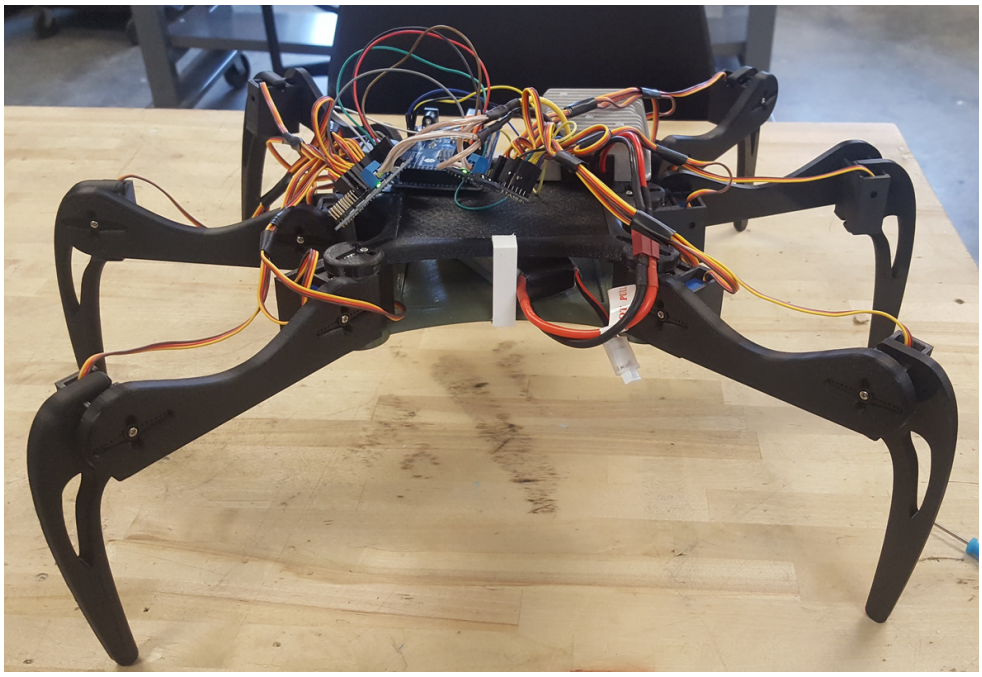
SAAGAR ARYA
HEXAPOD PROJECT

MARCH 2018 – JANUARY 2020



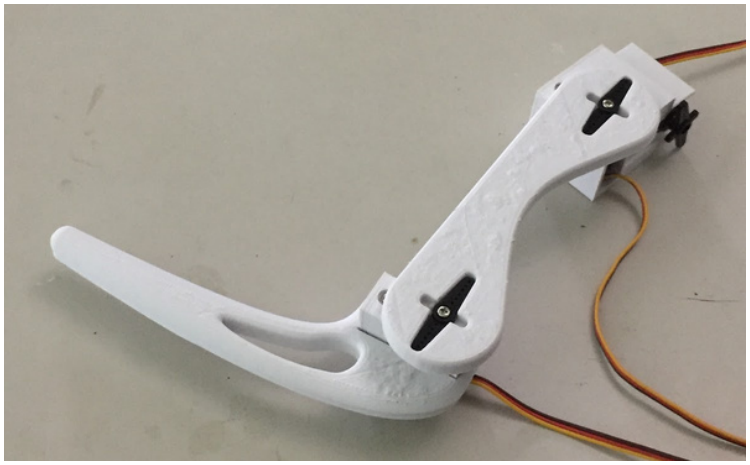
Completed Hexapod

SKILLS LEARNED/USED

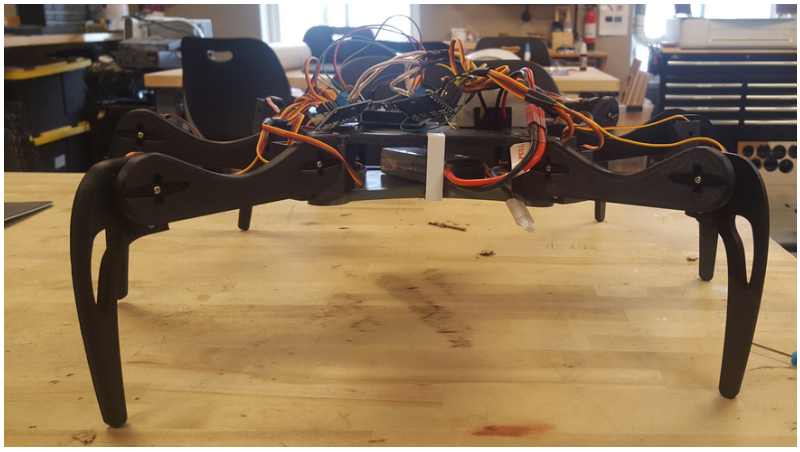
Autodesk Fusion 360
Ultimaker Cura
Arduino (Based on C++)
MIT App Inventor
Electrical Engineering
Physics Concepts

SUMMARY

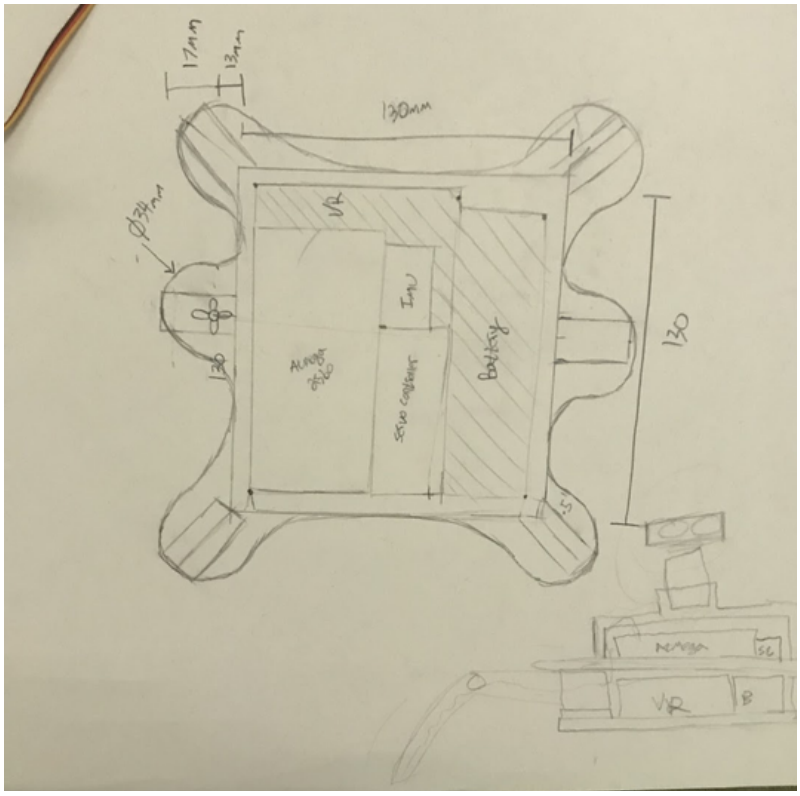
As I began wrapping up the drone project, I began brainstorming and working on creating a 6-legged walking robot. The project's goal was to create a robot similar to a spider with each of the six legs having independent and fluid movements through each of the 3 servos on the leg being able to be controlled independently. The first servo in each leg was the "hip" which rotated the entire leg. The second servo in each leg was the "knee" which was able to raise or lower the leg. The third servo in each leg was the "toe" which allowed the 3rd segment of each leg to be raised or lowered. Creating the system in which each of the 6 legs comprised of 18 servos worked together was the largest challenge. Due to budget constraints, most cheaper servos did not have the capability to provide the torque-to-weight ratio needed so that the robot would not just stumble around or not be able to stand up. Secondly, cheaper servos tended to only have one-sided rotation and were not able to hinge which meant motions like those needed for the hip would require a creative solution. First, by creating a slightly larger case for the servo to sit, I was able to create a hole directly under the output shaft which would allow the entire body of the servo to move if the servo horn was held in position. For this purpose, the bottom plate had a small cylinder extruded to directly fit into the hole of the servo, the top plate had an indent that matched the shape of the servo horn, and both of the plates were held together by a 3D-printed clamp. After the entirety of the hexapod was finished 3D printing and assembled, I used an Arduino Mega and 2 servo controllers which let each servo be at a unique address and therefore controlled independently of the others. In further work, I added a Bluetooth Sensor and used MIT App Inventor to control the hexapod with my phone.



