HR 2 BREAKDOWN

TEAM: NAU NASA Psyche Sampling Team - #B7

Due Date: **Friday, March 6, 2020 at 11:59pm**

Provide several pics of the current state of your completed system thus far here:

Figure 1: Full Mainframe & Base System with Drill Holder Plate and Torque Motor

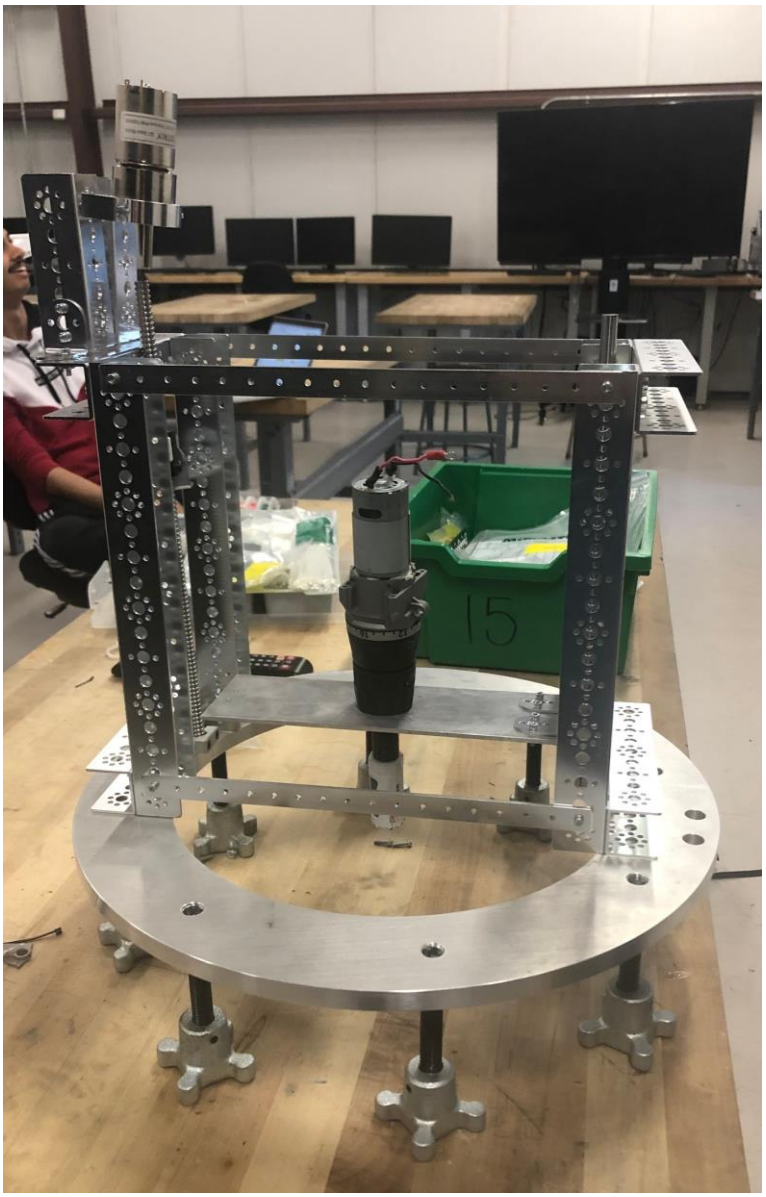


Figure 2: Full Mainframe & Base System with Drill Holder Plate and Torque Motor (Front View)

