Team Meeting

Date: October 9, 2020 **Location**: HCRS **Time**: 3:45 PM

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Alyssa Devincenzi
- Natalie Harvey

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Recap of in-class activity	Matt	10
2	Discuss plan for documentation		15
3	Systems design (FBD)		15
4	Constraints and criteria (Engineering Spec)		15
5	Plan design specification document		10

Notes	Action Items

• All meetings will use this template
• All python files will be under the “python” directory in the project folder.
• Each team member can choose to have their own folder, but the final code will be in a folder called “main”
• Design notebook will have a separate folder under the project folder. (ideally ALL electronic, including figures)
• External code will be kept in a folder under “python”; each file will have a form filled out, documenting its use.
• RFAI question: Can there be user input when the robot returns to the loading zone?
• Next meeting:
  ◦ Description and feature of sub-components
  ◦ Work Breakdown Structure, Gantt Chart
  ◦ Initial brainstorming
	1. Create FBD in LucidChart
	  a. Alyssa
	2. Create Engineering Specifications chart
	  a. Natalie
	3. Schedule next meeting
	  a. (wed/thur)

Team Meeting

Date: October 15, 2020 **Location**: HCRS **Time**: 4:30 pm

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi

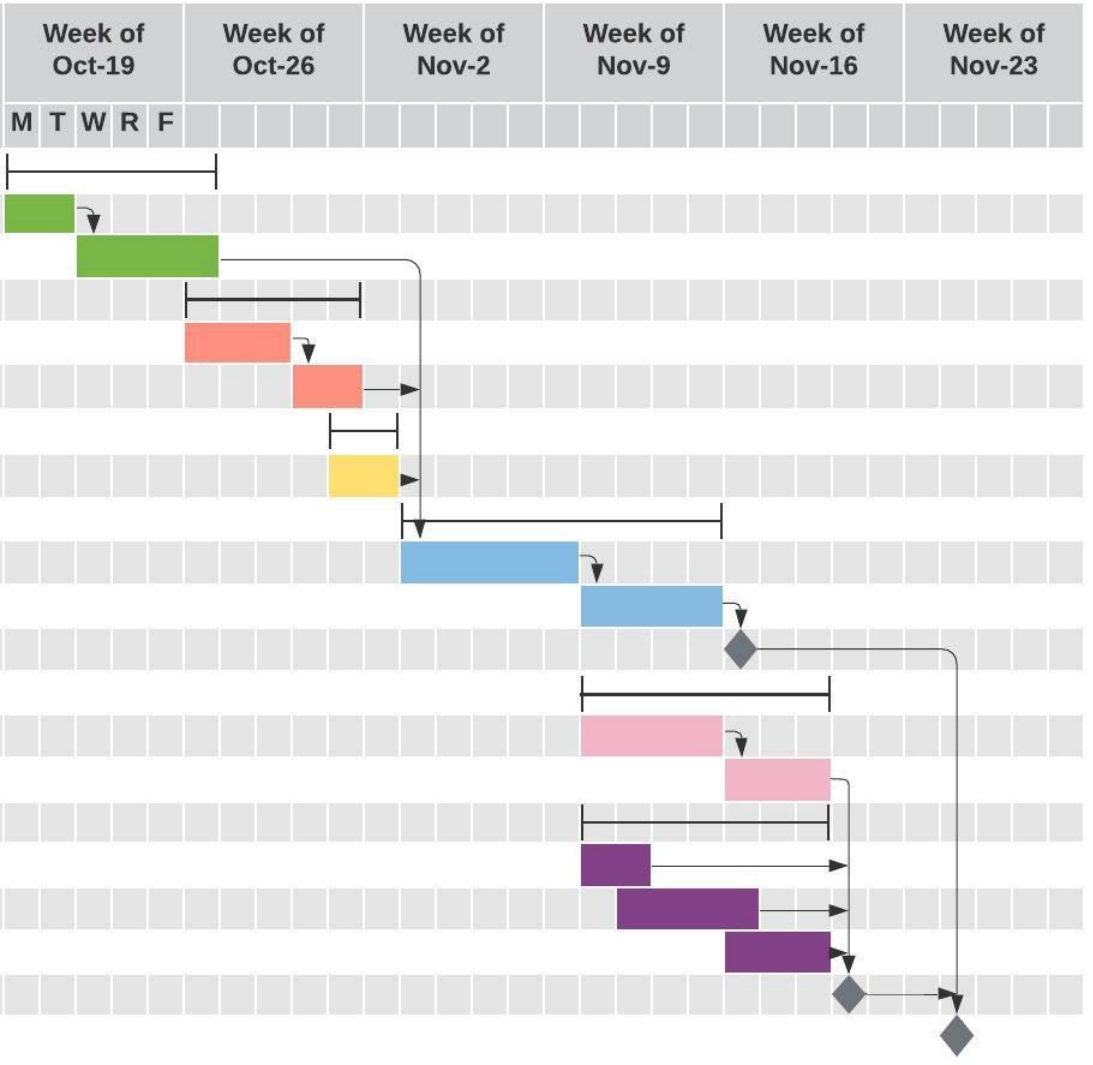
Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Review minutes from 10/9/20 meeting	Matt	5
2	Description and features of sub-components		30
3	Discuss timeline		10
4	WBS, Gantt Chart, project management, etc.		30
5			

Notes	Action Items
• Design Specification Review (DSR) document will be located under project documents. • Use Excel for Gantt Chart • Building will commence October 19, and should be completed by November 12	• Work-Breakdown Structure - Alyssa • Gantt Chart - Matt • DSR Final Draft - Natalie • Brainstorm design ideas for Cargo Containment System

