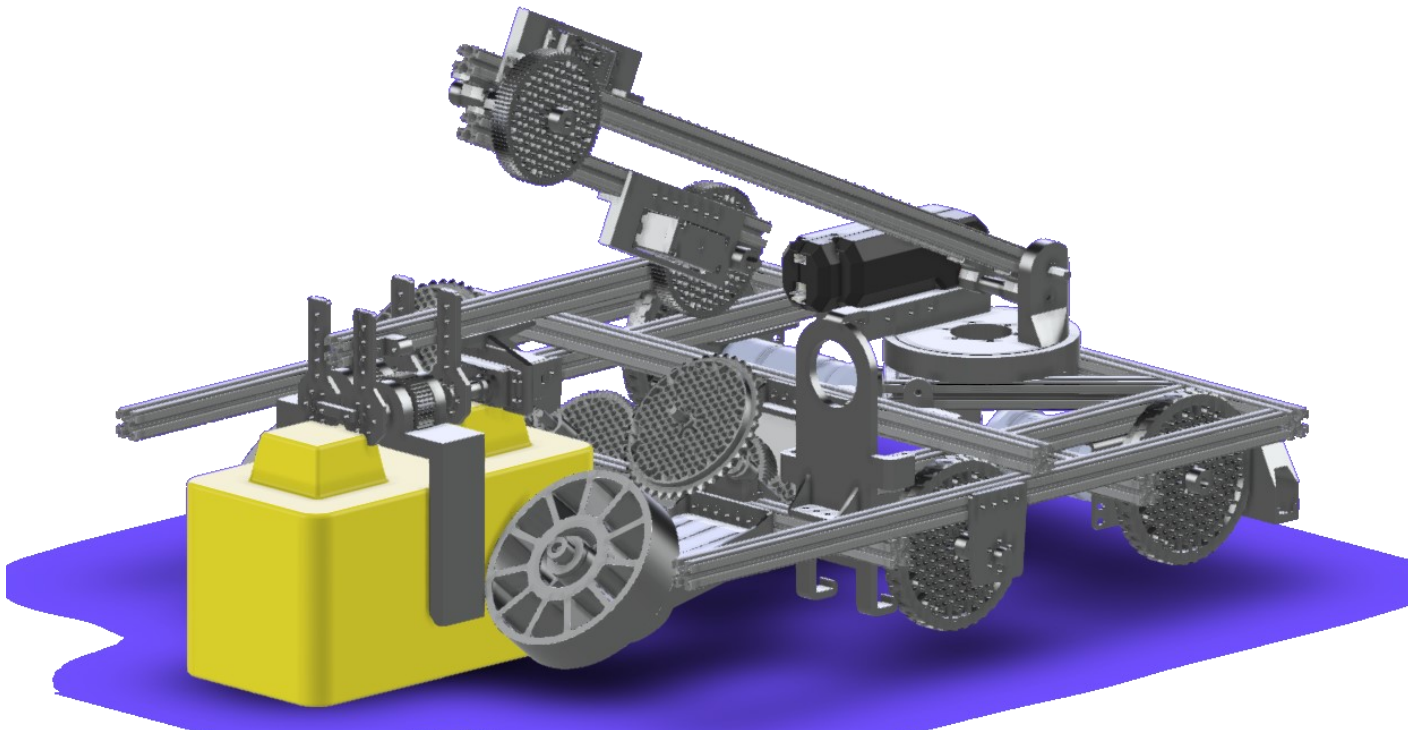


Rambam Rambots NoteBook (Team #17384)

RAMBAM RAMBOTS NoteBook



Team #17384

I. Summery

A. Our School:

Rambam Mesivta Maimonides High School (Rambam), is a (Private) Orthodox Jewish boys high school in Lawrence, New York. Rambam was founded in 1991 by a group of community minded individuals who saw the need for an all boys' Mesivta program that offers combined excellence in Limudei Kodesh and College Preparatory studies. Since then school has recived the Blue Ribbon award from the US Department of Education and Middle States Accreditation. It is a small school by design and allows students to create and grow teams with school assistance one of those teams are us, the Rambam Rambots.



B. Our Team:

The Rambots were originally founded as the Rambam Robotics team, which was entirely directly student funded and competed in RoboCup junior lightweight. Students provided tools and parts, but were provided a room by the school As the team grew it was then forced to become Ravenotics keeping to the schools Raven name for teams. Eventually, Steven father of Yaacov W. took over as mentor. The name Rambam Rambots came about when a RoboCup announcer announced the team as Rambam Rambots and the name stuck. The administration approved of the new name and Steven created the logo we use today. In 2018 RoboCup changed their rules limiting teams to 4 members from the prior 10, therefore the team split into two and joined RoboCup soccer Standard with two teams. In 2018 the lab was also reopened @ Rambam giving the team a great space to work in. In 2019 Steven had left and the school administration decided team should expand so under the guidance of Reuven and Mr. Fusaro , we joined FTC as well as only RoboCup team.



I. Summery

C. Hightlights

- Summery page 2
- Bio pages 5,6&7
- Team timeline pages 11,12 &13

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I. Team

A. Team Members



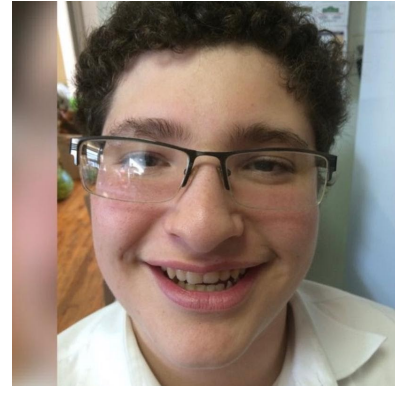
Avi
Software Team-Sensor Input

12th Grade - Age 17
About: Co-Captain of the mock trial team and Captain of the debate team, this is



Jonathan
Software Team-Computer Vision

11th Grade - Age 17
About: Captain of JV College Bowl, this is his first year on the Rambam Rambots.