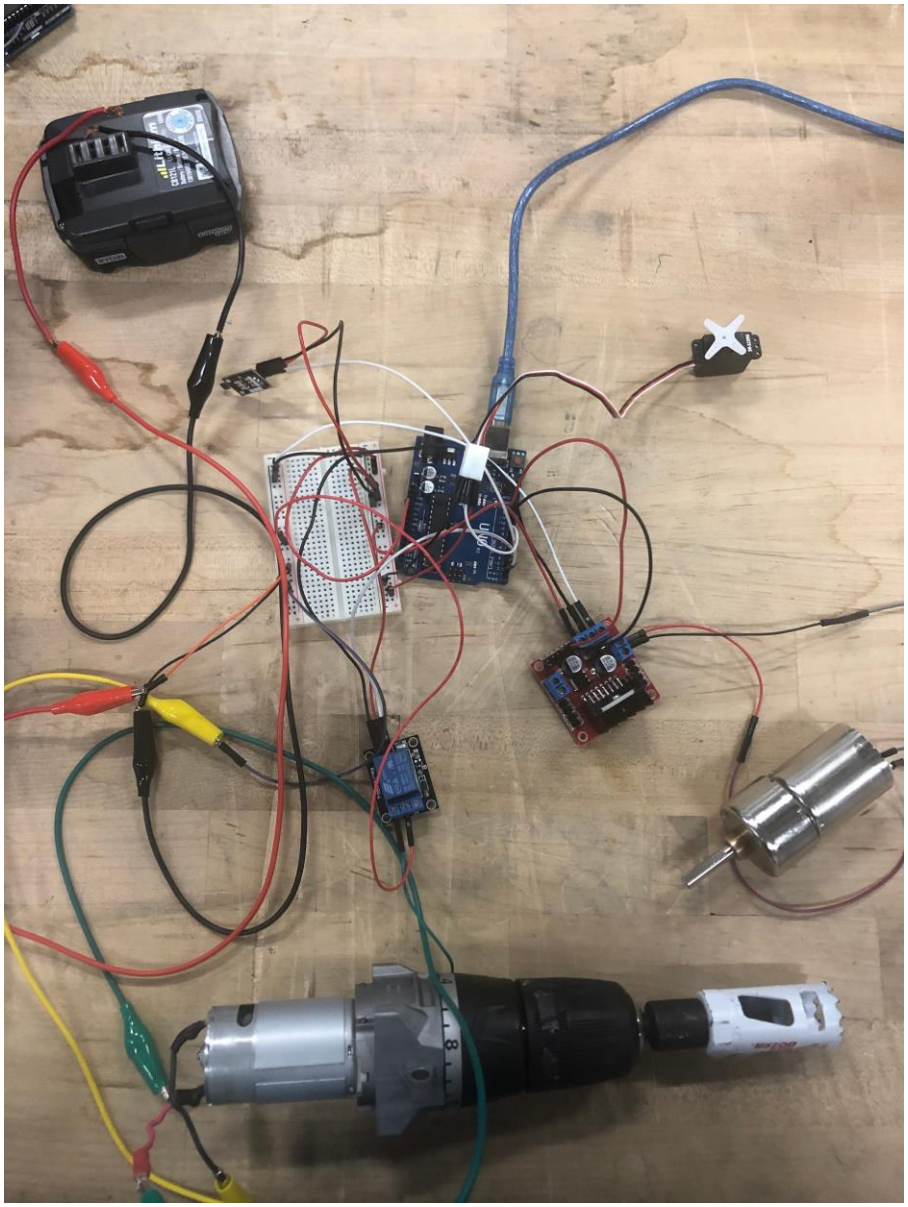
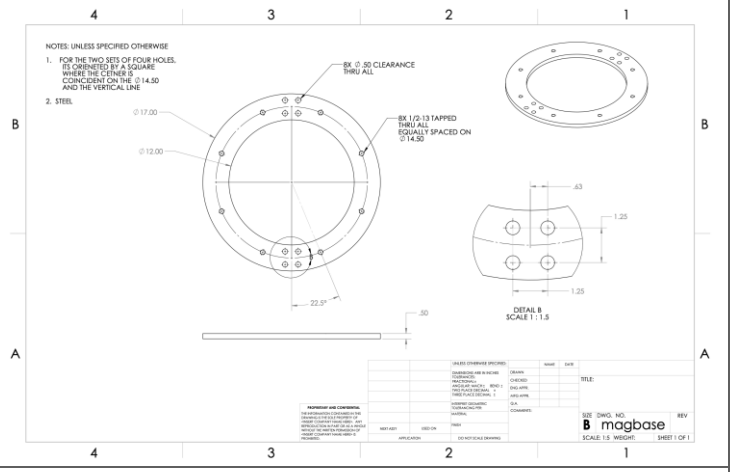