MACRO Project Gantt Chart

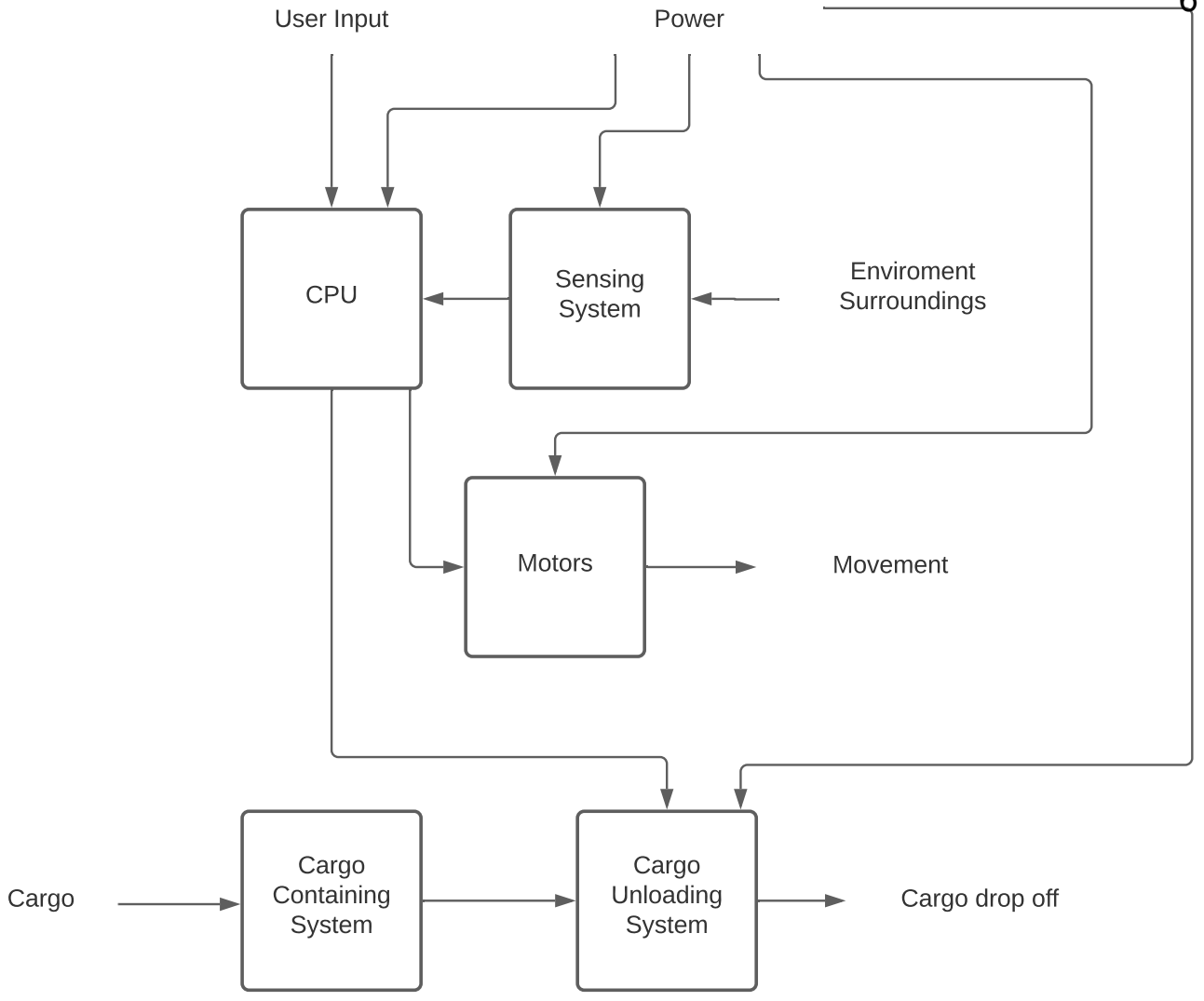
Team 30

Task name	Duration	Start date	Finish date
Cargo Containment	*8 Days*	Oct-19	Oct-26
Build Cargo Hold			
Build Unloading Mechanism			
Drivetrain	5 Days	Oct-26	Oct-30
Build Frame			
Install Motors			
Sensor Array	4 Days	Oct-30	Nov-2
Installation			
Programming	11 Days	Nov-3	Nov-13
Write Program			
Testing/Debugging			
MACRO Complete	28 Days	Oct-19	Nov-16
Video Presentation	9 Days	Nov-10	Nov-18
Create Powerpoint			
Voice Overs			
Written Documentation	9 Days	Nov-10	Nov-18
Write Cover Letter, Executive Summary, Design Considerations			
Write Analysis, Results & Discussion, Scaling to Official Mars Project			
Write Conclusion & Recommendations, External Code Appendix			
Documentation Complete	9 Days	Nov-10	Nov-18
END OF TERM	37 Days	Oct-19	Nov-24



- Macro Project
  - Robot
    - Cargo Containment
      - Build Cargo Hold
      - Build Unloading Mechanism
    - Drive Train
      - Build Frame
      - Install Motors
    - Sensor Array
      - Install Sensors
    - Program
      - Write Main Program
      - Test Program
      - Debug
  - Documentaiton
    - Video Presentation
      - Powepoint
      - Voice Over
    - Written Reprt
      - Cover Letter
      - Executive Summary
      - Design Considerations
      - MACRO Physical Analysis
      - Scaling to Official Mars Project
      - Results and Discussion
      - Conclusion and Recommendations
      - Use of External Code Appendix

Customer Need	Technical Need	Technical Requirement	Target Value
Navigate to sites	Success rate of runs per total number of runs	Success rate of at least 90%	At least 95%
Recognize and handle hazards	Rate of successfully recognizing and handling obstacles per total obstacles encountered	Success rate greater than 95%	Same as Technical Requirement
Timely delivery of mission hardware	Difference between desired and actual speed	A difference no greater than 2 cm/s	Same as Technical Requirement
Transporting cargo from location without dropping or tipping the cargo	Success rate of transportation per total attempted runs	Success rate greater than 90%	Greater than 95%
Drop off on target	Distance of cargo from the target after drop off	Distance less than 5 cm	Same as Technical Requirement


User Input
Power
CPU
Sensing System
Enviroment Surroundings
Motors
Movement
Cargo
Cargo Containing System
Cargo Unloading System
Cargo drop off

Team Meeting

Date: October 19, 2020 **Location**: HCRS **Time**: 12:00 PM

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

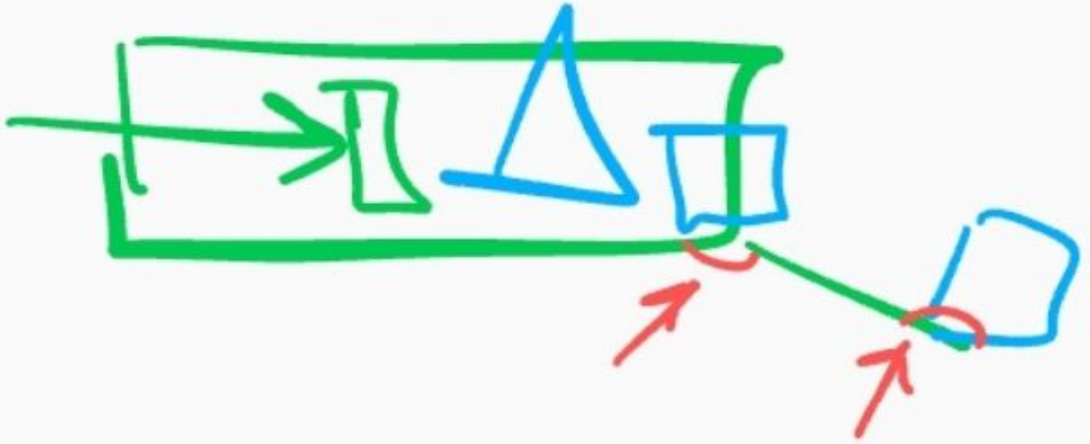
- Matthew Stuber
- Alyssa Devincenzi
- Natalie Harvey

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Brainstorm Ideas for Cargo Containment		15
2	Select a Design		20
3	Begin Building Process		40
4			
5			

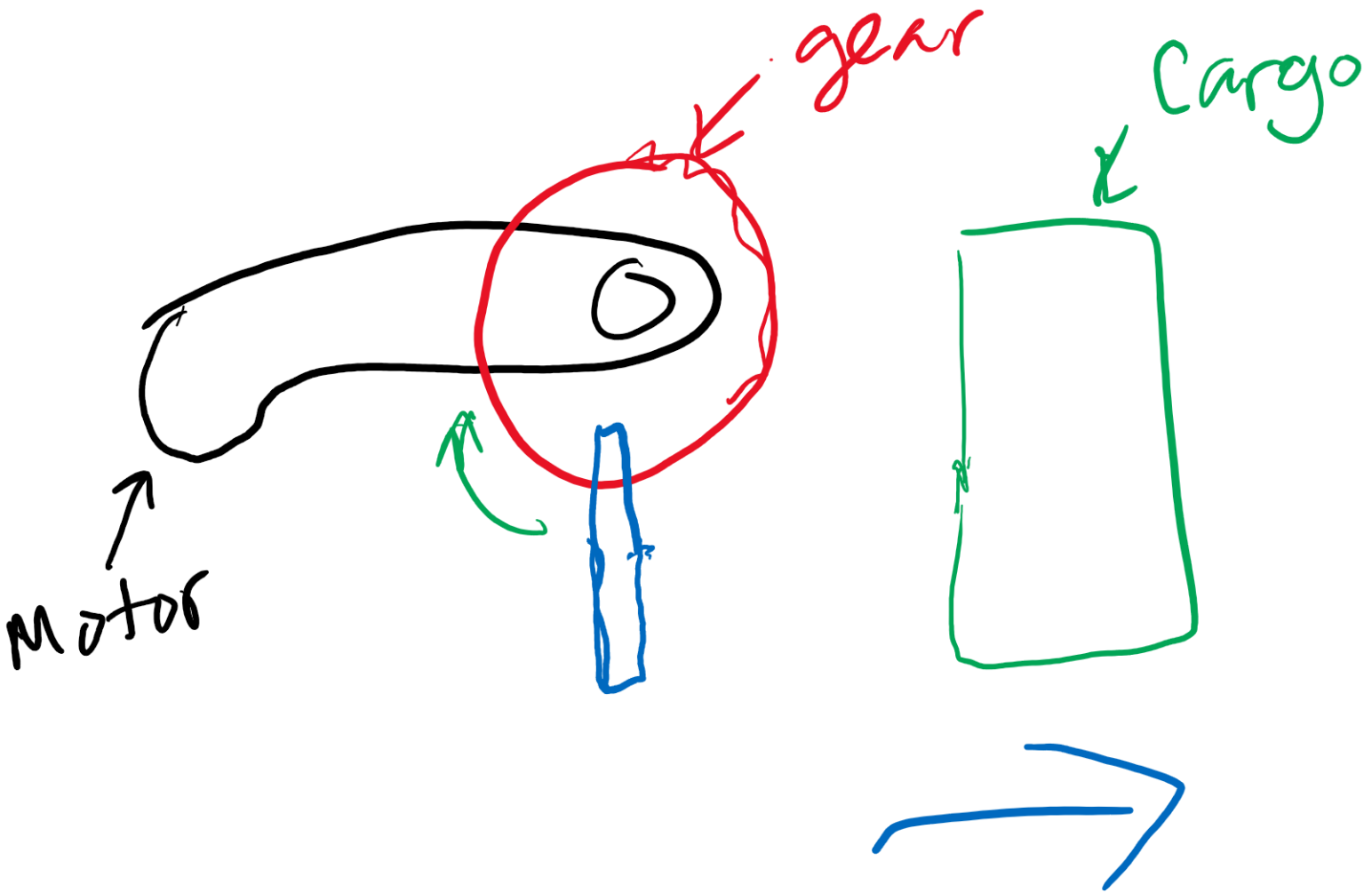
Notes	Action Items
● Brainstorming notes document saved separately ○ Notes and drawings ● RFAI question: What is the maximum angle that the cargo can be tilted during transport. For example, can the cargo be transported at a small angle? ● RFAI question: What material are the cargo containers made out of?	● Write up RFAI questions

