Introduction to Robotics Technical Paper

Robot Name: Rachel

Team Epic

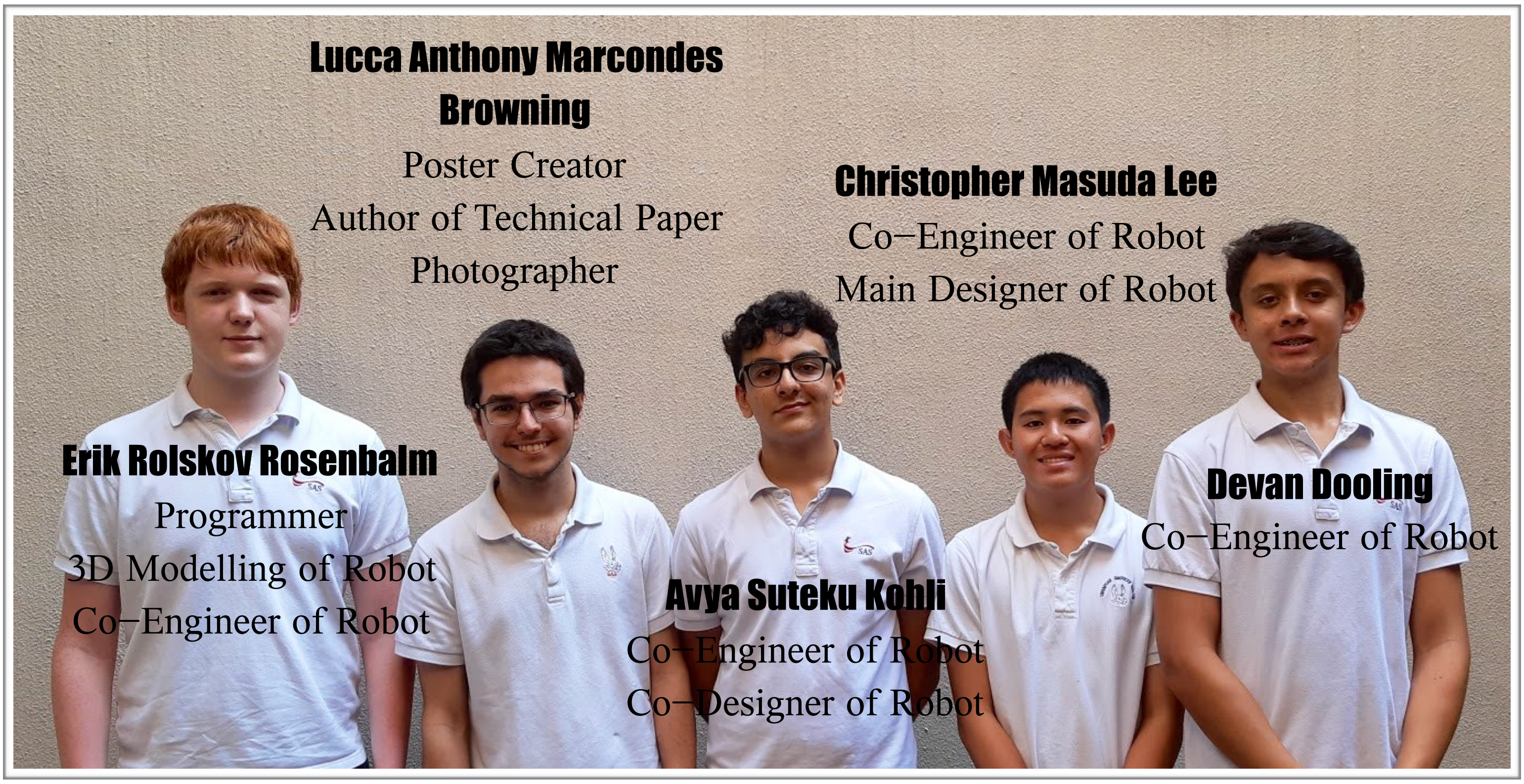
Quarter 2, 2019

Singapore American School
Singapore, Singapore 40 Woodlands Street 41

Mentor: Mr. Barton Millar

The Team

And their roles in the creation of Rachel