Figure 3: Full Current Electrical Arduino Setup with Relay, Motor Driver, Hall Effect Sensor, & Drill, Torque and Servo Motors (not plugged into power source on the top left)

The following are the Action Items each person completed between Hardware Review 1 and Hardware Review 2:

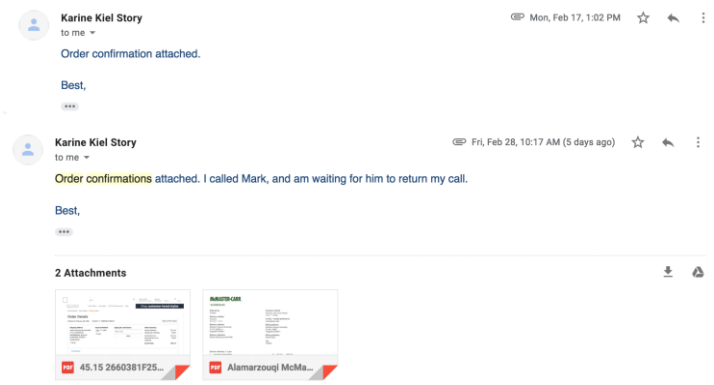
Team Member: Andrew Acosta

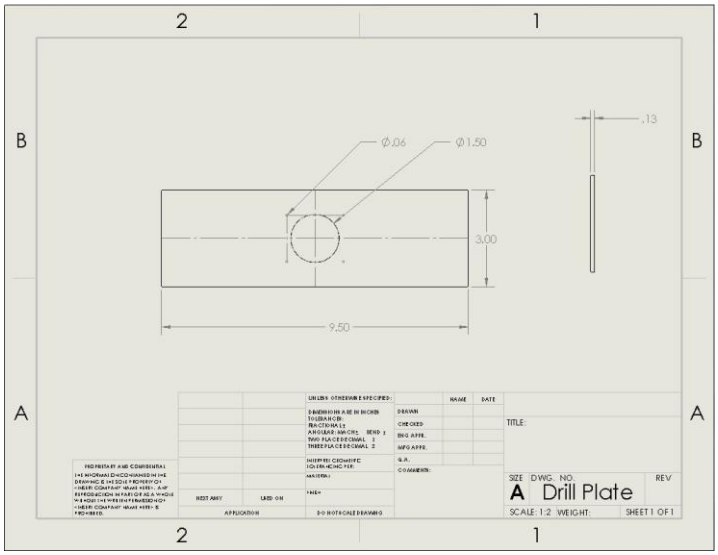
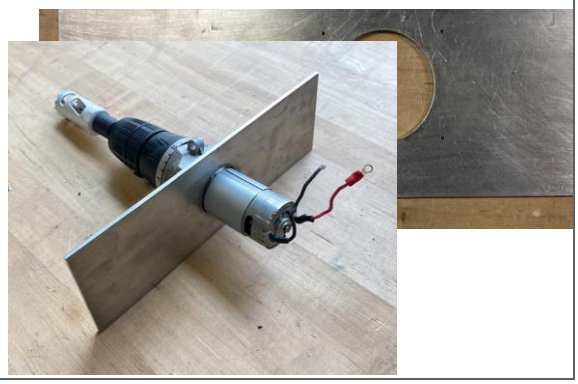
Action Item	Date Completed	Result/Proof of Completion
Helped built the tower used to house the electrical components and drill	2/13/20	
Completed the drawing for the magnetic base	2/18/20	
Created an Excel File to figure out the best AWG to be used for the electromagnetic base	2/24/20	