Betzalel
Captain Hardware Team

12th Grade - Age 17
About: Betzalel is the most senior member of the Robotics team with this being his 4th consecutive year with 3 previous years on Robocup.



Dovid
Hardware Team-Brainstorming

9th Grade- Age 14
About: A young freshman trying to prove himself on the most elite FTC team in the



Eliezer
Captain Software Team-Output

10th Grade - Age 16
About: This is Eliezer's second year on the Rambam Rambots, having previously



Shua
Hardware Team-Sensors & Engineering Notebook

10th Grade - Age 15
About: This is Shua's first year on the Rambam Rambots

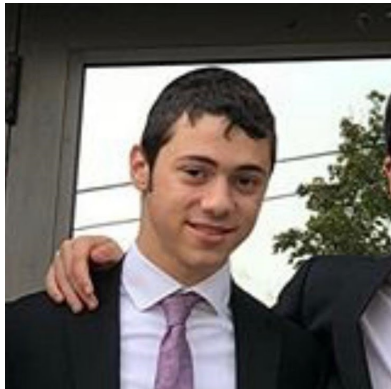
I. Team



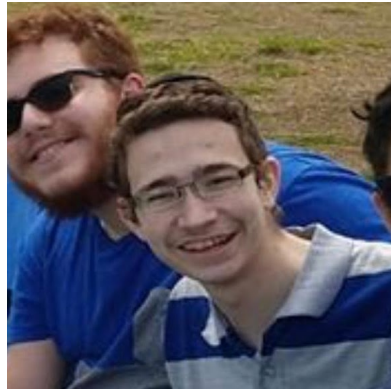
Eli
Hardware Team-Claw
11th Grade - Age 16
About: Currently the head of the Rambam Flight (Drone) Club. This is Eli's second year on the Rambam Rambots.



Rafi
Software Team-Output
10th Grade - Age 15
About: This is Rafi's first year on the Rambam Rambots



Uriel
Captain Software Team-Sensor Input & Computer Vision
12th Grade - Age 17
About: Captain of the debate team and Editor-in-Chief of school paper Hamasmid, this is Uriel's second year on the Rambam Rambots, previous-



Ariel
Hardware Team-Claw & Software Team-Sensor Input
11th Grade - Age 16
About: Ariel is currently the layout editor for two school newspapers, Hamasmid and the Rambam Onion. In addition this is his second year on



Yaakov
Captain Hardware Team
10th Grade - Age 16
About: Currently Master-of-Coin (Treasurer) on Student Council this is Yaakov's second year on the Rambam Rambots, having previously done design and building for Robocup.

I. Team

B. Mentors



Mr. Fusaro

Science Teacher - Rambam Me-sivta

Age 30

About: This is Mr. Fusaro's third year at Rambam. Though he initially started as a biology teacher he has since expanded his classes to include STEM and Python and has since become a mentor for the Robotics team.



Reuven

Engineer-HTM

Age 25

About: A City College graduate and Project Engineer at HTM. This is Reuven's first year as a mentor for the Rambam Rambots.

2. Starting off

A. How We Joined FTC (First Tech Challenge)

At the end of last year our prior mentor Steven Weinberger left us. So a group of students (this years captains) went to the school administration and posed the question, what is going to happen to the team. The answer given was that the school was working towards recruiting a new mentor (Reuven) and wanted the team to expand and join new competitions. The question was then posed of which competition to enter. The issue there was that we are a Jewish team and many competitions take place on the Sabbath, fortunately for us there are a variety of FTC competitions that take place on Sundays.

B. Recruitment

Unlike Robocup which allows only 4 members per team, FTC allows 15, this gave us a lot of extra spots to fill on the team. In the beginning of the year an information session was announced and two challenges were open to the school. The first was a hardware knowledge challenge and the second was a coding challenge. Together they

2. Starting off

yielded only 13 replies, leaving us with a 13 member team. Over the first few weeks two members left and one joined leaving us with the current twelve.

3. Fundraising & Business Plan

A. Funding

Being as we are a High School extra-curricular a considerable portion of our funding comes from said school. This year we were given a spending budget of \$2,000 to be split between the FTC and RoboCup teams. This amount is in addition to salaries for the two mentors which are undisclosed. In addition we have been provided with a \$3,000 grant from Bloomberg, leaving us with \$5,000 total to be split with \$1,500 going towards RoboCup and \$3,500 going towards FTC.

B. Spending:

Funding is of no use if there is no way to spend it. Being as we are a school team we have had to follow school policy regarding funding. That policy requires us to do all ordering through the school's Director of Operations (Aaron). Our system involved a spreadsheet where items were to be placed and then Aaron was to be sent an email asking him to order. On the next page is a screenshot of the ordering spreadsheet taken: 1/17/20

4. Team Timeline

A. Guide

Here are what the following events mean. Meeting-formal team meeting, Discussion-Discussion over WhatsApp or briefly in person, Build Scession-A time when a few members got together to build the robot, CAD-An update was made to the CAD file.