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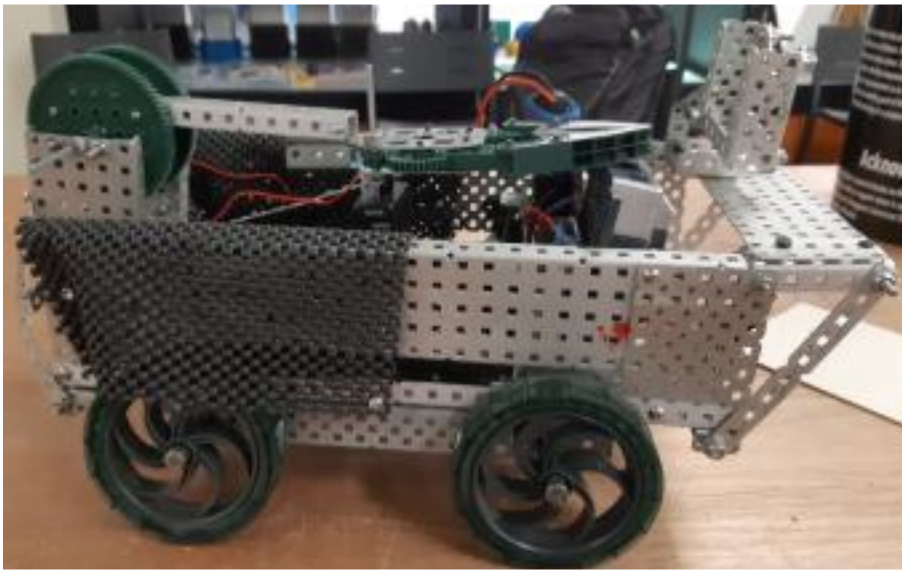

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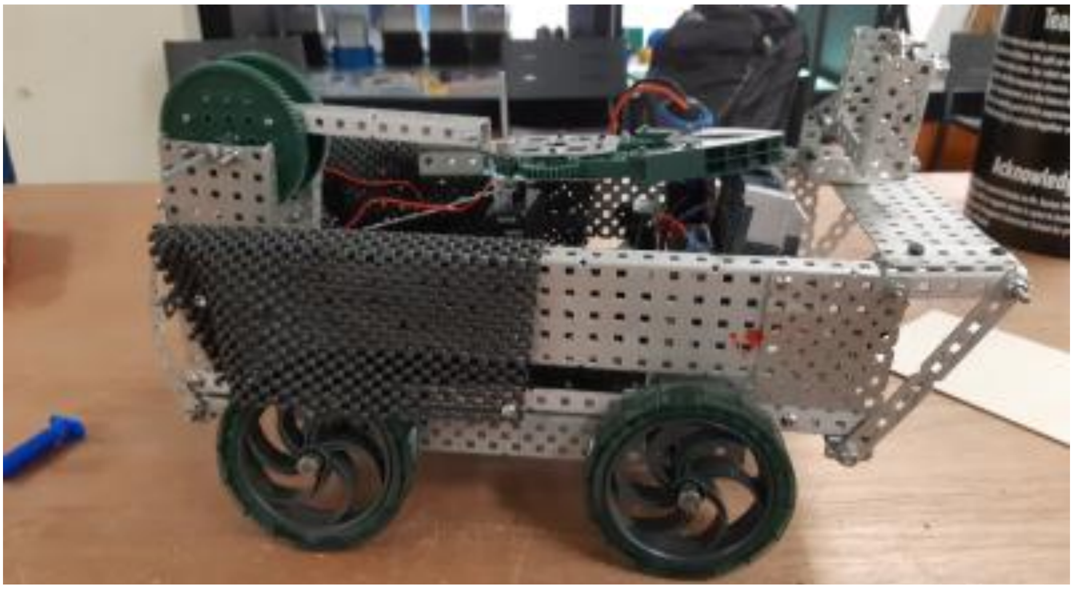

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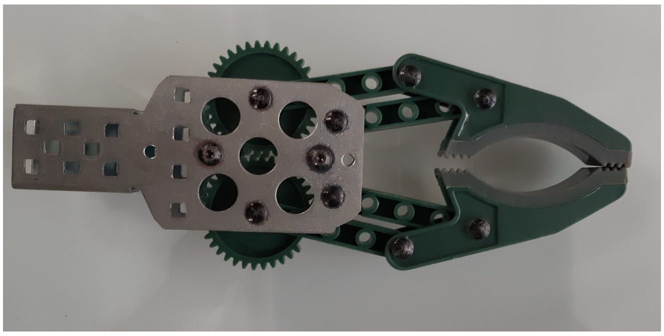

