

COMP444 FINAL PROJECT: WATER DISPENSER ROBOT.

Here, I will document my project and include a video of the working Water Dispenser Robot as well as the resources I referred to.

- Design decisions ? How did you approach the overall design of the project? What resources did you employ at this stage to assist you in creating an overall design?

The ultrasonic distance sensor project from the SIK guide is where i got the idea for my project. It is amazing how it can sense anything within its radius. The water dispenser idea came to my mind because I like drinking water continuously especially when I am studying so I frequently refill my bottle. I also figured that it can be used for various purposes: in short to dispense any fluid like sanitizer, juices, alcohol. As a start, i decided to construct the body of the robot completely out of cardboard and binding it together with glue sticks. Another advantage of this project is that it minimizes contact because of the obvious reason that it is totally autonomous. It helps reduce the spread of any viruses such as Covid-19 due to minimal contact especially in crowded places like store entrances, workplaces, events. The size of the dispenser would always vary depending on what you are dispensing or the quantity you need. I designed an average size water dispenser that holds around five litres of water and works with a bottle/container that is upto 40 centimeters tall. This dispenser can be useful in households or small workplaces. I bought a water motor and a single channel relay that would trigger the motor when the sensor senses something within the set radius. I have used a direct USB power source. The USB can be plugged into any socket or power source for it to start functioning. I preferred not to go with a battery source because this would drain the batteries very fast since it needs power all time for it to function. This keeps us away from changing batteries frequently and save us money too. I also had to get a water pipe that dispenses the water. I used the Arduino Uno microcontroller, ultrasonic distance sensor and breadboard provided in the SIK guide.

- General programming considerations ? Were any special programming considerations required to implement your design? Where did you seek resource information to assist in this process?

By following the instructor's advice on writing out code for all SIK exercises, I got a really good understanding of what is needed for the project. Most of the programming was from Circuit 3B-Distance Sensor from the SIK guide. I also used an online resource from the Arduino website where there were discussion forums about relay and water pumps. I have to say, the programming part of this project was way easier than I thought it would be.

- Program implementation ? Discuss your robots programming. What major categories of robotic control did you implement? What control approach did you employ to manage the overall control of your robot?

I came up with a formula after referring to the discussion forums in the Arduino website which is used to calculate the distance of the object from the sensor. If the value is less than 5 then the relay will trigger the motor and water will keep pumping until the distance between the object and the sensor is greater than or equal to 5. The robotic control entirely depends on the ultrasonic sensor and the project is deployed with the basics of a closed loop feedback system as I explained above. I used the standalone reactive robot control approach whereby I wrote the program that is needed and uploaded it to the microcontroller and then I would only need a power source for it to function. There is no computer required once the program is uploaded to the microcontroller. I have used a direct USB power source.

- Testing ? Discuss your test approach, your test plan and test results. That is, how did you test your robot and program to ensure you had met your design goals? Discuss any deviations from your expected test plan output and what you did about this.

There was not too much testing to be done. I had deployed a project with the ultrasonic distance sensor from the SIK guide so I just had to make sure my connections are on point and the relay trigger is coordinating with the water pump. So, before I put up the whole project together, I made sure the relay and the motor are working. I connected the circuit and tested the project with a small water source. It all worked well so I started building the actual body of the robot. The only work around I had to do was extend the wires connecting the water motor and the rest of the circuit because I had to make sure the water motor is at the bottom of the water source.

- Outcome ? Discuss the outcome of your project. Did your robot meet all design expectations? Now that you are done, what would you do differently were you to undertake the same project again?

The outcome of the project was on point! Just what I needed. Though, I had to deal with a few water spills because there would be some water flowing through the pipe even after you move your bottle away from the sensor. I put a little container at the bottom to collect those few drops of water flowing through the pipe even after moving the water bottle away from the sensor. This was something I expected, so all the design expectations of the robot were met. As an improvement to the project I would make sure I use plastic to make the body of the robot so it is safe from water spills. I would also work on the water flowing out even after moving the bottle away from the sensor. The water can be pumped back to the water source or even completely avoided from flowing after moving the bottle away from the sensor. I would also incorporate night light using photoresistors so the dispenser can easily be spotted in dark and you can serve yourself without turning the lights on.

Resources i referred to:

<https://forum.arduino.cc/t/12v-water-pump-controlled-by-arduino-and-relay-wont-work/703268>

Water motor and relay resources link:

https://www.amazon.ca/Gikfun-Submersible-Fountain-Aquarium-EK1893C/dp/B07BKXJXK1/ref=asc_df_B07BKXJXK1/?tag=googleshopc0c-20&linkCode=df0&hvadid=335380394635&hvpos=&hvnetw=g&hvrnd=3669625759641990778&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmcl=&hvlocint=&hvlocphy=9001212&hvtargid=pla-674997990675&pssc=1

https://www.amazon.ca/Relay-Module-Optocoupler-Channel-Trigger/dp/B07WXJ9GTP/ref=sr_1_9?gclid=EAIaIQobChMIu_Sg94KX9QIVaPHjBx1maQH2EAAAYASAAEgLGwvD_BwE&hvadid=208376727730&hvdev=c&hvlocphy=9001212&hvnetw=g&hvqmt=e&hvrnd=15118458241789344726&hvtargid=kwd-302494268144&hydadcr=23339_10093185&keywords=arduino+5v+relay&qid=1641262420&sr=8-9

What i used for the project:

- Ultrasonic distance sensor
- Arduino Uno controller
- Relay 5V
- Breadboard Circuit board
- Jumper wires
- Submersible water motor
- Plastic water pipe
- USB cable

I have only included a video demonstration of the project in this zip folder.

Below is a link to the video of the working Water Dispenser Robot.

<https://youtu.be/BZFfSyPJ7wM>

Below is the code for this project.

```
//WATER DISPENSER  
  
#define trigger 5  
  
#define echo 4  
  
#define Relay 6
```

```
float time=0
```

```
float distance=0;
```

```
void setup()
```

```
{
```

```
Serial.begin(9600);
```

```
pinMode(trigger,OUTPUT);
```

```
pinMode(echo,INPUT);
```

```
pinMode(Relay,OUTPUT);
```

```
delay(2000);
```

```
}
```

```
void loop()
```

```
{
```

```
measure_distanceFromSensor();
```

```
if(distance<5)
```

```
{
```

```
digitalWrite(Relay,HIGH); //if the object is near the relay triggers the  
motor
```

```
}
```

```
else
```

```
{
```

```
    digitalWrite(Relay,LOW); //if the object is not near, the reading is ignored
```

```
}
```

```
    delay(250);
```

```
}
```

```
void measure_distanceFromSensor()
```

```
{
```

```
    digitalWrite(trigger,LOW);
```

```
    delayMicroseconds(2);
```

```
    digitalWrite(trigger,HIGH);
```

```
    delayMicroseconds(10);
```

```
    digitalWrite(trigger,LOW);
```

```
    delayMicroseconds(2);
```

```
    time=pulseIn(echo,HIGH);
```

```
    distance=time*500/50000; //distance calculation formula
```

```
}
```

The circuit connection is as mentioned below:

Regular Wires Connection.

Breadboard	Redboard
+5V	5V
-GND	GND

Sensor Connection.

Sensor	Breadboard	Redboard
GND	-GND	
VCC	+GND	
Sensor Echo		Input 4
Sensor Trig		Input 5

Relay Connection.

Relay	Breadboard	Redboard
Input		Input6
VCC	+VE	
GND	-GND	

Water Pump Connection.

Water Pump	Breadboard	Relay	RedBoard
+VE		NO	
	+VE	COM	
-VE	-VE		