Idea Generation

- Loading
  - Top should remain open, allowing the user to manually insert cargo.
- Drop Off
  - Cargo slides down a pivoting ramp
  - Conveyor belt
  - Push off
  - Door on back of MACRO
  - Claw in the back
  - Tilted Bed
  - Platform that lowers
  - Trap Door
  - Can combine features if needed
- Containment
  - Should be able to accommodate all types of payloads
    - At least 5.5 in wide and 6.5 in tall
  - If possible, could carry more than 1.
  - Bars on sides to keep cargo in place.
- Cargo measurements:
  - Cylinder: 5in diameter
  - Rectangular: 3.5in x 5in (height)
  - Cone: 3in diameter x 5.9in



Push-off Idea



Team Meeting

Date: October 21, 2020 **Location**: Virtual **Time**: 11:30 AM

Meeting Facilitator: Matthew Stuber

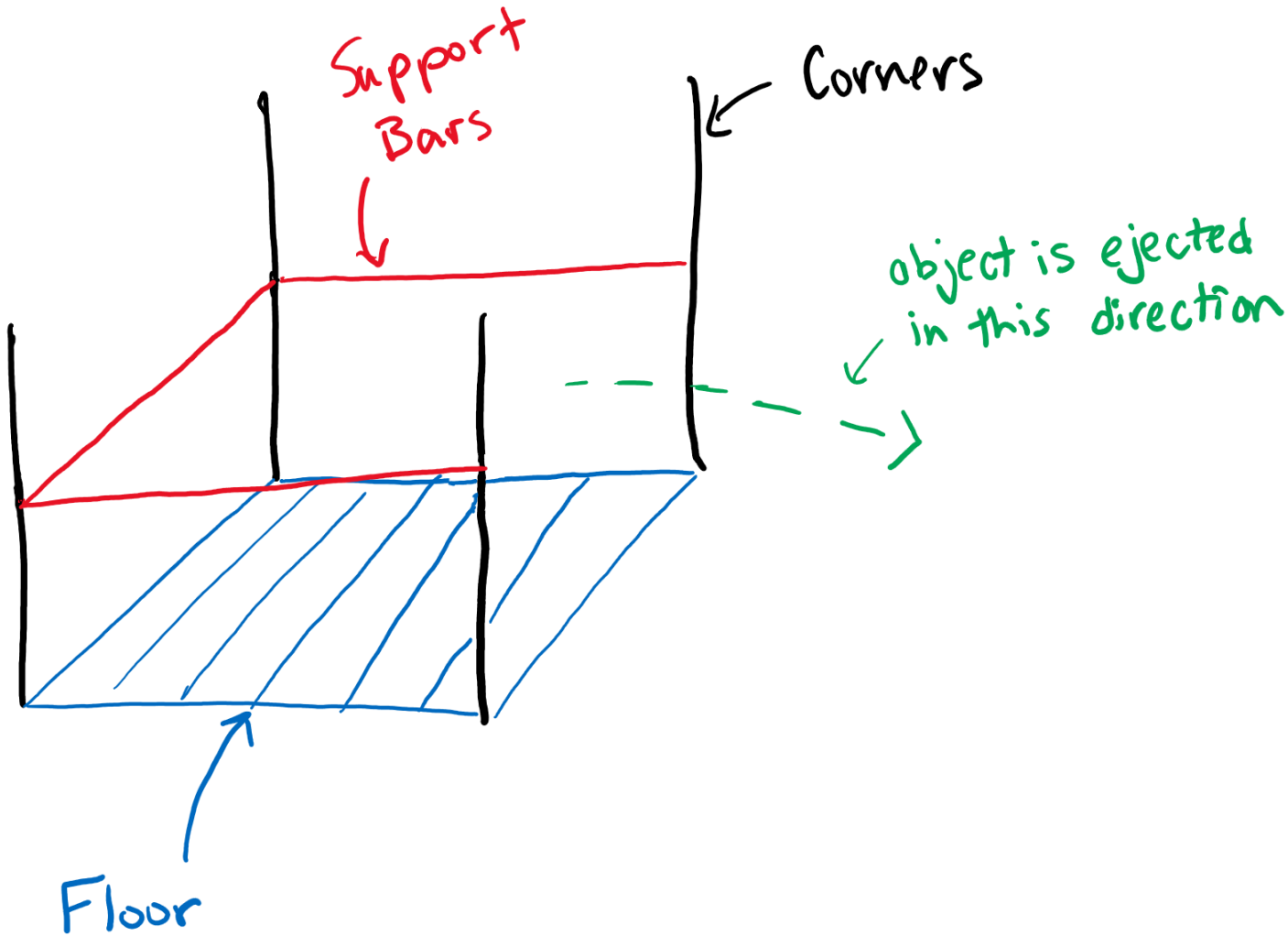
Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi
- Agathiya Tharun

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	RFAI #2	n/a	5
2	Brainstorming	n/a	25
3			
4			
5			

Notes	Action Items
● The slanted platform inside the cargo container is our best option ● Stick with the trap door at the back ● Conveyor belts take up too much room ● If slanted platform is not permitted, use pushing mechanism	● Schedule next meeting ○ 1pm - 5:30 pm Friday, 10/23

Walls of Container



Team Meeting

Date: October 23, 2020 **Location**: HCRS **Time**: 1:30

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Build session - cargo containment	n/a	80
2			
3			
4			
5			

Notes	Action Items
• Need a way to fasten cargo hold to frame.	• Sign up for a project office hours spot

Team Meeting

Date: October 28, 2020 **Location**: HCRS **Time**: 12:45 PM

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi
- Agathiya Tharun

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Brainstorm Drivetrain	n/a	30
2	Building Session	n/a	90
3			
4			
5			

Notes	Action Items
• Rebuild cargo bed to improve structural integrity. • Position motors • Add more connection blocks in cargo bed to improve structure and limit open gaps • Fix angle of ramp to not be too steep	Improve structure of cargo bed.

Adjustments:
10-28-20

- Cargo Bed needed to be rebuilt for structural purposes; when weight was applied to the frame, the whole structure cambered inwards.

