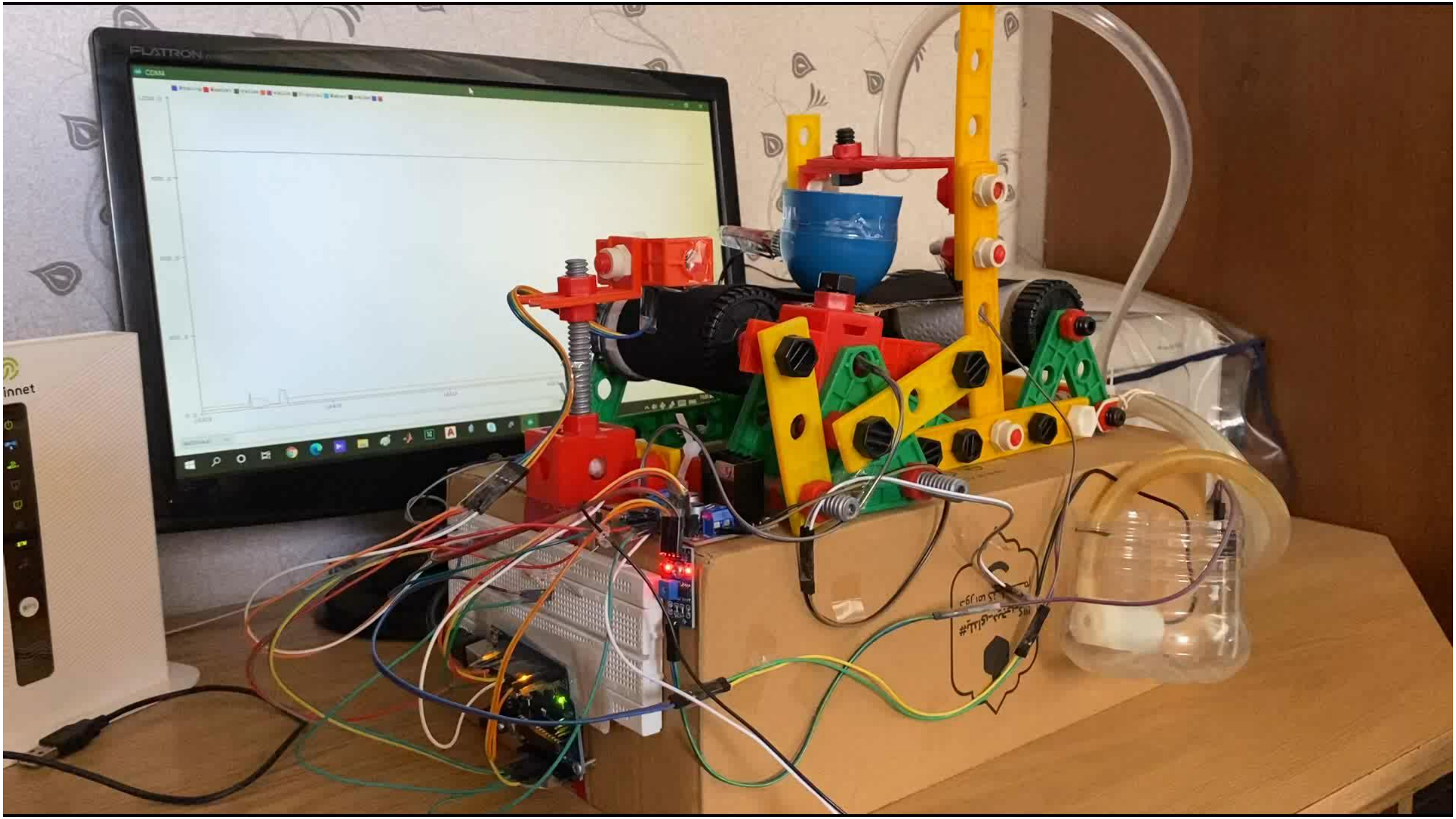
Pump


mobinnet






FLATRON
COM4


FLATRON
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THE END

Thanks for your Time and Consideration