9/11/19: Discussion: Planning for this year began, research competitions, Information session scheduled, and challenges were written up. If you view the recruitment section you can view the challenges

9/16/19: Information Session took place: we talked to prospective team members about the teams past and our goals for the coming year

Rambam Rambots NoteBook (Team #17384)

Item	Qty.	Justification	Cost	Shipping	Where to order from	Alternative/Description	Coupon code	Status
Ordered:								
FTC Registration	1	Necessary for entry	\$275	\$0	https://ftc.pitsco.com/			Received
Qualifier Registration	1	Necessary for entry	\$300		Invoice			Received
Control & Communication Set 2 - FTC	1	Necessary Robot Parts	\$249.00	\$28.53	* https://ftc.pitsco.com https://www.firsinspires.com			Received
REV Robotics Hub - FTC	1	Necessary Robot Parts	\$129.00		* https://ftc.pitsco.com http://www.revrobotics.com			Received
REV FIRST@ Tech Challenge Competition Set	1	Necessary Robot Parts	\$444.00		* https://ftc.pitsco.com https://www.firsinspires.com			Received
SKYSTONE™ Presented By Qualcomm Partial Red Game Set	1	Necessary Field Components	\$300	\$47	https://www.andymark.com/products/skystone			Received
Soft Tiles for FIRST Tech Challenge Field	36*	Necessary Field Components	\$230	\$36	https://www.andymark.com/products/softtiles			Received
Red Gaff Tape	1	Field Markings	\$8.95		https://www.amazon.com/dp/B07DZZG884/			Received
Blue Gaff Tape	1	Field Markings	\$10.95		https://www.amazon.com/dp/B07DZZG884/			Received
Thrust Needle Bearing	1	Used for base of claw	\$7.30		https://smile.amazon.com/SKF-AXK-4565-Th			Received
Screw driver kit	1	place and remove screws	\$7.99		https://smile.amazon.com/Kaisi-Precision-Scr			Received
multimeter	1	measure voltage and test circuit	\$8.99		https://smile.amazon.com/WeerPro-Vpro850L			Received
hot air tool	1	shrink heat shrink	\$10.66		https://smile.amazon.com/Miniature-Electric-F			Received
X-Acto knife set	1	Finishing prints	\$14.95		https://smile.amazon.com/Upgrade-Precision			Received
(2x) Wheels (2 total) (check notes for color and bore options)	2	(Brick loader)	\$25.70		https://www.andymark.com/products/4-in-corr			Received
JST Connectors	1	Wire connection	\$7.99		https://smile.amazon.com/Micro-Connector-1			Received
Ribbon Wire	1	Wiring	\$6.98		https://smile.amazon.com/Ribbon-Cable-10-V			Received
USB Hub	1	connect camera to robot	\$5.79		https://www.amazon.com/Monoprice-4-Port-U			Received
USB Webcam	1	Robot can see	\$17.99		https://smile.amazon.com/Logitech-Desktop			Received
Pending:								
Name	1	Justification	\$0.00		URL			Requested

(Ordering Spreadsheet screenshot Taken: 1/18/2020)

4. Team Timeline

9/25/19: Meeting:

Objectives:

- Meet Reuven
- Present research and choose competitions for this year
- Chose the team for this year
- Figure out how much funding is needed
- Arrange for funding

What Happened:

This meeting was attended by only the team captains and mentors but also included associate principal Mr. Goldman (G-man). Different competitions were discussed but had issues:

- CIJE- not a member school (too late to join)
- Botball- too far away
- Best- competitions on the Sabbath
- Vex- competitions on the Sabbath
- RoboCup- Chosen
- FTC- Chosen

Once the competition was chosen funding had to be arranged. We estimated the costs between the two competitions would be ~\$5,000. We had already been awarded a grant of \$3,000 and the school said it would give us \$2,000 leaving us fully funded and ready for the coming season. With that a team could be chosen for FTC, with a RoboCup team to be pulled from FTC.

GAP: Due to the Jewish holidays of Rosh Hashana, Yom Kipper and Sukkot the team was put on hold until the end of October

10/30/19: Meeting:

Objectives:

- Create group assignments
- Decide how to exchange files and messages
- Discuss initial ideas

What Happened:

Team Was split up as follows:

4. Team Timeline

Coding:

Sensor input & Computer Vision:

- Uriel -Lead
- Yonatan
- Ariel

Output:

- Eliezer -Lead
- Eliyahu
- Rafi

Hardware:

Chassis and block input:

- Yaakov

Base and movement:

- Betzalel
- Dovid

Claw Itself:

- Ariel
- Eli

Sensors:

- Shua

Organization:

File organization structure:

Team folder for current project

- Google Drive for record keeping
- Fusion for CAD
- Github for code

Communication:

WhatsApp Groups

Case study (evaluation system):

To evaluate designs

Overview of Competition:

Autonomous section

Robot must move

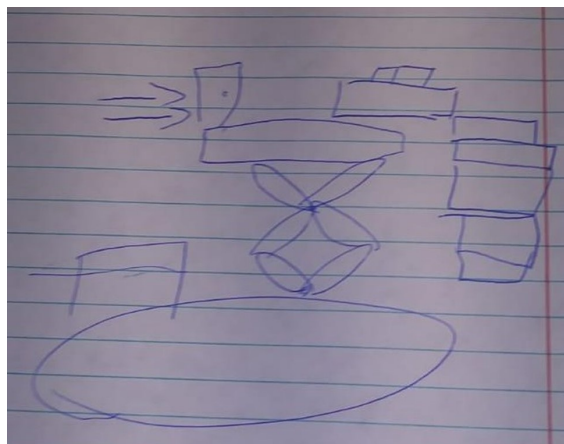
Be controlled

Sectional breakup (control, moving blocks)

