Nashua Community College
Nashua, New Hampshire

Electronic Engineering Technology

ELET274N: Capstone Final Project Report

Automatic Golf Ball Placer

Course Instructor: Prof Hughes

Performed by: [redacted]
Date report due: 05/04/2022

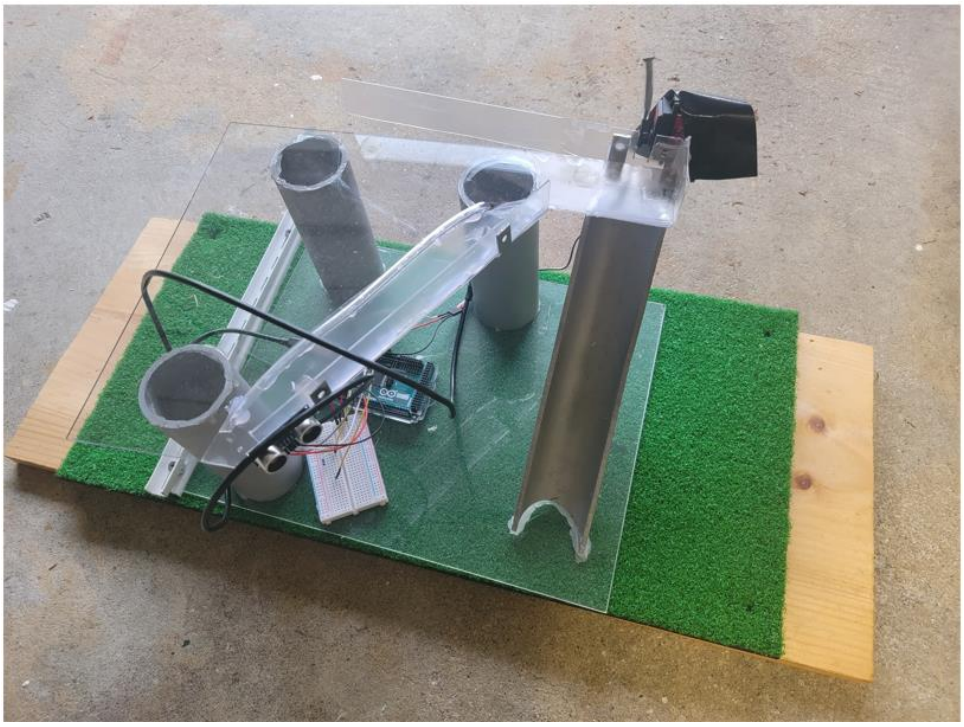
Grading Rubric:

Final Project complete and demonstrated (video) to instructor/+ evaluators	(30): ___
Project Complexity	(10): ___
Final Project write-up is well written, thorough, and clear.	(20): ___
Oral presentation evaluation from reviewers	(30): ___
Uploaded correctly (to Canvas)	(10): ___