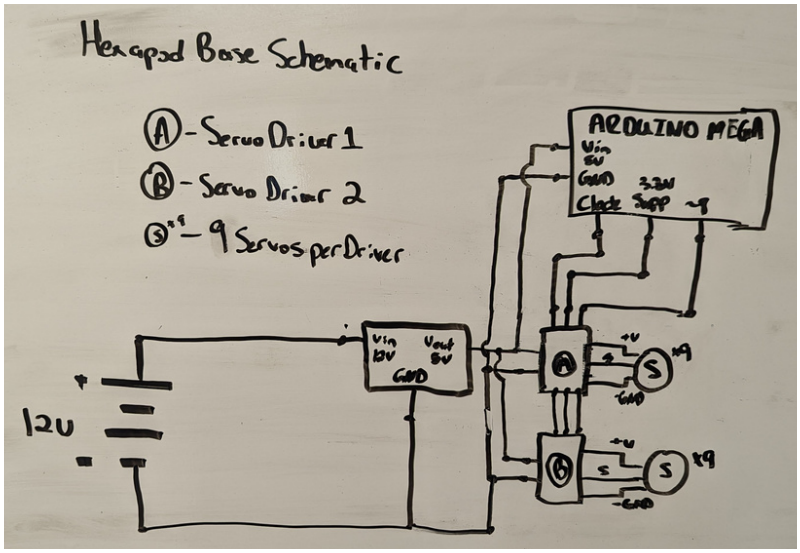
First Draft of Leg Assembly



Front View. Easier to See The White Clamp Hold Bottom/Top Plates Together Allowing the Servos To Hinge



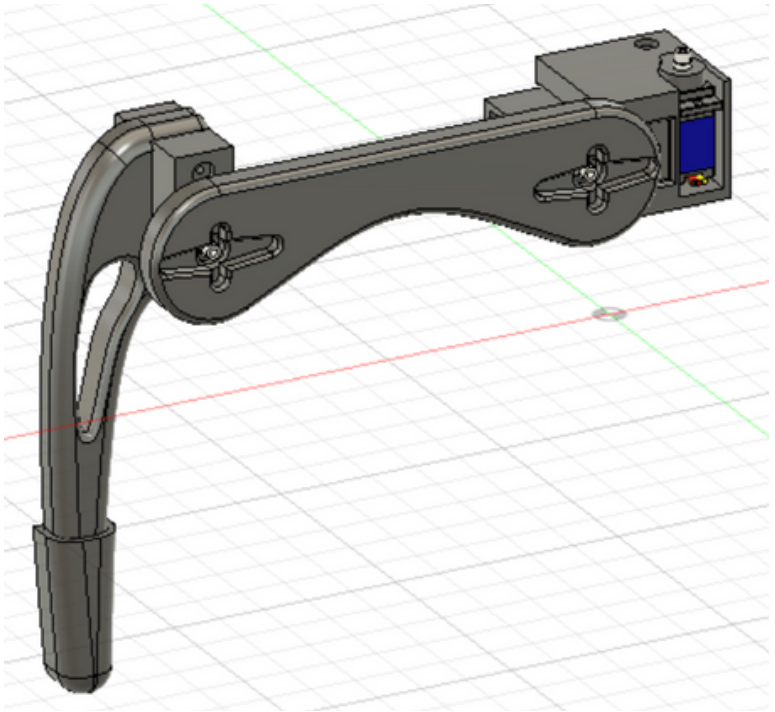
First Drawing/Outline of Hexapod



Schematic of Hexapod

```
class Leg
{
  public:
    int hipPulse = MIDPOINT;
    int kneePulse = SERVOMAX;
    int toePulse = SERVOMAX;

    int hipPin;
    int kneePin;
    int toePin;

    int board;

    Leg(int hip, int knee, int toe, int b);
    setHip(int a);
    setKnee(int a);
    setToe(int a);
};

Leg::Leg(int hip, int knee, int toe, int b)
{
  hipPin = hip;
  kneePin = knee;
  toePin = toe;
  board = b;
}
```

Leg Class of the Hexapod's Movement Code



3D Model of the Hexapod's Leg Assembly on Fusion 360