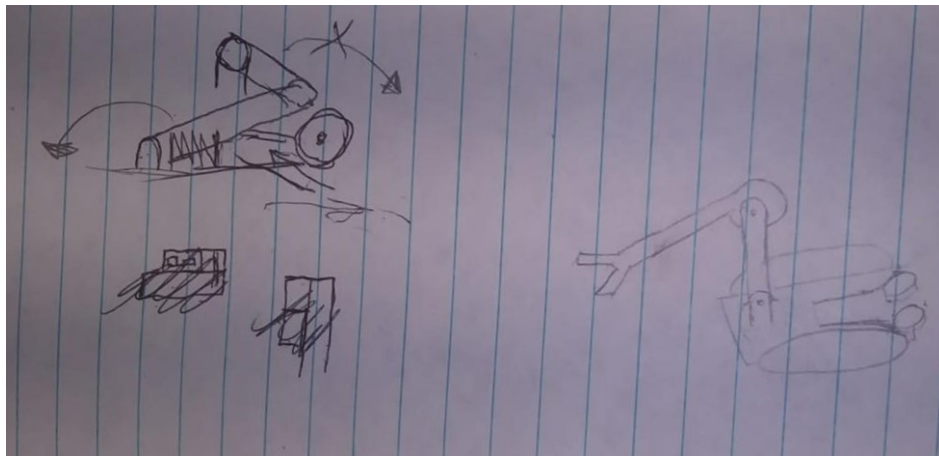
Main challenges: fabrication and software



(Board from first meeting)



(Initial scissor lift sketches)



(Initial Claw design sketches)

4. Team Timeline

NOTE: make a folder of research resources

Set deadlines for UML creation

GOAL for week:

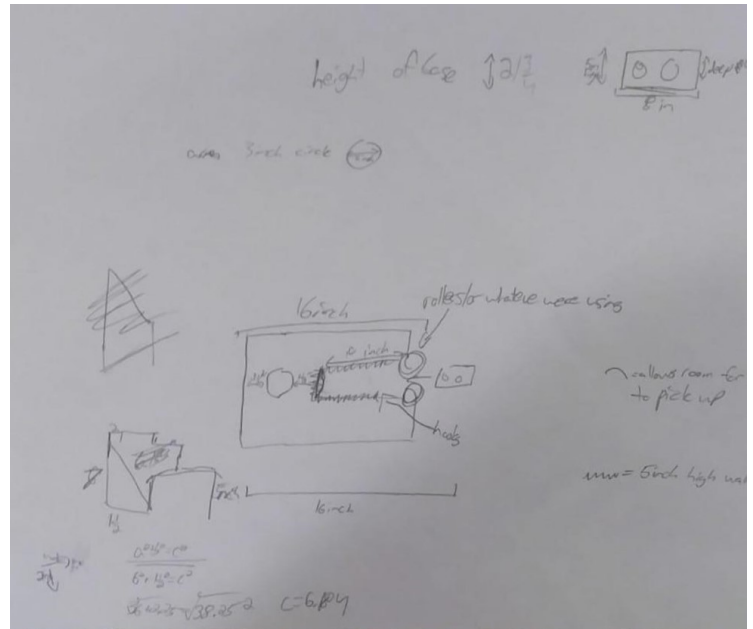
- brainstorm ideas for next week
- read FTC game manuals

Robot Tasks

- Pick things up
- Drive
- Stack
- Move building zone
- Line sensor/color camera

Ideas were discussed:

- A 2 wheeled brick loader
- A claw arm
- Tank tread style driving



(Initial Block input sketches)

11/3/19: CAD-File and folder was created and base of robot is designed

Meeting::

Objectives:

- Use Case Study method to decide on previously brainstormed designs

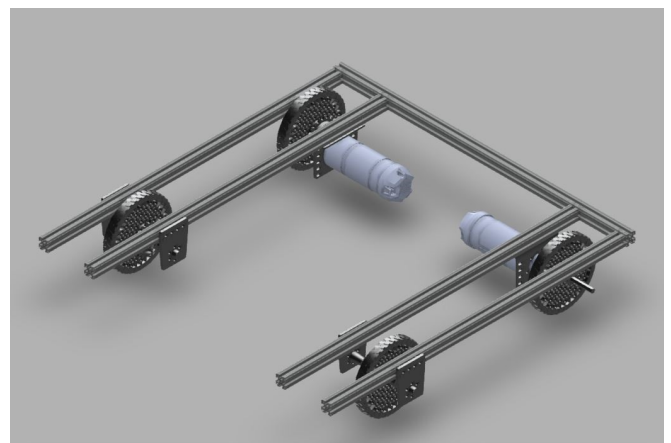
Case Study Method: Each design idea is rated in a variety of objective categories with a perceived score out of 5. Which ever had the highest rating won out.

What Happened:

A few different designs were thought up with competing schools up thought

Picking up the brick:

- Using a pair of vertical rollers
- Using Horizontal/diagonal rollers
- Using just the lifting mechanism to load bricks



(CAD of base of the robot)

4. Team Timeline

Lifting and placing the brick:

- Scissor lift with rollers that move up & down
- Arms and claw with stationary rollers
- Scissor lift with claw arm at the end

The Case Study:

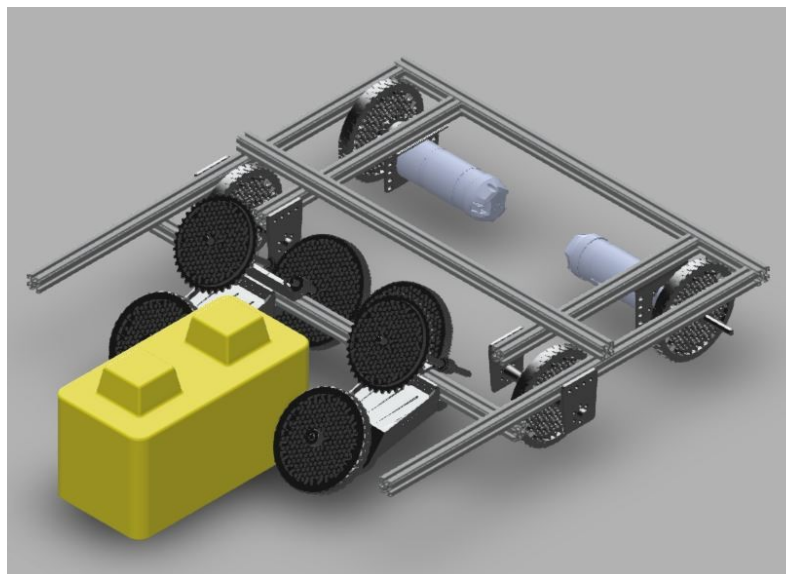
Lifting block	Scissors w/ moving rollers	Arm and claw	Scissor lift claw	Block input	1 horizontal rollers	2 vertical rollers	3 No rollers
Complexity to implement	5	3	4	Complexity to implement	4	3	4
Perceived speed	2	4	3	Perceived speed	2	4	3
compatibility/ different scenarios	4	3	3	Compatibility w/ different scenarios	3	4	2
reliability	5	4	5	reliability	2	5	4
cost/shipping time	3	1	3	total	11	16	13
total	19	15	18	averages	3.8	3	3.6
averages	3.8	3	3.6				