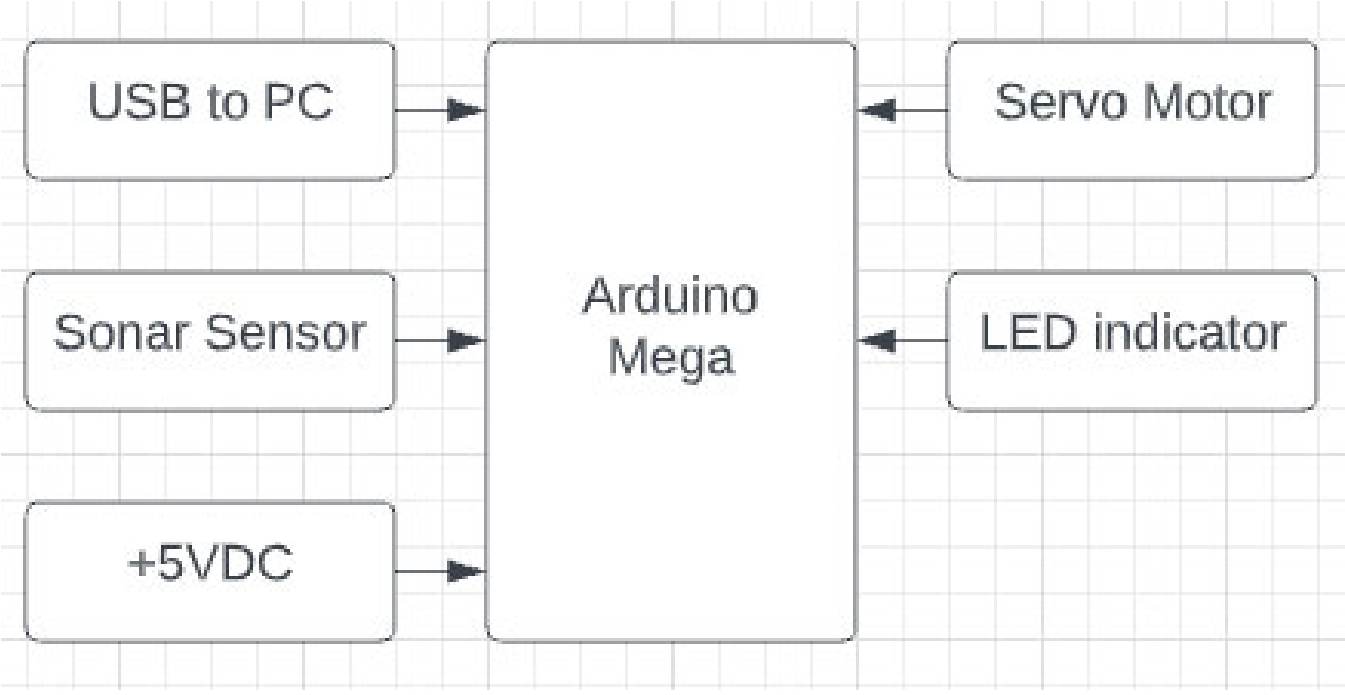
Grade ____

No late submission accepted.

Introduction: This automatic golf ball dispenser is a mechanical device that is able to hold and dispense golf balls at the wave of a golf club. This machine holds the golf ball in an acrylic plate that is located on the top of the device. It can comfortably hold 17~21 golf balls depending how they are placed in. Once you have loaded your golf balls into the top of the machine you will notice that the machine is at an angle leaning down and to the left side of the machine. That allows you to place the golf balls wherever in the hopper on the top and they will all fall down to a slot that is only wide enough for one golf ball. Once the golf balls make it down there you will notice that the golf balls go to a single file line, that will prevent the golf balls from jamming. Once the balls are lined up single file they will lie in front of a servo with an arm that is just long enough to knock the balls down the ramp. Now that you have the golf balls lined up in front of the ramp you will then need to wave your golf club in front of the sonar sensor that is in front of the machine. Once you wave your club 5" in front of the sonar you will then see the servo arm tilt 70° knocking the golf ball down the ramp that is on the machine. That ramp will roll the golf ball around 1' in front of the machine on the ground, it will vary depending on how tall the grass is and how firm the soil is. After that the servo will then revert back to its original position. When the servo tilts forward not only will it dispense a ball forward it will stay in that position preventing another ball from falling down into the dispensing spot until the program is complete. Once that servo arm retracts it will then allow another golf ball to drop down into the disposition spot. There is a 1 second delay in the code to make sure that another golf ball can drop down into that spot. Also while the servo is tilting forward, waiting and then going back to its original position you will notice that there is a green LED underneath the hopper that will illuminate while the program is in action, that is there more for troubleshooting purposes.