Drivetrain Brainstorming

Wheels

- Each wheel has its own motor
- Front wheels bigger than back
    - Larger wheels for easier clearance of obstacles when first encountered
- Back wheels - third largest size - small enough to allow for ramp to have a smaller incline

Motors

- Red, stronger motors used for back wheels
    - Stronger push from the back to help clear obstacles
- Weaker motors used for front wheels

Pi Stack

- Should be in a place where all wires can reach easily
- Located front center
    - With cargo in place, helps keep center of mass closer to geometric center of robot
- Battery pack connected with a shelf underneath the Pi stack

Frame

- Motors can be built into frame
- The major part of the frame consists of the sides of the cargo container
- Motors on sides for easy removal if necessary

Room for sensors

- Leave room underneath for line follower and hall sensor
- Ultrasonic on front

Angle Correction

- Use axles and axle connectors to easily transition from the angled bed to horizontal building for the sensors

Team Meeting

Date: October 30, 2020 **Location**: HCRS **Time**: 1:00

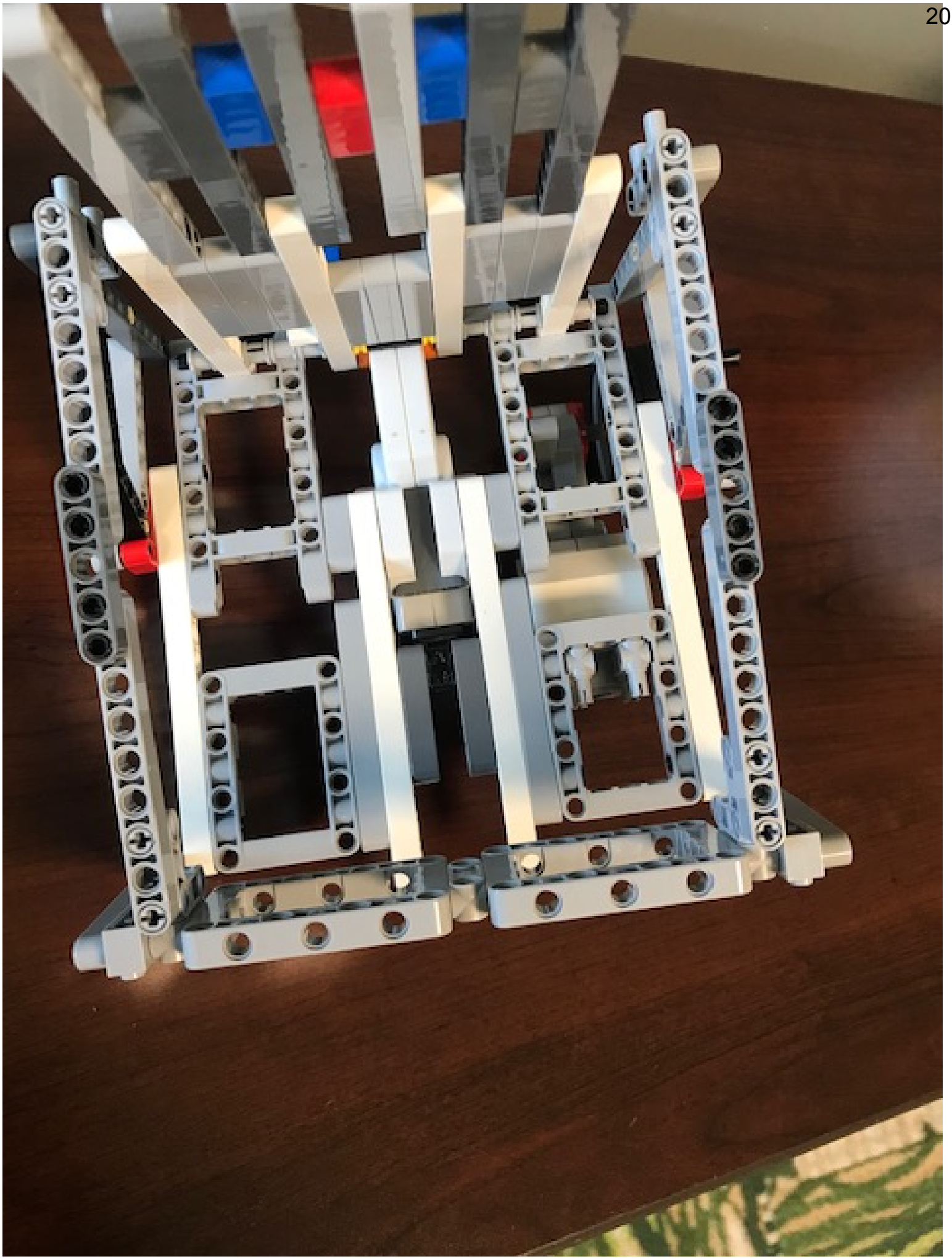
Meeting Facilitator: Matthew Stuber

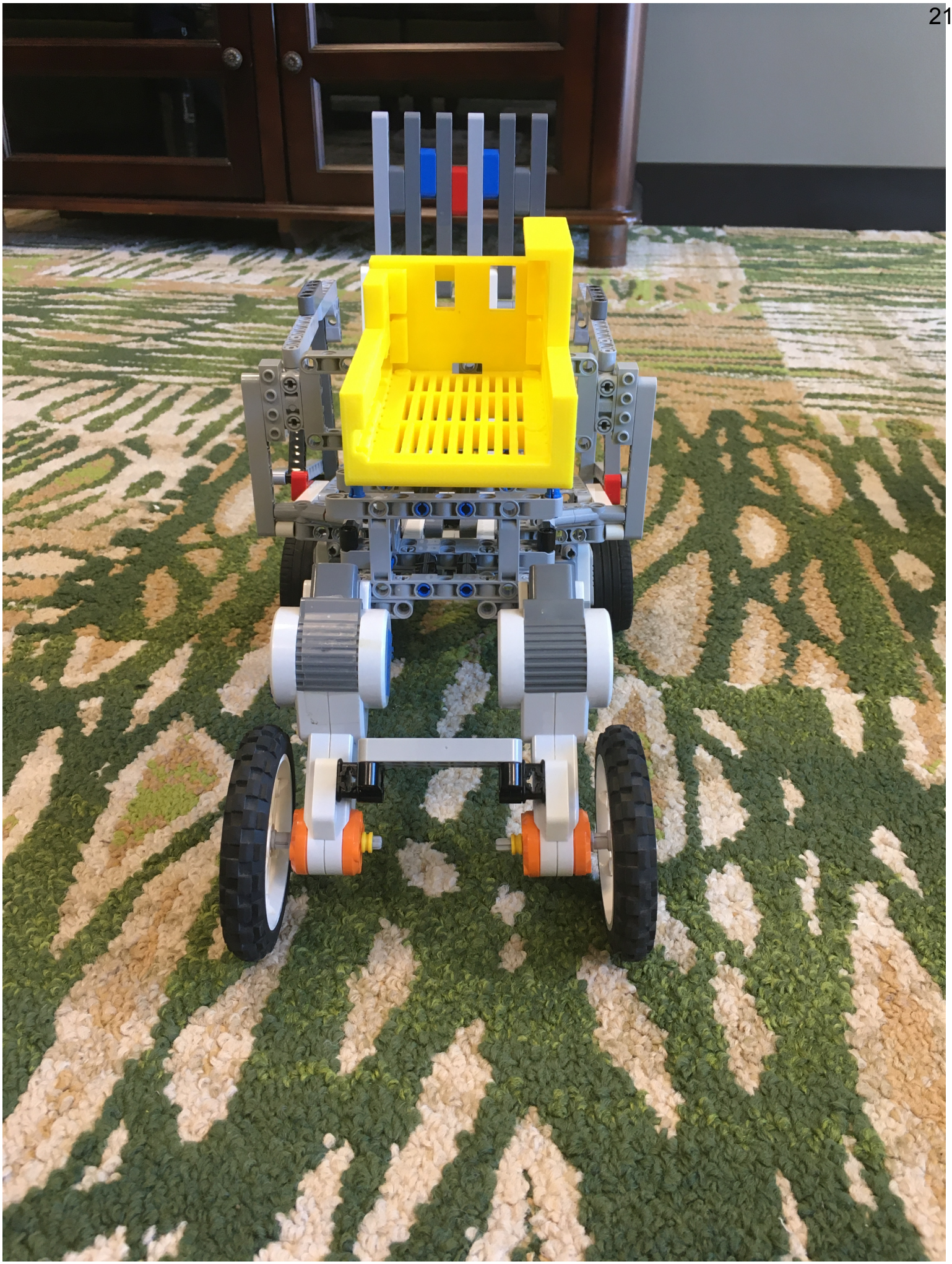
Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Build Session	n/a	105
2			
3			
4			
5			

Notes	Action Items
● Rebuilt cargo bed to be more sturdy ● Lessened angle of ramp	Set up another meeting for more building





Team Meeting

Date: November 2, 2020 **Location**: HCRS **Time**: 5:30 PM

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Alyssa Devincenzi
- Natalie Harvey
- Agathiya Tharun