11/5/19: CAD-Brick loader was added

11/7/19: Robot Parts Arrived (Rev kit, and sky-stones)

11/11/19: Build secession:

Yaakov and Eli were at school anyway for the mini open house robotics presentation so they decided to begin building. Though only the first 3 extrusions where connected.



(CAD addition of brick loader)

4. Team Timeline

11/13/19: Team meeting:

Objectives:

- Continue building the robot based on the CAD model

What happened:

- Building of the robot continued with the entire base being completed

11/14/19: Beginnings of the claw arm are in the CAD file

11/20/19: Meeting:

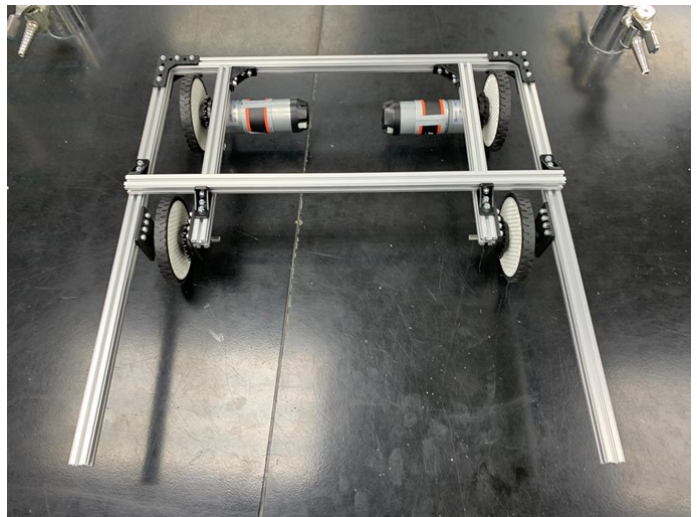
Unfortunately, no progress was made due to a lot of joking around

11/27/19: CAD– Base of arm was redesigned and strengthened

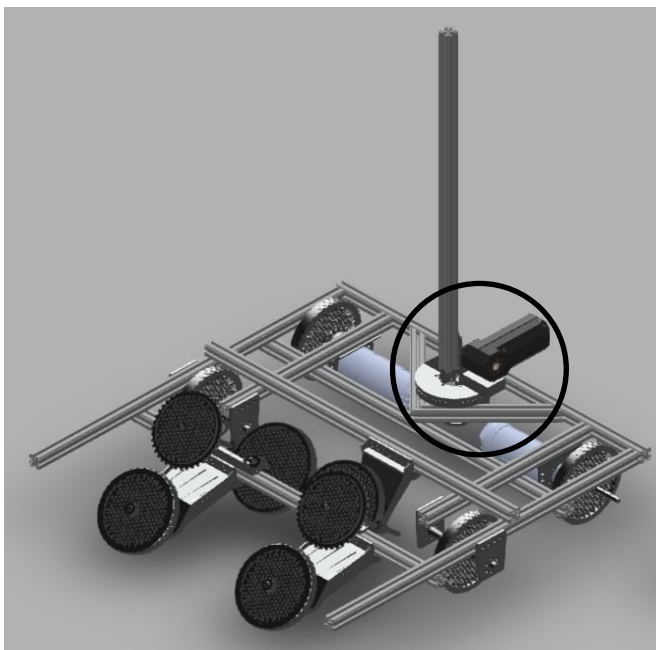
11/27/19: UML class diagram completed and coding began (see on next page)



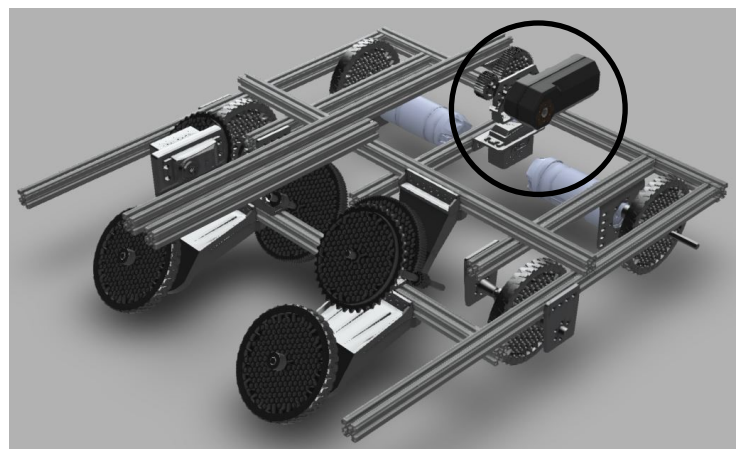
(Yaakov working on the robot)