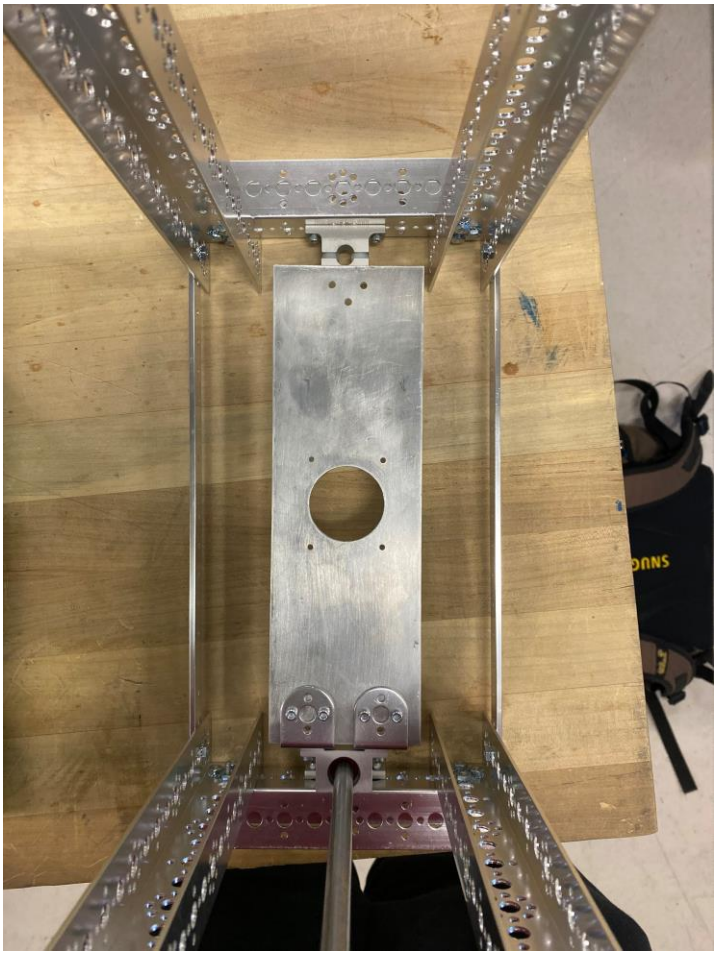
Gauge	thickness	bolt length	max turns	turns x14	bolt circumference	length (in)	length (ft)	for 14 bolts	
30	0.01	3	300	4200	1.570796327	471.238898	39.2699082	549.778714	
26	0.0159	3	188.679245	2641.50943	1.570796327	296.376665	24.6980555	345.772776	
22	0.0253	3	118.577075	1660.07905	1.570796327	186.260434	15.5217028	217.30384	
4	0.2043	3	10	140	1.570796327	15.7079633	1.30899694	18.3259571	yes
8	0.1285	3	23.3463035	326.848249	1.570796327	36.6722878	3.05602398	42.7843357	no
2	0.2576	3	11.6459627	163.043478	1.570796327	18.2934355	1.52445296	21.3423414	yes
6	0.162	3	18.5185185	259.259259	1.570796327	29.0888209	2.42406841	33.9369577	almost
10	0.1019	3	29.4406281	412.168793	1.570796327	46.2452304	3.8537692	53.9527688	