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Review of current design flaws	Matt	10
2	Brainstorm Ideas to fix	n/a	10
3	Build	n/a	60
4			
5			

Notes	Action Items
• BrickPi can only control 4 independent motors • MACRO cannot turn as is with treads. • Start rebuilding the front wheels of the MACRO - large roller in the front (two widest, largest wheels), driven by one motor and no treads to start • Stabilize the new front wheel • Test and alter front when until a viable solution is found	Schedule another building meeting

New Drivetrain Ideas - Cannot use five motors, and it turns badly with original setup

- One big roller in the front - either free-rolling or driven by a single motor
- Two free-rolling wheels

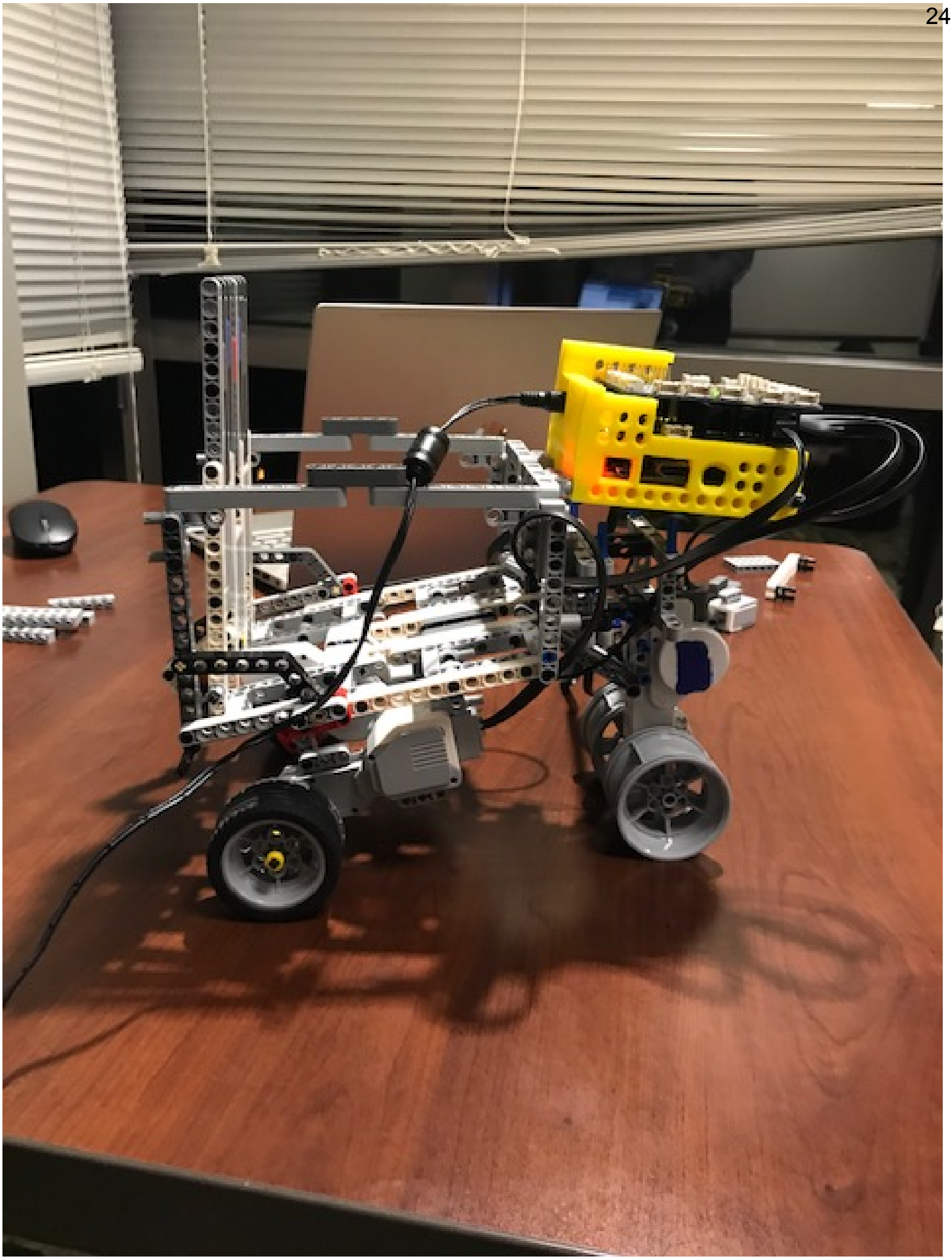
- Final Decision: one big roller in the front driven by a motor
    - Use the two biggest and widest wheels, with no tread to start
        - Concerns about it turning or going over obstacles

Tests

- Tested when finished building
    - Turns well, sometimes struggles with getting over large obstacles
- Tested big roller with treads - does not turn well
- Can get over most obstacles - cannot get over one-inch pipe without flipping

Attaching sensors

- Line finders attached to bottom - closer to the front wheels about 2 in above the ground
- Color sensor between the line finders



11/1/20

Test: Motor Test

Goals:

1. Determine how well the macro is able to turn as is
2. Determine if the BRICKPI can control 5 independent motors.

Setup:

- Macro will be controlled by using two push sensors. Further details are in the test code
- Carpet floor & Table top test site

Observations:

- MACRO travels forward fine
- MACRO had trouble turning, frame started to disconnect, multiple failures
- BRICKPI cannot control more than 5 motors.
    - BP_PORT_4 is equivalent to BP_PORT_D in set_motor_power()
- Gate functionality is good, desired motor power around 25.
- Removed front wheel treads, worked “ok” on carpet, “great” on table top (less friction)

Team Meeting

Date: November 4, 2020 **Location**: Shreeve C111 **Time**: 9:45 AM

Meeting Facilitator: Matt Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi
- Agathiya Tharun

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Testing	n/a	45
2	Programming	Matt	45
3			
4			
5			

Notes	Action Items
• Extended Gate to decrease the exit speed of cargo • Cargo should be able to slide off gate with no problem now	• Write line following algorithm ○ Matt

11/4/20

Test: Cargo Delivery, Obstacles

Goals: Test cargo delivery system with all types of cargo
Test ability to go over obstacles

Setup: Paper on top of carpet test site

Observations:

Cargo delivery
Cylinder
- Cylinder did not slide out when gate opens and robot is stationary
- When we move forward constantly it slides out but falls over
- Going slower, did not as often tip
- When motors go constantly cylinder doesn't slide off
- Need to move jerk motors a few times to get cylinder to move

-Made gate longer
- Tipped fewer times

Cone
- Tipped because of flat edge
- Keep driving forward- acceleration decreased- didn't tip half of the time

-made gate longer and angled at end
- Didn't tip
- Have to jerk 1 time and then keep driving

-made gate shorter but still angled at end
- Ramp is too steep, cone tips

Cylinder with new ramp
- One jerk and keep moving
- It don't keep moving, cylinder gets stuck on motor

-increased acceleration to 65
- Works without the jerk

-increase acceleration to 100
- Also works without jerk

Cone with increased acceleration
- Works without jerk
- Cone went to side in cargo container and fell over

-add pieces on side to prevent movement
- Cone gets stuck
- Pushes cone sideways and cone falls off side of ramp

-made side pieces less of an angle
- Works well when cylinder placed in middle

11/4/20

- Works when cylinder is on side also

Block
- Slid well
- Got stuck inside side pieces

-Move side pieces to be parallel to sides of cargo container
- works well

Block with newly placed side pieces
- Works well

Cylinder with new side pieces
- Works well

Obstacles
Wooden board while holding cylinder
- Went over wooden board with no problems
- Gate opens when going over board

Pipe while holding cylinder
- Robot tipped
- Just the back wheels make it over

Conclusion
- Made gate longer
- Added angled piece at bottom of ramp
- Added side pieces to bottom of cargo container

Team Meeting

Date: November 5 2020 **Location**: HCRS **Time**: 4:30

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Natalie Harvey
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Recap of 11/4 office hours	Matt	10
2	Attach sensors to frame	n/a	20
3	Rebuild frame to fit rechargeable battery	n/a	15
4	Test linefinding algorithms	Matt	20
5			

Notes	Action Items
• Rechargeable battery is longer than battery pack • Might want to move pi to make it easier for sensors to reach • Linefinding is not working well	Schedule another meeting for more testing