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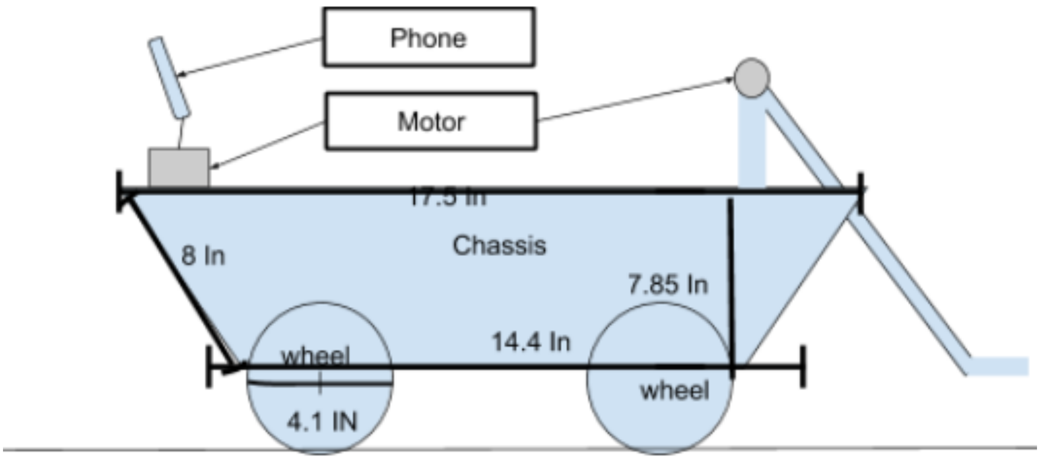