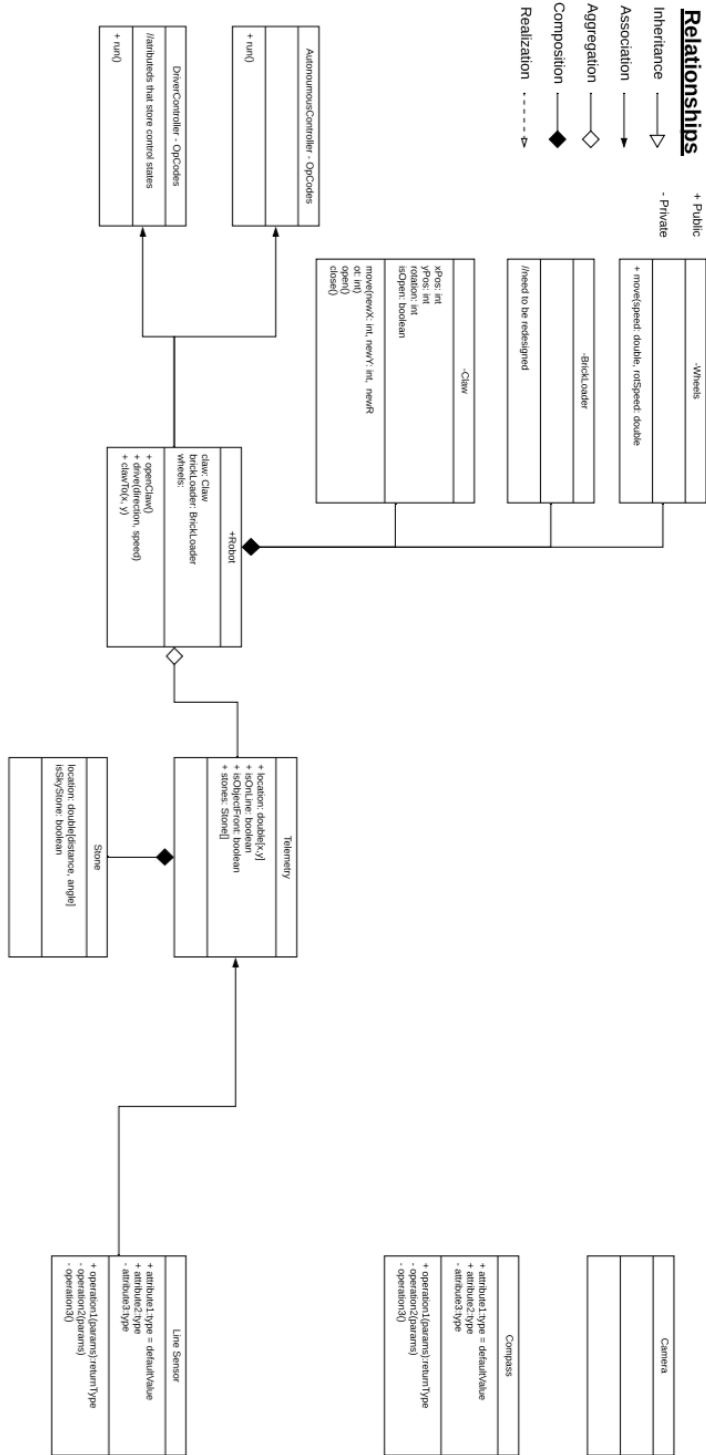
(The progress made on 11/13/19)



(Base of arm was redesigned and strengthened)



(Beginnings of the claw arm are modeled in the CAD file)



4. Team Timeline

12/2/19: Parts were printed for brick loader

12/4/19: Build session:

Objectives:

- Build the brick loader based off CAD model using 3D printed parts

What happened:

- Building of the robot continued with the brick loader being completed

12/11/19: Build session:

Objectives:

- List and print claw parts to be printed

What happened:

- Claw parts were printed
- Claw arm was increased to 3 segments

12/18/19: Build session:

Objectives:

- Build the claw arm

What happened:

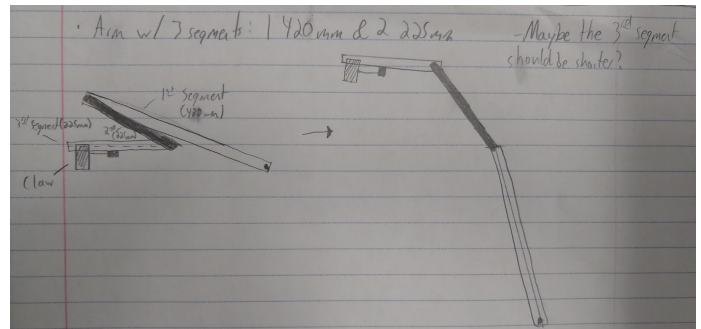
- Claw arm was

12/19/19: Yaakov and Eli visited CIJE innovation day to see what a competition like this was like
Work was done on importing OpenCV

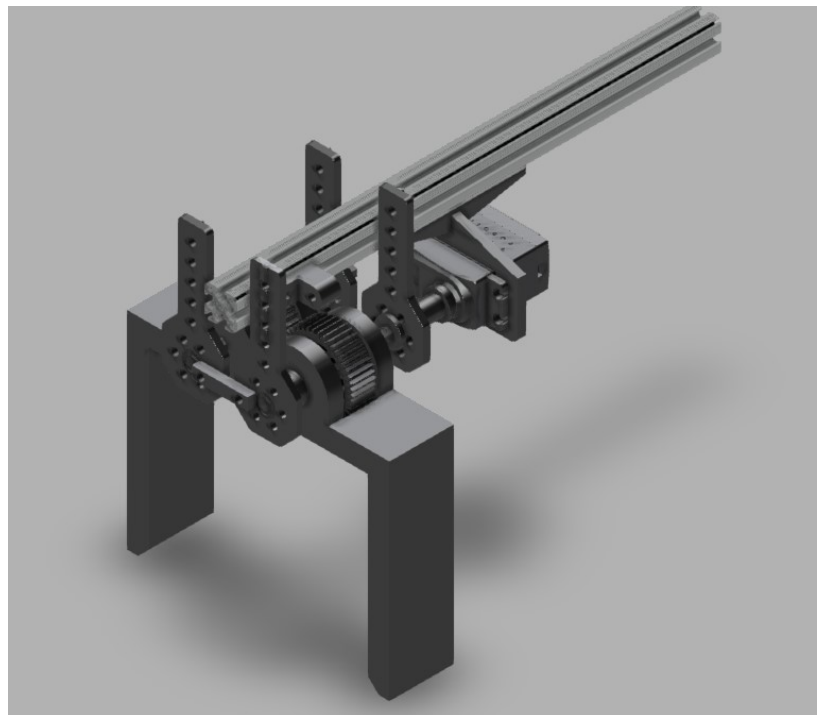
12/20/19: Finished first version of Claw Object (in code)