11/5/20

Test: Line Finding

Goals: follow a solid line successfully on both straight and curved sections

Setup: paper with a line taped to a table

Initial test
- Line Finders are sensing line, but not turning
- Sensors think table is line

More white paper
- Macro moving too fast, could not tell if it was turning
- Lower speed
- Senses line, but is not turning enough to stay on line

Adjustments to code
- At power 10- works well
    - Senses line and turns quickly
    - Able to adjust well when started tilted
- At power 20
    - Turns quickly to get back on line
- When at angle with spaces, still adjusts
    - Human involvement- more testing needed
- Power 30
    - Senses when off line and makes adjustments quickly
- Clear tape does not affect line sensing

Curve
- Turned 2in radius 90 degrees solid line- power 20
    - Noticed turn, only turned a little

Adjust to turn more slowly
    - Turns more but still not enough

Senses more often to adjust more often
    - Turns but not enough to make turn
- Can make a 45 degree turn
- Power 10, fix constant 70
    - Turns but not enough
- Went off line and turned way too much

Program option #2
- Still does not turn enough on turned part of line
- Follows line more smoothly
- One sensors is not sensing
    - Right sensor is not sensing line
    - Adjust sensitivity of linefinder to be more sensitive
    - Sensing jerky movements

11/5/20

Lower values
- Makes smaller turns to adjust
- Longer off the line the more it adjusts

Change values- Integral constant to 4
- Adjusts more smoothly

Curve
- Does not turn at all

Increase speed to 30
- Adjusts smoothly
- Also adjusts smoothly when started slanted

Note: May need to change constants as speed changes

Note: Faster speed while going straight and increase speed when correcting for help going over obstacles

Started more crooked
- Does well
- Does not correct when started too slanted

Increased speed, power at 30
- Jerked, unstable, still follows line
- We should figure out how to slow down when turning
- Corrects well
- start at angle, corrected a bit and then traveled away from line
- Taking long time to turn

Increase power to 40
- Moves back onto line

Increase power to 50
- Corrects back onto line
- Works great on straight solid line

Increase power to 60
- Causing gate to fall
- Turns back onto line when put on straight
- Also follows line when started slanted

Note: Back wheel 2 and ⅜ in. 5.5 cm

11/6/20

Presentation of Competency

Cargo Drop Off
Attempt 1: MACRO moved backwards due to coding error
Attempt 2: MACRO delivered cargo right side up, on the drop off location (however, getting the location right was purley chance, it did not follow the line or sense the magnet)

Line following (straight solid, dashed curve, and then straight solid)
Attempt 1: MACRO did not follow line (line finders are sensing line, but MACRO is not turning at all to correct)
Attempt 2: same as attempt 1
Attempt 3: same as attempt 1

It was later realized that the line finders were plugged into the wrong ports

Obstacle (wooden dowel)
Attempt 1: gate holding cargo in fell down at the beginning of the run and the cargo fell out, MACRO made it over the obstacle though (motor holding the gate up was not engaged)
Attempt 2: MACRO carried cargo and made it over the dowel

Hill
Attempt 1: MACRO made it over hill with no problems

Team Meeting

Date: November 9, 2020 **Location**: Shreeve C111 **Time**: 9:45 AM

Meeting Facilitator: Matthew Stuber

Electronic Signatures of Attendees:

- Matthew Stuber
- Alyssa Devincenzi
- Natalie Harvey
- Agathiya Tharun

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Test cargo drop off with magnet	n/a	20
2	Test line finder on track	n/a	45
3			
4			
5			

Notes	Action Items
• Does not track well on curves • Cargo drop off sequence successful	Schedule another meeting for more testing of line finding

11/9/20

Test: Line Following, Hall Sensor

Setup: Track is straight and then branches with dashed on one side and dotted on the other, and join back up with a solid line

Goals: Successfully follow entire track
Accurately sense magnet

Line following
Power at 40
Starting on straight

- Turned a little at the branch but continued going mostly straight

Starting on curve

- Turned a small amount but not enough
- Too fast

Power at 20

- Did not turn at all

Adjustment to turn more fix constant

Solid curved line

- Turned a good amount to stay on line

Change fix constant based on speed- need formula

Start on curved dashed

- Turned to stay on line but not enough (followed cure for 1 feet)

Adjustment to turn more fix at 35

- Stayed on line for longer than before but did not follow for all of it (1.5 feet)

Fix at 55

- Did not turn at all
- Sensing line but not turning

Note: Made motor power too high?

- Sensing but not turning

fix at 35

- Turns enough to stay on solid line curve entire time
- Dashed almost made entire turn- followed turn for 1.5 feet

11/9/20

Code adjustments
- Back wheels not turning

Undo adjustments
Fix constant at 45
- Not turning

Constant at 35
- Follows solid curved line
- Follows dashed curved line for about 1.5 feet

Note: Need to have wheels go in different directions maybe

Turning at 100 speed
- Follows curve for 1 feet

More adjustments
- Back wheels are not moving
- Might be overloading motors

- Back wheels turn a small amount and then stop

More adjustments
- Follows dashed curve for 1.5 feet

Make it go faster
- Back wheels stop turning when sensing black

Code adjustments
    - Followed entire dashed curve (2.5 feet)
    - Followed entire solid curve (2 feet)

Hall sensor
Magnet under solid curved line
- Gate opened right away

Sensor test
- Sensor is sensing magnet

Test 2 starting close to magnet but not on top of it
- Gate opened right away before it got to magnet

11/9/20

Test far away from magnet

- Gate opens immediately
- Is not sensing magnet

Adjustments to code

- Gate did not open at magnet
-

Lower threshold for sensing magnet

- Stoped at magnet but gate did not open

Negative speed for gate motor

- Stops at magnet and gate opens
- Going too slow

Team Meeting

Date: November 11 2020 **Location**: Shreeve C111 **Time**: 9:45 AM

Meeting Facilitator: Matt

Electronic Signatures of Attendees:

- Matt Stuber
- Natalie Harvey
- Agathiya Tharun
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Test turnoff and cargo drop on track	n/a	60
2			
3			
4			
5			

Notes	Action Items

• Analog hall sensor is unreliable
  ○ Senses the magnet ~50%
  ○ Think about switching to IMU
• Cargo drop off sequence works
• See testing notes 11/11 for more info
	Put IMU on MACRO

11/11/20

Test: Line finding

Goal: Follow line for entire track

Setup: Track with turns, solid, dotted, and dashed

Line finding
Dashed curve
- Turned to stay on line for 1.5 feet before going off of line

New program- overcorrects
- Turns wrong way

First program
- Sensing line on right linefinder only- turns wrong way
- Turns enough to follow solid line curve
- Makes it halfway on dashed curve

Overcorrecting program
- Dashed curve follows almost all of curve (1.75 feet)
- Followed for halfway and then turned the wrong way

(lower speed)
- Follows dashed curve the whole curve (2 feet) but did not stay very close to line
- Turns to stay on dashed curve and solid curve whole way

(turn harder)
- Follows line a bit more closely

(Change time delay)
- Turns many times zig zag direction not close to line

Dotted curve
- Turns to follow entire (2 foot) curve and stays close to line

Branch sharp turn
- Turns many times but does not follow line

(Change constant)
- Turns to follow line accurately, zigzags back and forth about 3.5 in
- Follows line

(time delay 0)
- Follows line more closely but more jerks
- Goes in circle
- At branch went off line 1 out of 5 times

(adjustments)

- Less error, more jerky

With cargo cylinder

- Less jerky
- Lost line halfway through curve
- Not turning enough

(turn more)

- Followed dashed curve 2 out of 4 times
- Dotted line- lost line at beginning of curve every time
- Followed solid curve

(code adjustments)