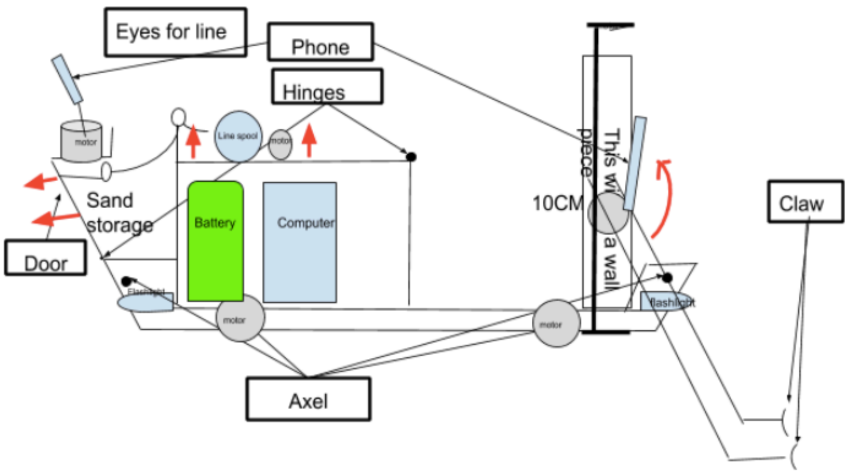

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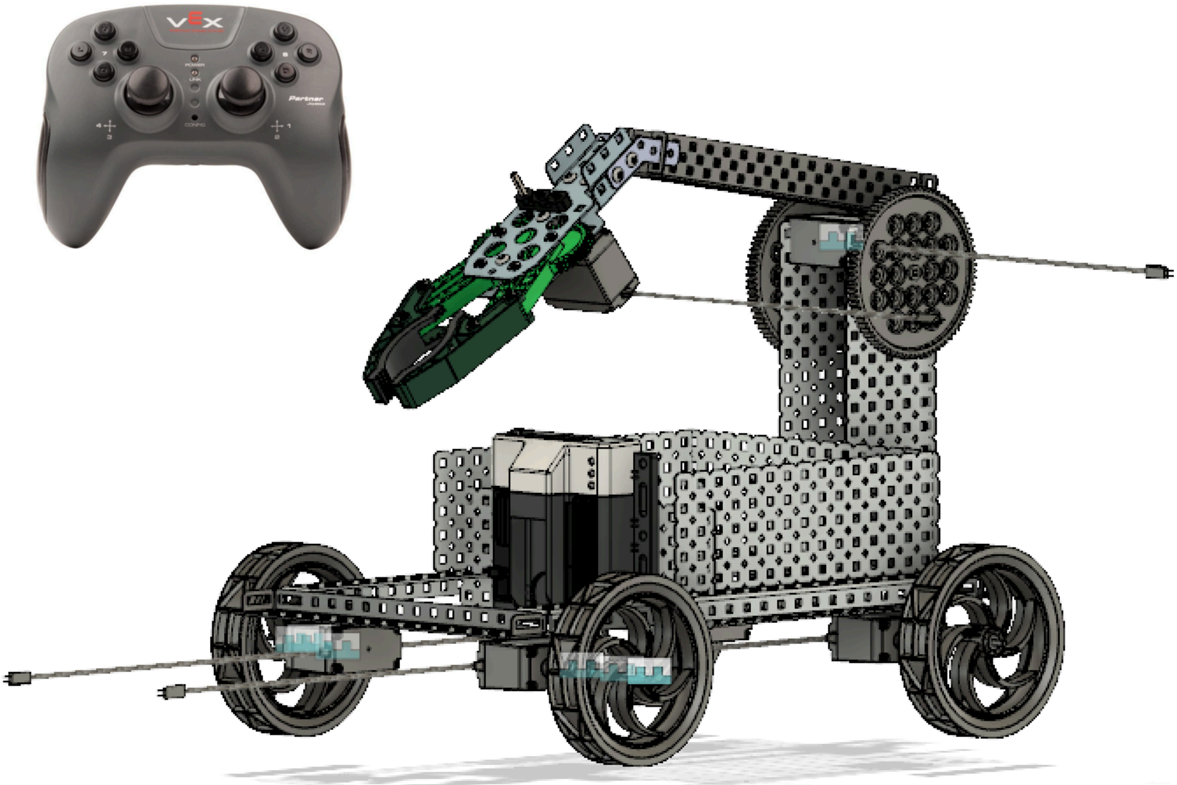


Bill of Materials

a. Bearing Flat
b. Thin Spacer (4.8mm)
c. Shaft Collar with #8-32 Setscrew
d. #8-32 Keps Nut
e. #8-32 Nylock Nut
f. Long Motor Screw w/ Nylon Locking Patch
g. Short Motor Screw w/ Nylon Locking Patch
h. #8-32 Button Head Screw X 1.5” Long
i. #8-32 Button Head Screw X 1/2” Long
j. #8-32 Button Head Screw X 1/4” Long
k. Claw Assy
l. 2-Wire Motor 393 Module
m. Motor Controller 29
n. VEX Cortex
o. VEXnet Key
p. 7.2V Rechargeable Battery
q. Gear, 60 Tooth
r. Gear, 84 Tooth
s. VEX Wheel (4” Diameter)
t. Collar
u. 1/4” Motor Screw
v. 1/2” Motor Screw
w. 1/4” Screw
x. 1/2” Screw
y. 1.5” Screw
z. Mesh
aa. Wood
bb. Line Spool
cc. Hook

The Abstract

Rachel, our Robot is similar to the already well known, VEX Clawbot with some key modifications. These include the sturdiness of our wheels, our chassis, the way we capture visual information and more. Mr. Barton Millar, our instructor for this Robotics course, wanted to simulate a house fire to measure the ability of the aforementioned robot. Because of this, he orchestrated a simulation in which our prototype Robot had to save a barbie Doll family in an artificial house. Not only did we have to cross a bridge with a 12 inch gap and traverse smoke created by a smoke machine, but we also had to put out a small, chemically induced fire.

Because of this, our robot was catered to destroy fire and save innocent people at the absolute ease of the one using the robot. This entailed including the aforementioned components as well as working with the nature of the project, which included coding our controls differently to what the VEX Clawbot had to meet the specific requirements of our task.

Throughout the process of this project, we used in-house equipment, as well as softwares such as Fusion 360, as well as the VEX catalogue.

This project culminated the basics of Robotics taut throughout the semester for our team and made us more creative in the process. We learned to apply ourselves and put in the hard work and dedication we needed to build our very first robot, Rachel.

The Theme

Every year in the United States of America 73,200 wildfires burn approximately 6.9 million acres of land, on average, leaving nothing but charred, dead land. Not only do trees and other flora meet their end in these fires, but fauna do too. Wild creatures such as squirrels, foxes, deer and more suffer at the hands of these ravenous fires. Though, domestic animals are in danger of meeting their end too if a dog park were to burn, say if it were at the edge of a wildfire.