Obtained the MagBase	2/28/20	
Combined the tower and the Magbase	3/5/20	

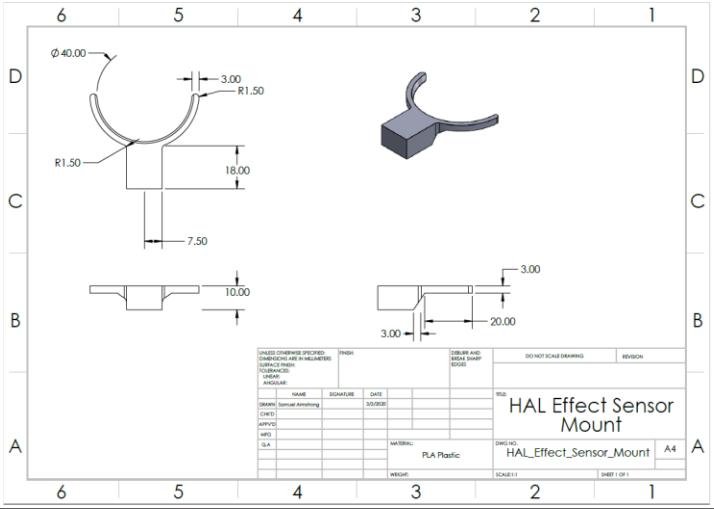
Team Member: Sultan Almarzouqi

Action Item	Date Completed	Result/Proof of Completion
Ordering Parts - Taking all the parts needed to complete the project and ordering them online.	2/10/2020	
Building the tower - Building the the tower base that holds all the parts together.	2/13/2020	

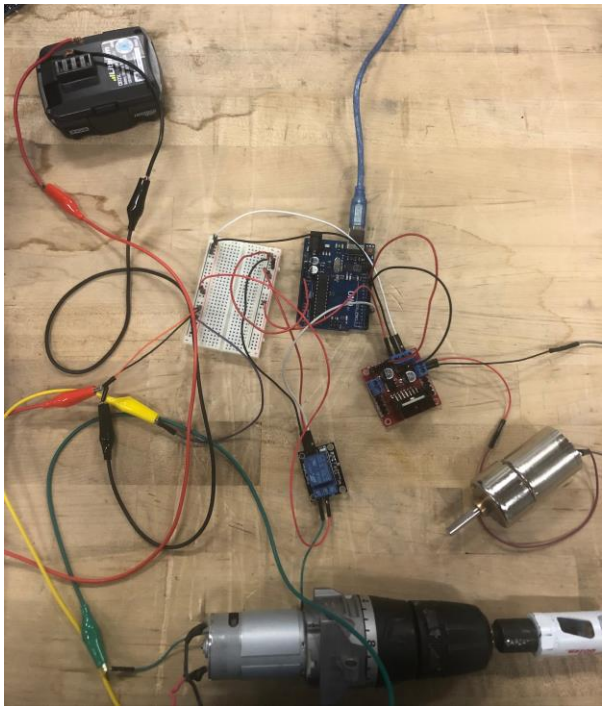
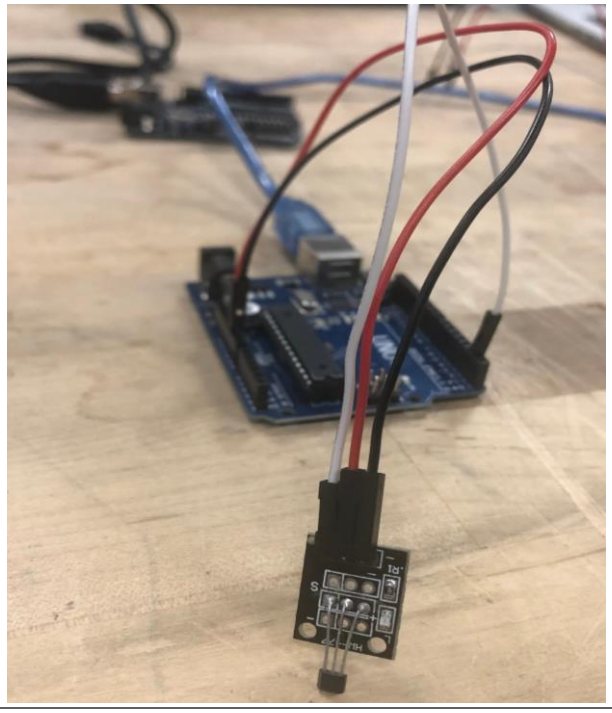
Creating the drill plate on solidworks - using solid work to create the drill plate that will be holding the drill	2/18/2020	
Mechaning the drill plate - Finish machining the drill plate	2/28/2020	