12/23/19: CAD-Claw brackets were modified

12/24/19: Made Wheels multi-threadable for turning capability



(Sketches of 3 segment claw)



(The CAD model of the claw)

Ariel expressed concerns with the angle of the brick loader though due to it being designed for new wheels that were yet to come it wasn't changes

4. Team Timeline

12/25/19: Build session:

Objectives:

- Build the claw itself

What happened:

- Claw was put together

12/26/19: CAD-Claw rotation system was created

12/30/19: Build session:

Objectives:

- Test robot code and get it driving

What happened:

- Robot drove
- I2C drivers failed testing

12/31/19: Last Meeting before finals:

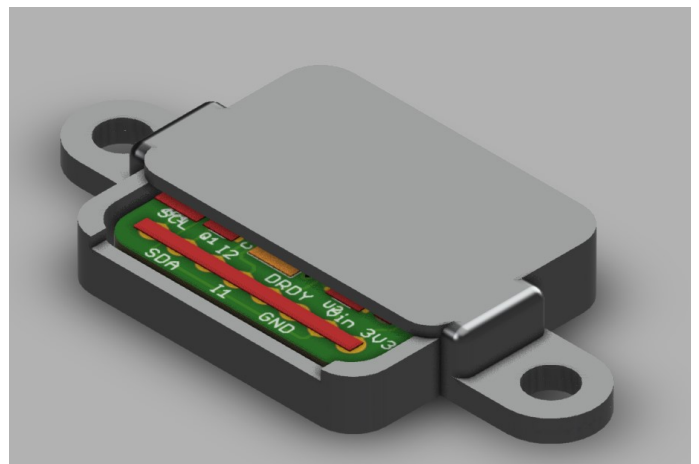
Objectives:

- To discuss the competition
- Discuss compass addition
- arm remeasure and print claw brackets

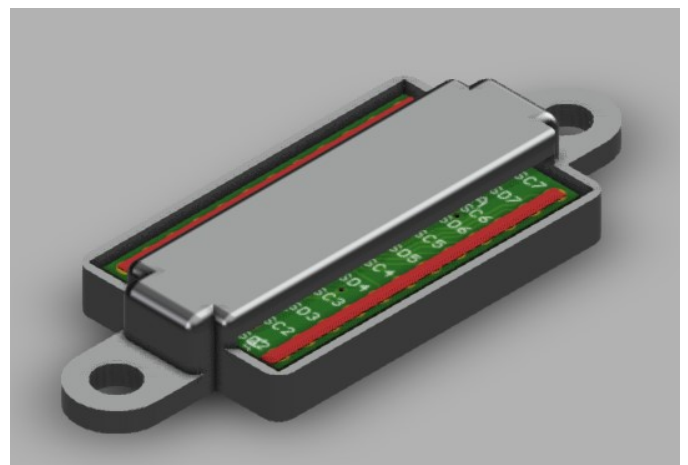
What happened:

- Competition was discussed
- Compasses where implemented

1/1/20 CAD-Mounts where designed for compasses and I2C Multiplexer



(Compass bracket)



(I2C Multiplexer bracket)

4. Team Timeline

1/14/20 Build session:

Objectives:

- To solder compasses to multiplexer and hub
- Screw on brackets
- Manage wires
- Test code

What happened:

- Wires were soldered and brackets mounted
- Brackets were screwed on
- Code didn't work

1/18/20: Try to get accelerometer code to work failed testing

5. Appendix

Parts list:

All parts will be RR-FTC (Rambam Rambots FTC Robot)
 Created by Shua 11/20/19
 Rambam Rambots FTC Robot

P/N RR-FTC-00 THE Robot Rev. A
 P/N RR-FTC-01 Control Electronics & Miscellaneous Rev. A
 P/N RR-FTC-02 THE Base Rev. A
 P/N RR-FTC-03 THE ARM Rev. A
 P/N RR-FTC-03.1 The Claw Rev. A
 P/N RR-FTC-04 THE Front loader Rev. A

Part Numbers

Part Number Prefix	Distributor
REV	Rev Robotics
am	AndyMark
F	Logitech
XT	Motorola
LSM	Adafruit
JST	daier
FBA	Hilitchi
10	Monoprice
3D Printed (A)	Ultimaker 3
3D Printed (B) & (C)	Crealty CR-10 Mini
3D Printed (D)	Monoprice Maker Select V2

P/N RR-FTC-01 Control Electronics & Miscellaneous Rev. A

Quantity	Part Number	Part Name	Revision
2	XT1764	Moto e4	Rev A.
1	REV-31-1153	Rev Robotics Expan-	Rev A.
1	REV-31-1302	Slim Battery,	Rev A.
3	LSM303	Compass & Accel-	Rev A.
4	REV-31-1407	Cable, Sensor, 4-pin,	Rev A.
4	REV-31-1412	Cable, Motor Power,	Rev A.
4	REV-11-1130	Cable, PWM Servo	Rev A.
25	REV-41-1161	Zip Ties, 160mm	Rev A.
2	F310	Logitech Gamepad	Rev A.
3	JST PH 2.0-4	4 pin connectors	Rev A.
As needed	FBA_CAB-10647	Ribbon Cable	Rev A.