The real problems start when these wildfires rave into smaller or even larger rural towns at the edges of a high risk wildfire areas. These homes, built out of flammable materials such as wood, have a chance of killing their inhabitants in the process of combustion. For example, 3521 people died in the United States of America alone last year due to either burning to death in a fire, or by dying from smoke inhalation. With either carbon dioxide or carbon monoxide, maybe even both, ending up in their lungs, they would either have the carbon monoxide entering their bloodstream and bonding with their haemoglobin, making oxygen transport so inefficient, it kills them. That, or they would just die from inhaling carbon dioxide nearly immediately. If they DO survive this, they still have to deal with the carcinogenic effects of ash and soot, possibly killing them in the aftermath of their harrowing experience with fire. This is why being around fires larger than say, a fireplace, is generally not a good idea. Removing people from dangerous fires, as well as domestic animals (and any other creature that applies is very important.

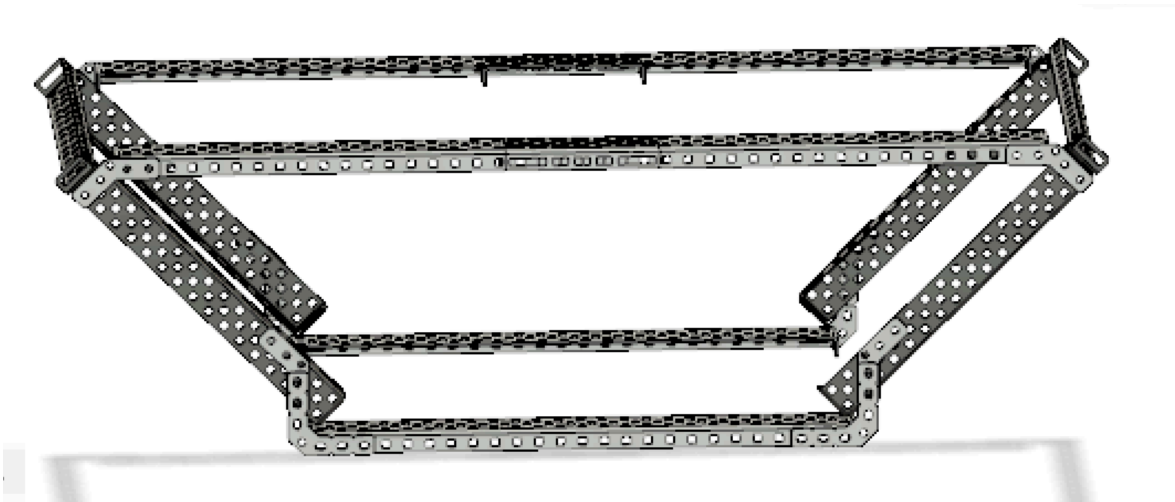
This is precisely why us at Team EPIC have specialised in a robot that can not only remove people from dangerous house fires, caused by wildfires or otherwise, but also make sure it does so in a short amount of time, to minimise their exposure to the aforementioned ash and soot.

Vehicle Systems and Design Rationale

Chassis

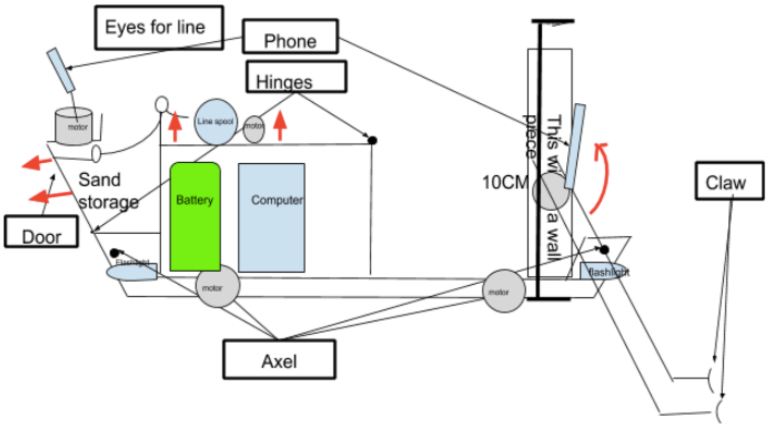
The chassis, in the context of the robot, needs to simply act as a mold to connect the multiple components in this robot efficiently. For this reason alone, we settled upon a trapezoidal prism, as shown below, to accommodate for the components *Rachel* has.