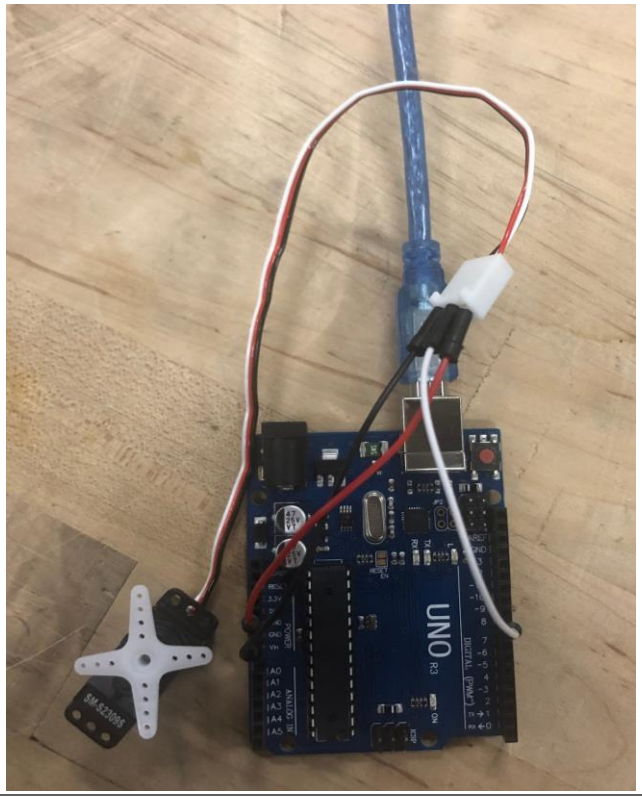
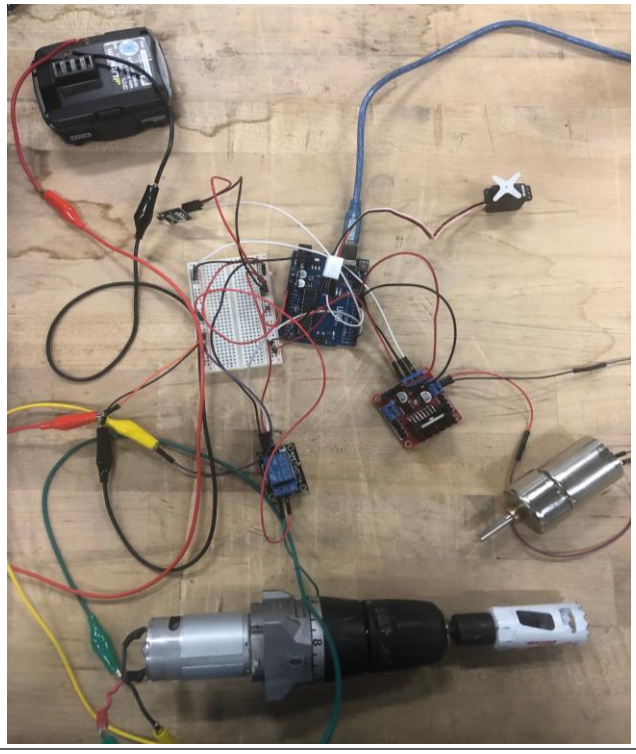
Attaching the drill plate to the tower base.	3/2/2020	