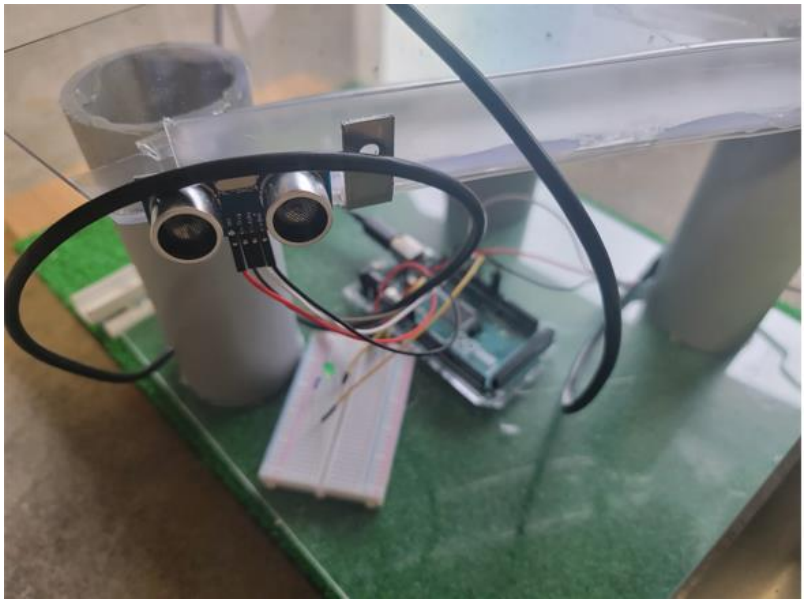


Hardware Block Diagram:



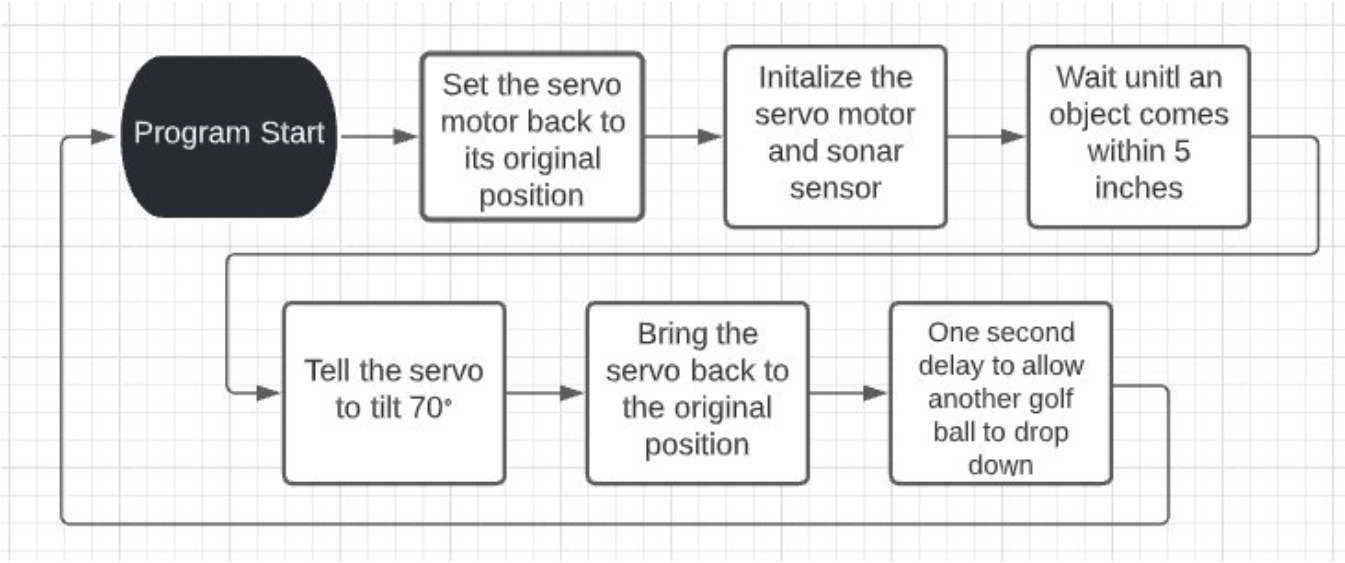
Bill of Materials:

Part name	Where it was ordered	QTY	Price
Arduino Mega	Amazon	1	$34.91
Golf Mat	Amazon	1	$17.99
USB Type B	Amazon	1	$8.49
High Torque Servo (3)	Amazon	1	$34.99
PVC Pipe (1-¼”)	Home Depot		$6.23
Plexi Glass/ Lexan	Home Depot		$7.49
Arduino Kit	Amazon	1	$23.99
Breadboards	Amazon	1	$12.86
Sonar Sensors(5)	Amazon	1	$9.29
Golf Mat	Amazon	1	$19.79
	Total Price		**$176.03**



