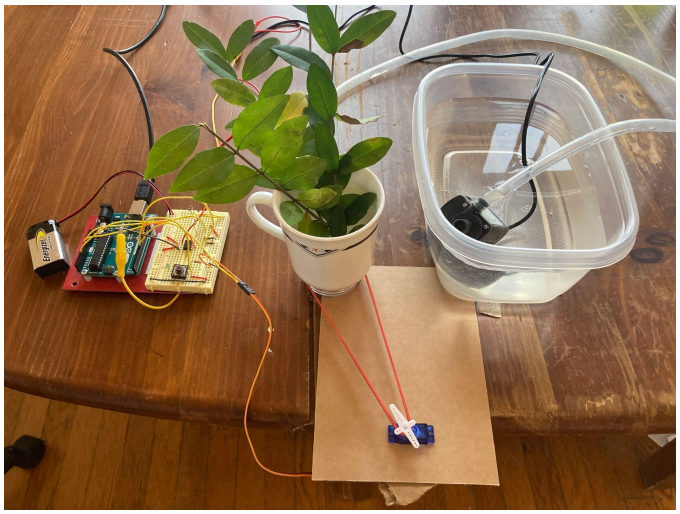
Glen Passow
gjp82
MAE 3780 Individual Project Final Report
Fall 2021

Happy Plant

1. Overview

My project's function is to allow for easy watering of a plant and to rotate the plant when light levels are high to avoid uneven growth. The sensors and actuators are a DC submersible pump, a continuous servo, a photoresistor, and a button. If the button is pressed, the pump will turn on (pumping water through a tube) and the continuous servo will spin, allowing for easy and uniform watering. If the light levels are above a certain threshold, the servo will rotate regardless of whether or not the button is pressed. Finally, if the button is not pressed and light levels are low, the system will remain stationary.



The Assembled Project

2. Design Considerations

What I would do differently if I started again:

If I were to start this project again, I would get a larger turntable and get a better method to keep the rubber band on the shaft of the servo. The larger turntable would allow for larger plants to be compatible with the system and a better pulley or wheel would make it harder for the rubber band to slip off of the servo. Overall, the project went extremely well and the same components could all be used to achieve the same result reliably and effectively.

What would I change with more money and time:

With fewer constraints I would make a more robust “base” to hold the continuous servo and plant, buy a larger servo, and buy a much larger turntable. The more robust base would allow for the servo to be screwed into the base for a firmer connection while the larger turntable and servo would allow for the system to be used with a larger plant. In essence, a bigger, more solidly built system would do a better job of providing useful watering and plant rotation.

3. Assembly Instructions

1. Assemble the circuit as shown in appendix B
2. Cut a hole in the 5" x 7" x 1/16" piece of cardboard as shown in appendix C. Make sure to leave the hole small enough to be a press fit for the servo. The tight fit is what allows the servo to not rotate when the rubber band is later attached.
3. Press the servo into the hole.
4. Glue the turntable onto the cardboard so that the center of the servo shaft and the center of the turntable are 6 inches apart
5. Stretch a rubber band around the servo shaft and the turntable to allow the servo to spin the turntable.
6. Place the pump in a reservoir of water close enough to the turntable so that the tubing can reach the plant.
7. Upload the code to the Arduino
8. Turn on the system and enjoy!

4. Operation Instructions

To use this device follow these simple steps:

1. Make sure that the reservoir is full of water (make sure the DC pump intake is below the water surface).
2. Ensure that the photoresistor is not covered or in the shadow of anything.
3. Place a plant on the center of the turntable. Remember that it will spin on its own when it is light, so you need to have the load centered.
4. Press the button to rotate the plant and pump water through the tube for easy watering. Watch your plant revolve when ambient light levels are high.

Appendix A: Bill of Materials:

Summary of Parts from Kit

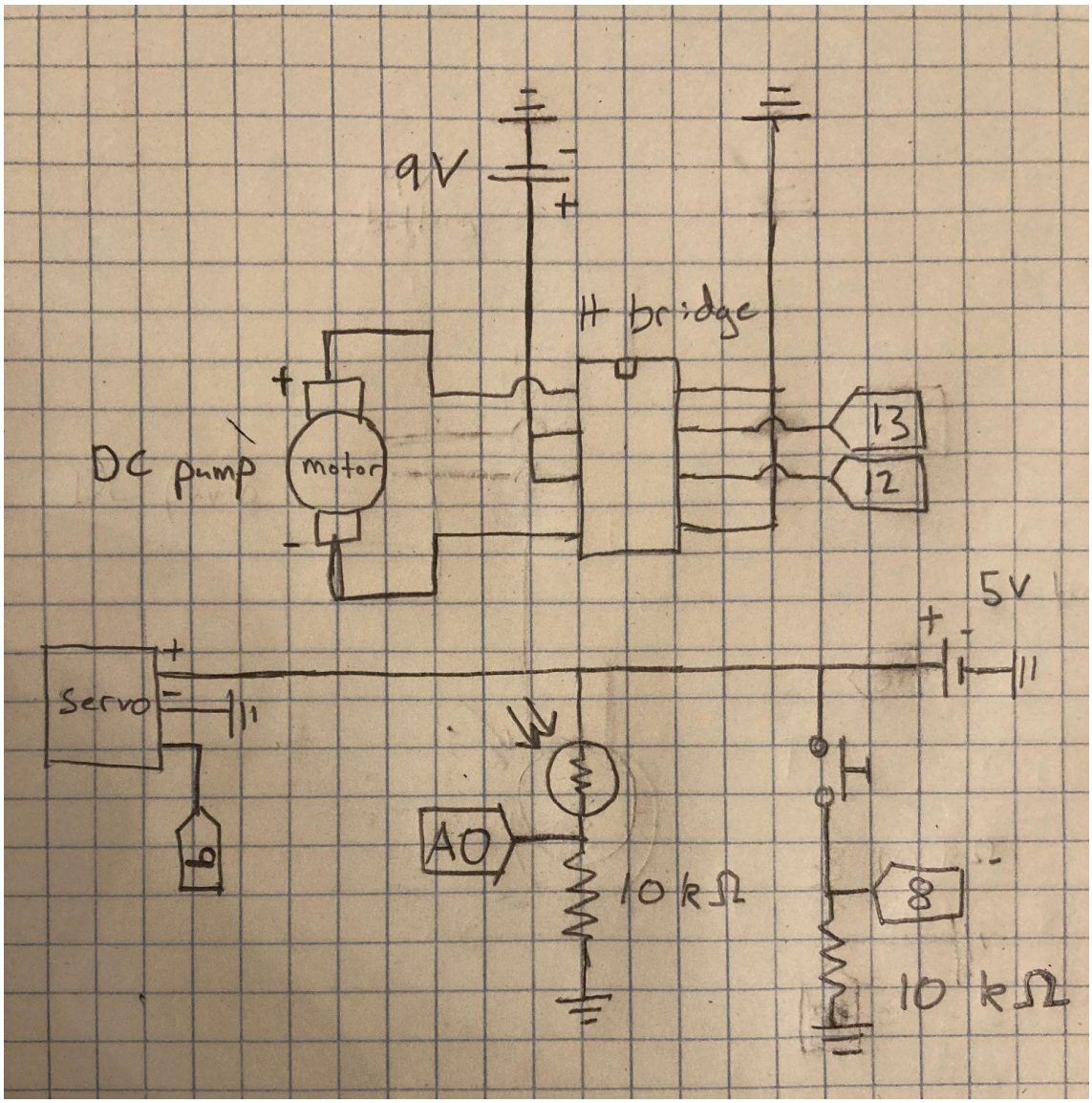
Item	Vendor	Part Number	Quantity	Price/Unit	Subtotal
Arduino Uno	Digi-Key	1050-1024-ND	1	$20.90	$20.90
9V battery	Jameco	71455K68	1	$1.68	$1.68
9V battery battery	Jameco	2207056	1	$1.39	$1.39
9V battery leads	Jameco	216452	1	0.29	0.29
Continuous Servo	DFRobot	SER-0043	1	$3.90	$3.90
Bread Board	Newark	79X3922	1	$2.71	$2.71
Push Button	Jameco	155380	1	$0.35	$0.35
Motor Driver IC: L9110H	Digi-Key	1528-4489-ND	1	$1.42	1.42
Resistor 10k Ω	Digi-Key	10kQBK-ND	2	$0.01	$0.02
Alligator Clips	Sparkfun	PRT-12978	1	$0.33	$0.33
Wire Kit	Amazon	B07PQKNQ22	1	$2.17	$2.17
USB A to B	Monoprice	39918	1	$1.09	$1.09
				Total:	$36.25

Summary of Purchased Parts

Item	Vendor	Part Number	Quantity	Price/Unit	Subtotal
DC MINI IMMERSIBLE WATER PUMP 6V (tubing is included	Digi-Key	1738-1398-ND	1	$9.20	$9.20
Big Bands (Rubber bands)	Amazon	B003QX65Wo	1	$2.18	$2.18
Photoresistor	Digikey	1528-2141-ND	1	$0.95	$0.95
Turntable 4”	Amazon	B098FZGYDX	1	$5.80	$5.80
glue	Lab	N/A	1	$1.75	$1.75
5" x 7" x 1/16" card	Lab	N/A	1	$0.11	$0.11
				Total:	$19.99