Team Member: Sam Armstrong

Action Item	Date Completed	Result/Proof of Completion
Built the tower base assembly to house the drill assembly.	2/13/2020	
Researched ball screw technology and put together order of necessary parts in excel to be ordered.	2/17/2020	Linear Acuator Parts Order Qty. | Item | Details | Source | Price ($) | Part No. 3 | Easy-Access Base-Mounted Shaft Support | for 3/8" Shaft Diameter, 6061 Aluminum | https://www.mcmaster.com/catalog/126/1220 | 40.14 | 1865K2 1 | External-Thread Ball Nut with 3/8"-8 Right-Hand Thread for Ball Screw | n/a | https://www.mcmaster.com/catalog/126/1245 | 63.46 | 3405N072 1 | Mounted Linear Sleeve Bearing | Self Align, 0.0005" Shaft Clearance, 1-5/16" Overall Length | https://www.mcmaster.com/catalog/126/1227 | 53.31 | 6374K119 1 | Ball Screw | Right Hand, 3/8"-8 Thread Size, 1 Foot Long | https://www.mcmaster.com/catalog/126/1245 | 44.31 | 3405N061 1 | Linear Motion Shaft | 1060 Carbon Steel, 3/8" Diameter, 12" Long | https://www.mcmaster.com/catalog/126/3926 | 16.95 | 1655T132 Total | 218.17
Researched a cheaper amazon alternative to the motor couplers on Mcmaster and researched high torque servos. Placed order in excel sheet for ordering.	2/24/2020	Coupler and Servo Motor Order Qty. | Item | Details | Source | Price ($) | Part No. 1 | Ruland FCR16-6-4-A Clamping Beam Coupling, Polished Aluminum, Inch | n/a | https://www.amazon.com/Ruland-FCR16-6-4-Cl | 9.41 | n/a 1 | 2 Sets 20KG RC Digital Servo - Large Torque High Speed Full Metal Gear | n/a | https://www.amazon.com/Sets-20KG-Digital-Ser | 31.99 | n/a Total | 41.4
Modeled a 3d-printable mount to attach the HALL Effect sensor to the body of the drill.	3/2/2020	

Team Member: Karissa Barroso

Action Item	Date Completed	Result/Proof of Completion
Arduino Setup -Putting together an arduino setup with a torque motor using a motor driver and powering the drill motor using a relay switch.	2/14/2020	
Arduino Setup - Installing a hall effect sensor in the arduino set up.	2/21/2020	

Arduino Setup - Installing a servo motor into the Arduino set up.	2/26/2020	
Arduino Setup - Developing a full circuit utilizing all key components to the Arduino control. (like using a breadboard to all operate under one arduino and one power source)	2/28/2020	

Team Member: Scott Sprauer

Action Item	Date Completed	Result/Proof of Completion

Arduino Coding - Learned the basics of coding and set up an arduino uno. This was done with a virtual tool and was helpful in learning the very basics.	1/23/20	2.3_code §
		`int LED=13;`
		`int counter=0;`
		`void setup() {`
		`  // put your setup code here, to run once:`
		`  pinMode(LED,OUTPUT);`
		`  Serial.begin(9600);`
		`}`
		
		`void loop() {`
		`  // put your main code here, to run repeatedly:`
		`  counter = counter +1; // adding one everytime time it loops`
		`  Serial.print("Blink Number # ");`
		`  Serial.println(counter);`
		`  digitalWrite(LED,HIGH);`
		`  delay(1000);`
		`  digitalWrite(LED,LOW);`
		`  delay(500);`
		`}`

Arduino Coding - Coding the arduino in such a way to power a torque motor and varying its speed throughout the code.	2/5/20	Analog
		`unsigned long currTime, prevTime;`
		`const unsigned long intv = 20;`
		
		`void setup()`
		`{`
		`  Serial.begin(9600);`
		`  pinMode(11, OUTPUT);`
		`  pinMode(10, OUTPUT);`
		`  pinMode(5, OUTPUT);`
		`  pinMode(6, OUTPUT);`
		`  prevTime = millis();`
		`}`
		
		`void loop()`
		`{`
		`  int valx, valy, speedx, speedy;`
		`  currTime=millis();`
		`  valx = analogRead(A0);`
		`  valy = analogRead(A1);`
		`  if(currTime-prevTime > intv){`
		`  if(valx > 502 && valx < 522)`
		`  {`
		`  analogWrite(11,0);//Clockwise`
		`  analogWrite(10,0);`
		`  }`
		`  else if(valx >= 522){`

Arduino Coding - Collected relays and learned how to properly code the relay as to not burn up the motors, as well as learned how to develop a code to calculate rpm's with the hall effect sensor.	2/12/20	Relay
		`const int relay = 8;`
		