- Does not follow dashed curve
- Moving slower- possible battery issue
- Pivoting on one wheel- moving in circle
- Went backwards when it sensed line
- Move backward and forward in small amounts while not on line

```
# File: constants.py
# Date: November 16 2020
# By: Matthew Stuber
# mjstuber
# Section: 2
# Team: 30
#
# ELECTRONIC SIGNATURE
# Matthew Stuber
#
# The electronic signature above indicates that the program
# submitted for evaluation is my individual work. I have
# a general understanding of all aspects of its development
# and execution.
#
# This file contains the constants used in the MACRO program
#
# SETUP: BRICKPI PORTS          GROVEPI PORTS
#        A - Back LEFT          D2 - Right Line Finder
#        B - Front              D3 - *NOT USED*
#        C - Gate Motor         D4 - *NOT USED*
#        D - Back Right         D5 - *NOT USED*
#        1 - *NOT USED*         D6 - *NOT USED*
#        2 - *NOT USED*         D7 - Left Line Finder
#        3 - *NOT USED*         D8 - *NOT USED*
#        4 - TOUCH 1            A0 - *NOT USED*
#                               A1 - *NOT USED*
#                               A2 - *NOT USED*
#
# ------------------------------------------------------------------------
import math

RIGHT = 2 # Right linefinder
LEFT = 7 # Left linefinder
POWER = -60 # Motor power
SLEEP = .01 # Time delay
KP = 40 # Proportional constant
KI = 800000 # Integral constant
KD = 1000000 # Derivative constant
THRESHOLD = 10 # Analog signal threshold from hall sensor
MAGDEAD = 5 # Magnet Deadzone time, does not accept hall input
DIAMETER = 6.0325 # Wheel Diameter
SPEED = 18 # CHANGE THIS TO CHANGE DPS

# Derived Constants
RADIUS = DIAMETER / 2
DPS = SPEED / RADIUS * 180 / math.pi
```

Team Meeting

Date: November 16 2020 **Location**: Shreeve C111 **Time**: 9:45 AM

Meeting Facilitator:

Electronic Signatures of Attendees:

- Matt Stuber
- Natalie Harvey
- Agathiya Tharun
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Test IMU	n/a	60
2	Speed Test	n/a	10
3			
4			
5			

Notes	Action Items
• Could not get to testing IMU because the MACRO is jumping for some reason and the line finding algorithm is not working properly • Speed Test works fine	• Look at code and data from line finding tests • Think about possible line finding solutions

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Tests: Line finding and cargo drop off

Goals: Successfully follow entire line
Complete drop off sequence

Setup: Track solid and dashed with curve, magnet right before curve

1. Followed solid line for 10 inches before turning right and going off line
2. Followed straight line for 10 inches then turned left off of line at curve
3. Did not turn to stay on curve

Different code
1. Followed solid black line for 1 foot before turning left fast
2. Turned to stay on line entire time, alot of error, moves very fast when it senses line
3. Turned left in a circle after following line for 1 foot
4. Jerky turned left off of line after turn
5. Turns left off of line at dashed curve
6. Did not turn at all
7. Did not turn at all, sensed line
8. Turned to the right off of line immediately
9. Followed line but did not sense curve that is dashed

Dotted line with curve
1. Did not turn at all
2. Line followers are sensing but robot is not turning
3. Followed line for 3 inches, then turned left off of line
4. Turning too much when it corrects
5. Turn was too slow- tried to turn and stopped
6. Followed line but turned off line at curve
7. Turned off of line at gap in dots
8. Went slowly when on line then turned off line and sped up
9. Followed line for 16 inches then turned off, speeding up at turns
10. Followed line on straight solid part, turned off line at curve
11. Went slowly then sped up a lot when turning off of line

Diagonal track
1. Turned to stay on line, didn't sense magnet
2. Turned to stay on line, large error, not sensing magnet, not travelling over
3. Sensed magnet
4. Followed line, sensed magnet and turned, and dropped off cargo

Outside of class testing
1. Continues to be extremely jerky when attempting to turn