Final Test Plan: If someone else were to try and test and debug my project I would tell them these few things. When you boot the system there is a line of code in the beginning to make sure that the servo goes back to its original position. Once it has completed that and it has called on all of the proper libraries and initialized all of the inputs and outputs it will then wait for an object to come within 5 inches of the sonar sensor. When I was first starting to create this project I ran into the issue of when I was presenting the golf club to the sensor it was not an even surface so the sonar sensor would not know that the golf club was there because it was getting to return pings from the uneven backside of the golf club. Also another issue I ran into is when I mounted the servo motor with a bent L bracket I mounted it with hot glue. Unfortunately the hot glue was not a good binder for a metal to plastic bond. The hot glue stuck just fine to the servo motor but it just barely stuck to the aluminum bracket. After using the machine several times and the servo kept pushing down and hitting the golf ball it kept pushing the servo farther and farther up loosening the hot glue bond. After enough trial runs the servo pushed itself so far back it was not hitting the golf ball enough for it to fall down the ramp. I discovered this on the day of my final presentation. So for a last minute decision I used gorilla tape and taped the servo to the bracket which held the servo in place and I did not run into that issue going forward.

Block Diagram:



Overall Goal: My overall goal when creating this device was to create a convenience for golfers when they are trying to create a routine swing. One of the hardest things to learn in golf is developing your unique swing and trying to make that swing habit. One of the ways you can make that swing habit is hitting golf balls over and over again until it has been burned into your brain about what is good in a swing and what is not. One of the problems with that is it can be very time consuming and I am trying to create a convencine that will help golfers find their swing and help save them a little bit of time in the process.

Final Code:

```
#include <Servo.h>

Servo servo1;
int servoPin = 9;

const int trigPin = 2;   // Sets the trigger pin to digital pin 2 on the Arduino
const int echoPin = 3;   // Sets the echo pin to digital pin 3 on the Arduino

const int greenLED = 7;     // Sets pin 7 to a LED to help troubleshoot

float distance = 0;       // A int to store the value of the sensor
float echoTime;           // Variable to store the time it takes for a ping to bounce off an ob
int pos = 0;              // variable to store the servo position


void setup()
{

  servo1.attach(9);           // Attaches the servo on pin 9 to the servo object
  Serial.begin (9600);        // Initialize serial connection

  pinMode(trigPin, OUTPUT);   // Trigger pin will only output pulses
  pinMode(echoPin, INPUT);    // Echo pin will measure the duration of pulses coming back from

  pinMode(greenLED, OUTPUT);  // Sets pin 7 to only output voltage

     servo1.write(200);
    delay(1000);

}
```

```
void loop() {

  // Send out an ultrasonic pulse that's 10ms long
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Use the pulseIn command to see how long it takes for the pulse to bounce back to the sens
  echoTime = pulseIn(echoPin, HIGH);

  // Calculate the distance of the object that reflected the pulse
  // Bounce time in usec, divided by 2, multiplied by speed of sound (34300 cm/sec)
  // Divided by 2.54 to convert from cm to inches

  distance = ((echoTime/2)*0.0343)/2.54;

  Serial.print(distance);     // Print the distance that was measured
  Serial.println(" in");      // Print units after the distance

  if(distance <= 10){          // When the golf club it put up to the snesor it will run this p


    digitalWrite(redPin, HIGH);
    servo1.write(200);          //Make sure the Servo is in the starting position when the proc
    delay(250);                 //Allow the servo a quarter of a second to get to the right pos
    servo1.write(130);          //Tell the servo to go to a pre determined position 130 degrees
    delay(500);                 //Allow the servo a half a second to get to the right position
    servo1.write(200);          //Tell the servo to go back to the original position
    delay(1000);                //Allow the servo one second to get back to the position with a

  }

   else{                                  //When no golf club is found

    //light the green LED
    digitalWrite(redPin, LOW);


  }

  delay(250);      // Delay 250 ms between each reading
}
```

Summary:

I have learned a lot from my capstone project from time management to how to better interface with an arudio. I learned how to code and diagnose a servo motor and sonar sensor. It was my first time using a sonar sensor and what I learned is that you need to present an almost flat surface to a sonar sensor so the sound has something to reflect off of. Another thing I learned is time management. At the beginning of this project I was very ambitious and I had all of my reports in on time but towards the end of the semester I started to lose that ambition. Also another issue I ran into was creating the mechanical and physical part of the project. Actually creating the device and making sure that it was tilted enough that the balls would fall down in front of the servo and making sure that the servo arm was long enough to hit the balls to knock down the ramp posed a challenge that I was not expecting and took a lot of time trying to overcome.