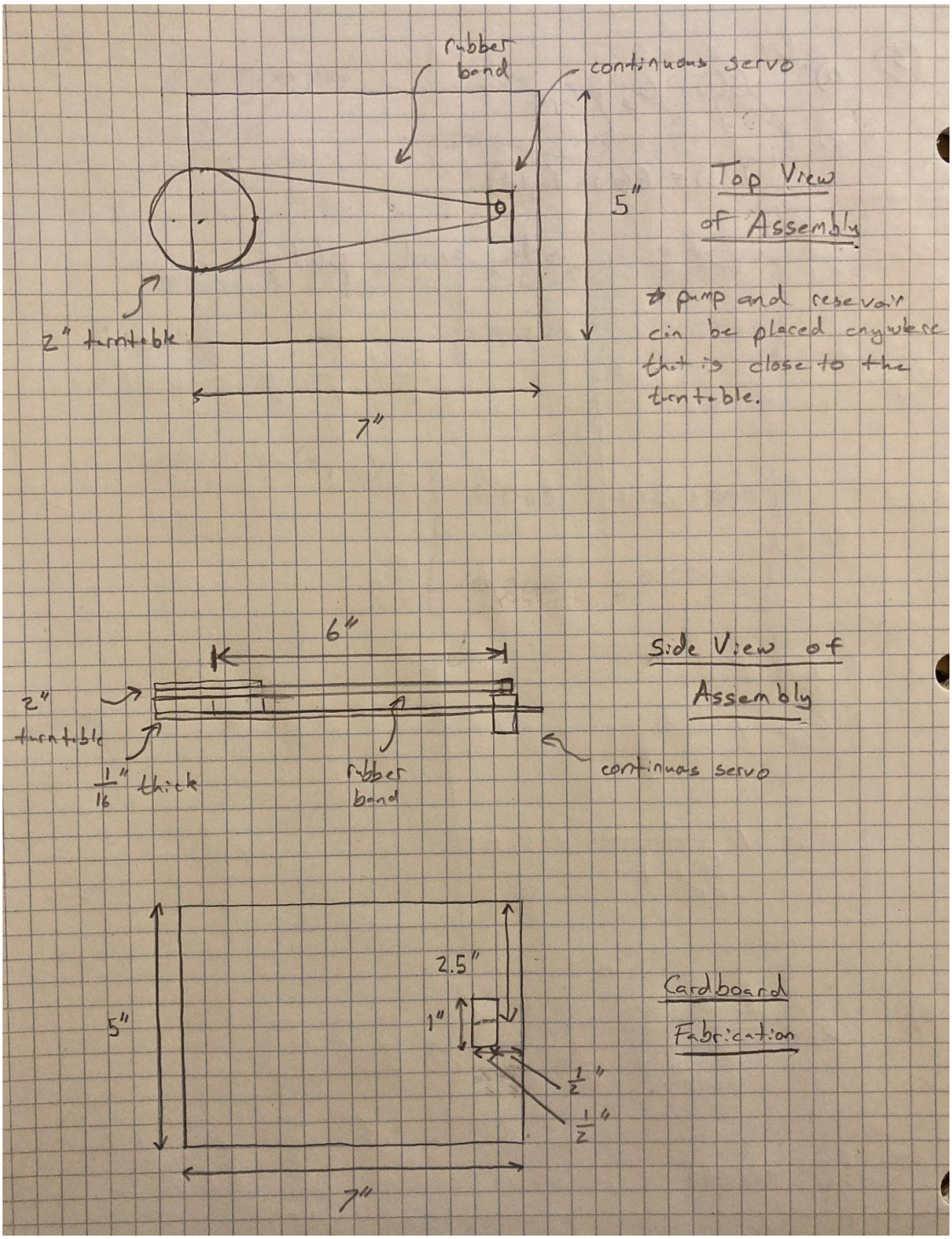
The total cost of purchased parts was $19.99 while the total cost of parts, including kit parts, was $56.24

Appendix B: Circuit Diagram



Circuit Diagram

Appendix C: CAD Files and Drawings



Drawings for Assembly and Fabrication

Appendix D: Commented Code

```
//This code runs a pump and continuous servo based on the input of a button and photoresistor
//When the button is pressed, the servo will spin and the pump will pump
//When light levels are above a threshold, the servo will spin
//When the button is not pressed and light levels are low, the system will be stationary

//Prepare to use the servo
#include <Servo.h> // load servo library
Servo myservo; // create servo object

//declare two variables for button and light readings
int button = 0;
int light = 0;

void setup(){
  myservo.attach(9); //servo control
  pinMode(8, INPUT); //button input
  pinMode(12, OUTPUT); //backwards pin
  pinMode(13, OUTPUT); //forward pin
  Serial.begin(9600); //prep for logging
}

void loop(){
  //read from sensors
  button = digitalRead(8);
  light = analogRead(A0);
  digitalWrite(12,LOW);
 //run pump and spin servo if button is pressed
  if(button == 1) {
          digitalWrite(13,HIGH);
          myservo.write(45);
//spin the servo if the light levels are high enough
  } else if(light > 900) {
          digitalWrite(13,LOW);
          myservo.write(45);
//do nothing if dark and the button is not pressed
```

```
  } else {
        digitalWrite(13,LOW);
        myservo.write(90);
  }
  Serial.write(light); //write the light value to Arduino IDE
}
```