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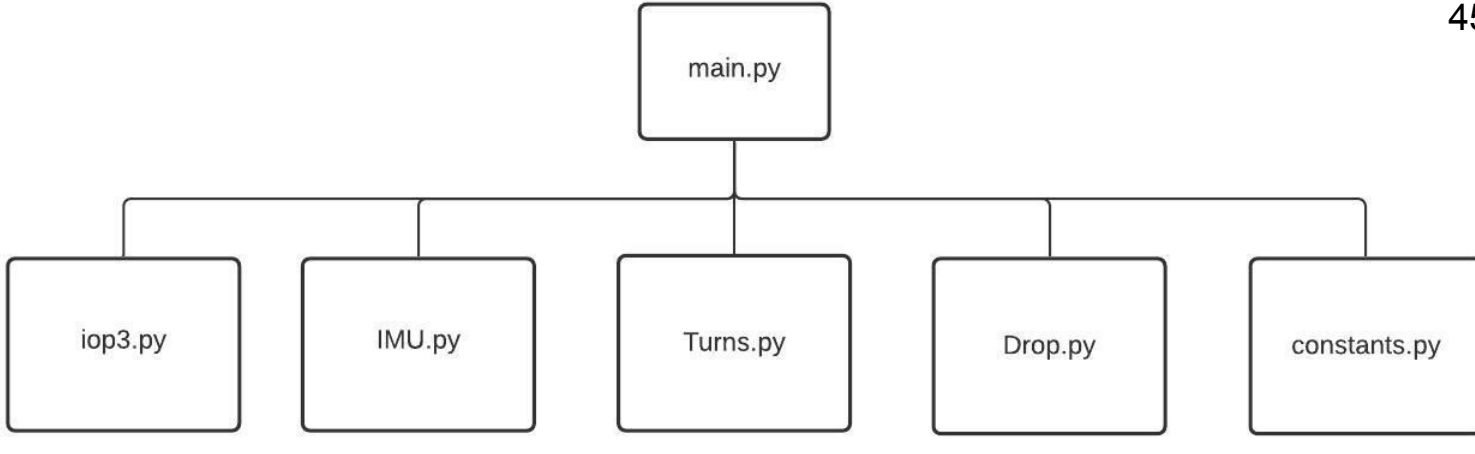
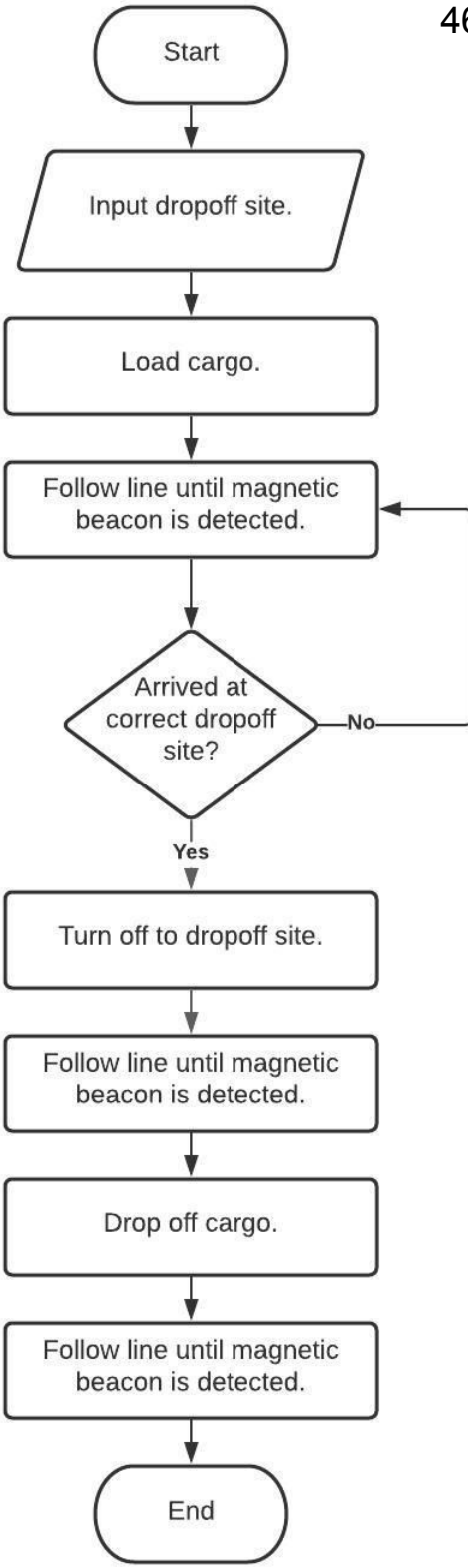
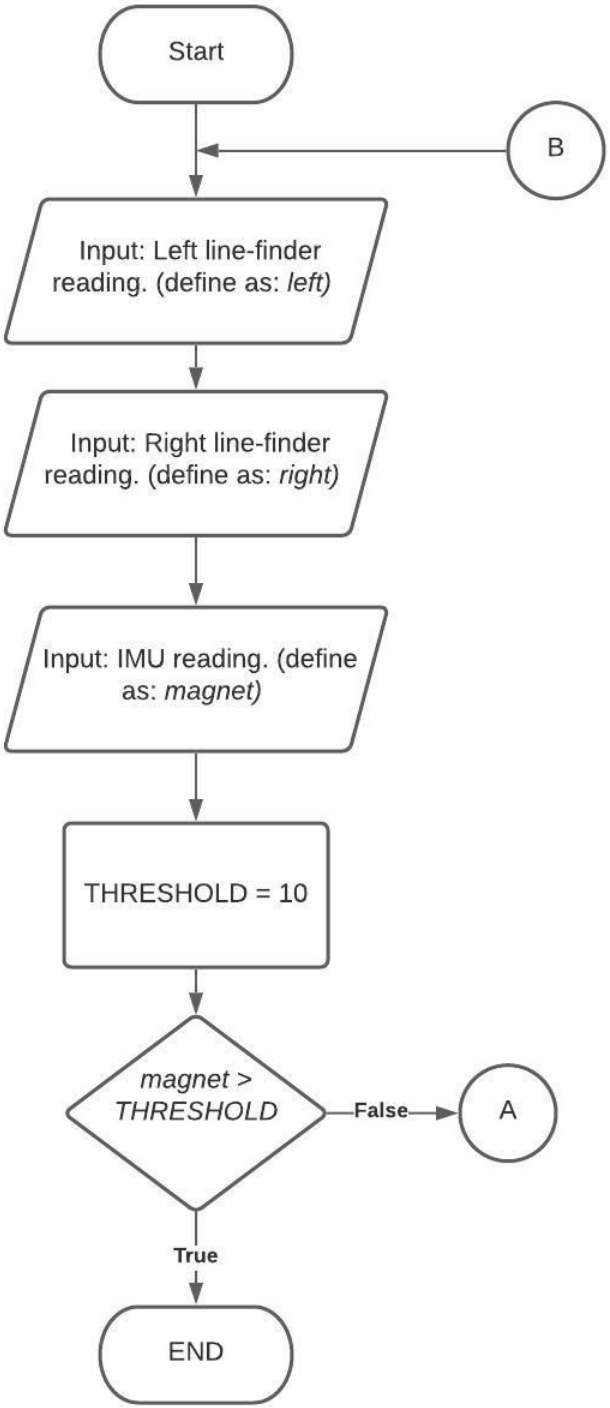
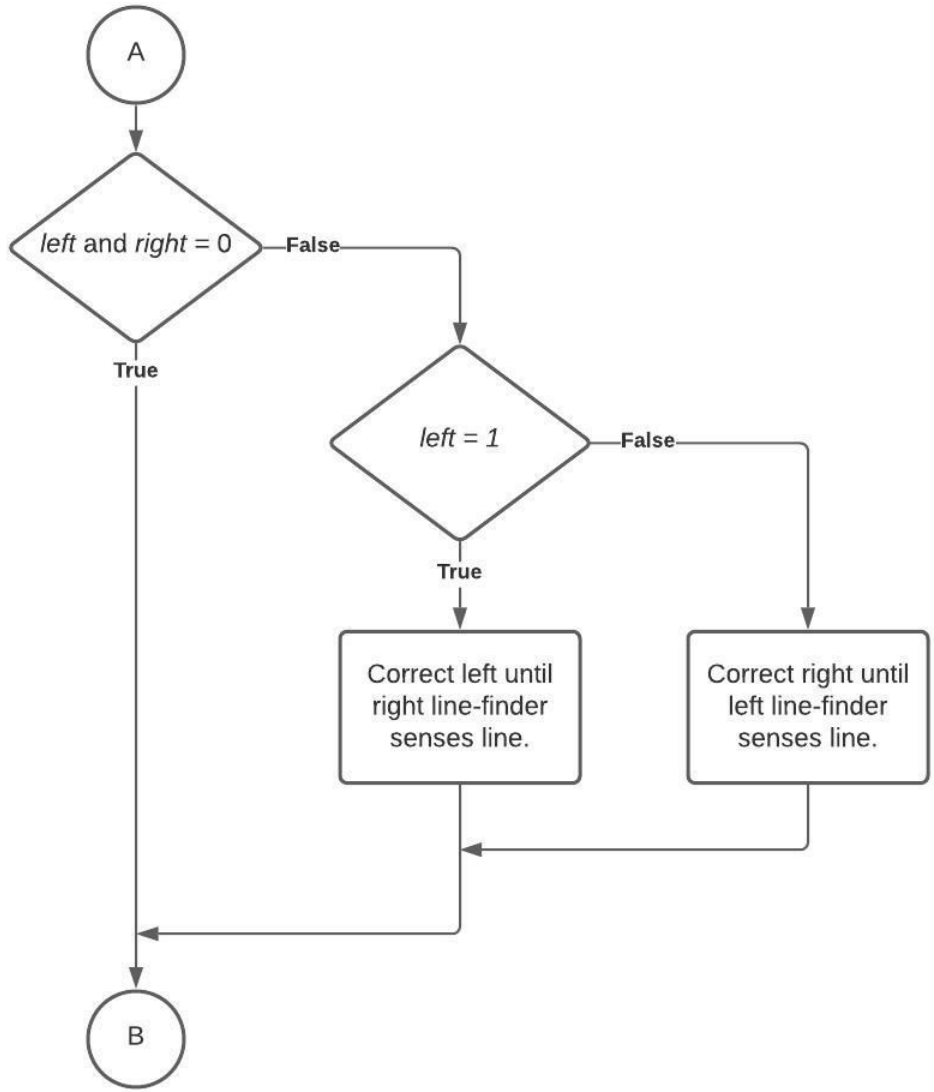
2. One of the motors does not respond properly to the line followers - it is squeaky, and its speeds are inconsistent
3. The motors take a long time to respond to the line followers
4. The motors are not responding appropriately to the line followers - it sometimes changes, but sometimes does not.
5. Line followers need to be recalibrated, or the motors have become inefficient
6. Make a program to test the motors (?)
    a. Max out both back wheels to see if it is going straight
7. Robot does not turn sufficiently
    a. Error seems to be with traction or conflicting code
8. Changed the code to match that of the main program for the project - it turns much better
    a. Turns are slightly skipping, but much smoother than before

				Sensor Options		
Design Need	Technical need	Normalizing function	Weight	Grove Hall Sensor	BrickPi Analog Hall Sensor	IMU
Range	minimum 1 inch	range (in) / 1 in	0.333	0.5	1	1
Reliability	% of successful attempts	successful attempts / total	0.5	0.8	0.2	0.8
Simplicity	lines of code	1 - lines / 10	0.166	0.8	0.7	0.2
			Total	**0.6993**	**0.5492**	**0.7662**


main.py
iop3.py
IMU.py
Turns.py
Drop.py
constants.py


Start
Input dropoff site.
Load cargo.
Follow line until magnetic beacon is detected.
Arrived at correct dropoff site?
No
Yes
Turn off to dropoff site.
Follow line until magnetic beacon is detected.
Drop off cargo.
Follow line until magnetic beacon is detected.
End


Start
B
Input: Left line-finder reading. (define as: left)
Input: Right line-finder reading. (define as: right)
Input: IMU reading. (define as: magnet)
THRESHOLD = 10
magnet > THRESHOLD
False
A
True
END


A
left and right = 0
False
True
left = 1
False
True
Correct left until right line-finder senses line.
Correct right until left line-finder senses line.
B

Team Meeting

Date: November 18 2020 **Location**: Earhart Lobby **Time**: 3:00 PM

Meeting Facilitator: Matt

Electronic Signatures of Attendees:

- Matt Stuber
- Natalie Harvey
- Agathiya Tharun
- Alyssa Devincenzi

Agenda			
Item	**Item Description**	**Presenter**	**Minutes**
1	Discuss plan for video presentation	Matt	15
2	Outline sections		25
3	Discuss plan for written report (time permitting)		20
4			
5			

Notes	Action Items
● Sections 1 and 2 - Alyssa ● Section 2- Natalie ● Section 3 - Matt ● Section 4 and 5 -Aggy ● Make sure to provide reasons for decisions and data	Complete the powerpoint and record video of your section