		`void setup() {`
		`  pinMode( relay, OUTPUT);`
		`  pinMode( 10 , OUTPUT);`
		`  pinMode(11, OUTPUT);`
		
		`}`
		
		`void loop() {`
		`  analogWrite(10, 2500);`
		`  analogWrite(11,0);`
		`  digitalWrite(relay, 1);`
		`  delay(8000);`
		`  digitalWrite(relay,0);`
		`  delay(3000);`
		
		`}`

Arduino Coding - Coding logical statements in attempt to create all full code for the different areas of the electrical system. Addition to servos.	2/26/20	Sweep §
		
		#include <Servo.h>
		
		Servo myservo; // create servo object
		// twelve servo objects can be created
		
		int pos = 0; // variable to store th
		
		void setup() {
		myservo.attach(9); // attaches the s
		}
		
		void loop() {
		for (pos = 0; pos <= 180; pos += 1) {
		// in steps of 1 degree
		myservo.write(pos); //
		delay(15); //
		}
		for (pos = 180; pos >= 0; pos -= 1) {
		myservo.write(pos); //
		delay(15); //
		}
		}

Arduino Coding - Attempt to start putting all codes together and create the full operational code.	3/4/20	state = digitalRead(sensor);
		Serial.print(revsPerMin);
		Serial.print ("\t");
		Serial.println(prevRPM);
		delay(500);
		
		if (fabs(revsPerMin-prevRPM)> 0.1) // if difference in r
		{
		currTimemillis = millis(); // tell me what time i
		prevRPM = revsPerMin; // set back to rpm
		if (initprevTimemillis == false) // dont do it the first
		{
		prevRPM = currTimemillis;
		initprevTimemillis = true;
		}
		
		}
		if (currTimemillis - prevTimemillis > 50) // if rpms have
		{
		digitalWrite(relay, 0);
		prevTimemillis = currTimemillis; // set back to n
		}
		else // Keep drill on
		{
		digitalWrite(relay,1);

The following are the Action Items for each team member between HR 2 and the Final Product presentation:

Team Member	Action Items	Date Due
Andrew Acosta	1. Finish electromagnet 2. Improve vertical system 3. Build caching system	1. 3/9/20 2. 3/15/20 3. 3/22/20
Sultan Almarzouqi	1. Upper motor frame set up 2. Attaching the tower magnetic base	1. 3/9/2020 2. 3/12/2020

Sam Armstrong	1. Print HALL Effect sensor mount 2. Design and print servo mount for core remover 3. Develop storage and caching system assembly 4. Connect motor to ball screw assembly	1. 3/13/2020 2. 3/20/2020 3. 3/22/2020 4. 3/9/2020
Karissa Barroso	1. Develop a setup for distance motors in the current full setup and put together a servo motor in a way that it can work how the team needs for the caching system. 2. Simplify circuit by getting rid of breadboard and soldering wires together. 3. Combine Arduino Hardware with Mainframe Hardware.	1. 3/11/2020 2. 3/14/2020 3. 3/22/2020
Scott Sprauer	1. Create code distance sensor and servos into a full system. 2. Get a full coding system up and running with the caching and magnet system inside. 3. Test program in full.	1. 3/11/20 2. 3/14/20 3. 3/22/20

DISCLAIMER

This work was created in partial fulfillment of Northern Arizona University's Capstone Course "ME 486C". The work is a result of the Psyche Student Collaborations component of NASA's Psyche Mission (https://psyche.asu.edu). "Psyche: A Journey to a Metal World" [Contract number NNM16AA09C] is part of the NASA Discovery Program mission to solar system targets. Trade names and trademarks of ASU and NASA are used in this work for identification only. Their usage does not constitute an official endorsement, either expressed or implied, by Arizona State University or National Aeronautics and Space Administration. The content is solely the responsibility of the authors and does not necessarily represent the official views of ASU or NASA.