5. Appendix

1	106631	USB Hub	Rev. A
2	109724	USB Micro-b OTG	Rev. A
1	3D Printed (D)	Rev Hub Bracket	Rev. A.

P/N RR-FTC-02 THE Base Rev. A

Quantity	Part Number	Part Name	Revision
4	REV-41-1354	Wheel, Traction,	Rev. A
6	REV-41-1432	Extrusion, 420mm,	Rev. A
2	REV-41-1431	Extrusion, 225mm,	Rev. A
2	REV-41-1430	Extrusion, 150mm,	Rev. A
2	REV-41-1301	HD Hex Motor, 40:1	Rev. A
4	REV-41-1303	Plastic Bracket, Mo-	Rev. A
4	REV-41-1340	Sprocket, #25, 20T	Rev. A
2	REV-41-1487	Metal Bracket, HD	Rev. A
2	REV-41-1326	Bearing, Through	Rev. A
4	REV-41-1327	Shaft Collars	Rev. A
4	REV-41-1347	Shaft, 5mm Hex,	Rev. A
2	REV-41-1322	Bearing, End Cap	Rev. A
As needed	REV-41-1359	Screw, Hex Cap, M3,	Rev. A
As needed	REV-41-1167	Screw, Drop-in, M3, 8mm	Rev. A
6	REV-41-1305	Plastic Bracket, 90	Rev. A
2	REV-41-1307	Plastic Bracket, 45	Rev. A
8	REV-41-1321	Plastic Bracket, Lap	Rev. A
As needed	REV-41-1361	Nut, Locking, M3	Rev. A

P/N RR-FTC-03 THE ARM Rev. A

Quantity	Part Number	Part Name	Revision
2	REV-41-1097	Smart Robot Servo	Rev. A
1	REV-41-1319	Plastic Bracket, Ser-	Rev. A
2	REV-41-1432	Extrusion, 420mm,	Rev. A
2	REV-41-1347	Shaft, 5mm Hex,	Rev. A
2	REV-41-1317	Bracket, Bearing Pil-	Rev. A
2	REV-41-1316	Bracket, Hex Pillow	Rev. A
3	REV-41-1327	Shaft Collars	Rev. A
1	REV-41-1337	Gear, 90T	Rev. A
1	REV-41-1325	Spacer, 15mm	Rev. A

5. Appendix

Quantity	Part Number	Part Name	Revision
1	REV-41-1324	Spacer, 3mm	Rev. A
1	REV-41-1323	Spacer, 1.5mm	Rev. A
2	REV-41-1364	Servo Gear Adapter	Rev. A
3	REV-41-1329	Bearing, Through Bore Long	Rev. A
1	REV-41-1300	Core Hex Motor	Rev. A
1	REV-41-1349	Shaft, 5mm Hex,	Rev. A
2	3D Printed (A)	Servo Bracket	Rev C.
1	3D Printed (D)	Servo Bracket	Rev B.
1	3D Printed (D)	Upper Shoulder	Rev. B
1	3D Printed (D)	Lower Shoulder	Rev. B
1	3D Printed (D)	Shoulder Gear	Rev. B
As needed	REV-41-1361	Nut, Locking, M3	Rev. A
As needed	REV-41-1359	Screw, Hex Cap, M3,	Rev. A

P/N RR-FTC-03.1 The Claw Rev. A

Quantity	Part Number	Part Name	Revision
4	REV-41-1329	Bearing, Through Bore Long	Rev. A
2	REV-41-1347	Shaft, 5mm Hex, 75mm	Rev. A
4	REV-41-1304	Plastic Bracket, Rod End	Rev. A
2	REV-41-1334	Gear, 45T	Rev. A
2	3D Printed (A)	Claw Arms	Rev. B
4	3D Printed (A)	Tension Stubs	Rev. C
2	3D Printed (D)	Tension Brackets	Rev. D
1	REV-41-1097	Smart Robot Servo (SRS)	Rev. A
1	REV-41-1328	Servo Shaft Adapter	Rev. A
As needed	REV-41-1360	Screw, Hex Cap, M3, 16mm	Rev. A
As needed	REV-41-1361	Nut, Locking, M3	Rev. A

P/N RR-FTC-04 THE Front loader Rev. A

Quantity	Part Number	Part Name	Revision
2	am-3480_green	Green Wheels	Rev. A

5. Appendix

2	REV-41-1337	90 tooth gear	Rev. A
2	REV-41-1334	45 tooth gear	Rev. A
1	REV-41-1300	Core Hex motor	Rev. A
2	REV-41-1347	Hex shaft 75mm	Rev. A
2	REV-41-1349	Hex shaft 135mm	Rev. A
4	REV-41-1326	Through bore bearing short	Rev. A
As Needed	REV-41-1327	Shaft collar	Rev. A
2	REV-41-1339	Small sprocket	Rev. A
1	REV-41-1365	Chain, #25 10ft	Rev. A
1	3D Printed (C)	Core Hex Bracket	Rev. A
2	3D Printed (B)	Loader Wheel Bracket	Rev. A

P/N RR-FTC-01

Power and Control the Robot

P/N RR-FTC-02

Supports basically the entire robot. Houses the motors and wheels.

P/N RR-FTC-03

Moves claw to where it needs to go.

P/N RR-FTC-03.1

Grabs bricks by applying pressure on 2 opposite sides. Easily controlled with 1 motor.

P/N RR-FTC-04

Loads the brick into the robot.