As shown above, this trapezoidal prism allows for efficient discharge of sand, our extinguisher of choice, through the simple opening of a door, making the use of a piston to push out the sand from the storage container in the chassis completely unnecessary.



Although these advantages doesn't solely relate to the putting out of the fire. As presented, this shape also allows for the completely unobstructed rays of light coming directly from the flashlights on the bottom end of each polar side of the chassis.

To prevent sand and fire from getting to the main circuit, including the computer, battery, and motor, there is a smaller airtight box holding the aforementioned components as shown in the previous diagram. To open this small box, there is a panel on the side of this small box that is openable from the top, as there is a hinge to be used as a "door". This is show the components is fit in there.

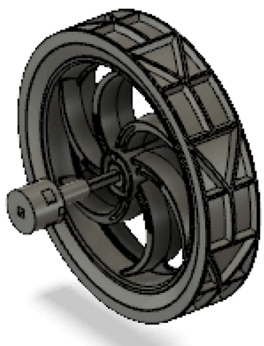


Though, this box is short enough in the main chassis to also allow for more components stored on top of it such as the line spool and motor used to power the door. The door is covered in depth in the door section.

Towards the back of the chassis (right), there is an empty ‘box’ of storage for salvaged objects from the wreckage of any given fire *Rachel* is thrown into as well as even animals and people saved by the claw can be put until the robot reaches into the clear.

Wheels

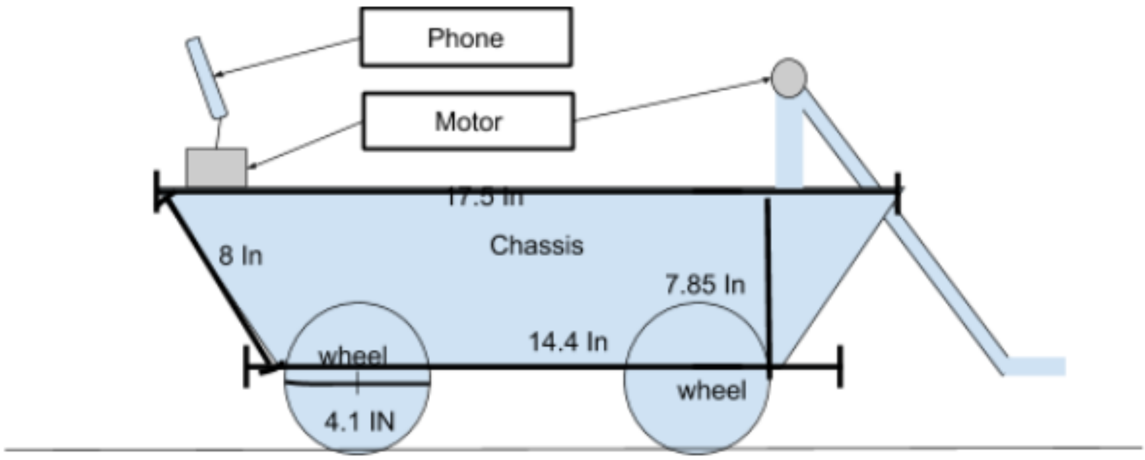
Our robot, *Rachel* will have to enter harrowing house-fires without any promise of making it out unscathed, if not alive. This means making it through scorched floors that would melt plastic at a moment’s notice. It also has to make it over gaps formed by instances such as wood flooring without falling into the darkness of a lower story or a basement.



To not lose our robot, we have to make its wheels not only able to withstand the overwhelming heat of combustion, but also able to make it through the wide gaps in surface often caused by house-fires. Because of this, we made a design that would work. Taking inspiration from 21st century warfare, we decided to implement a very similar design to armoured vehicle wheels. These armoured vehicles, when deployed profusely by the American Forces in both the Afghanistan and Iraq wars.

These were used to transport military personnel through rough terrain such as deserts and hills, that most other four wheeled vehicles would collapse at the thought of. They are also extremely efficient at crossing large gaps such as trenches and holes in the ground caused by artillery fire and otherwise.

This design did this through four wheel drive, as well as thick, and armoured wheels. Using this design, it would be able to easily climb the aforementioned unpaved hills, as well as drive in the sand of the desert without breaking down.

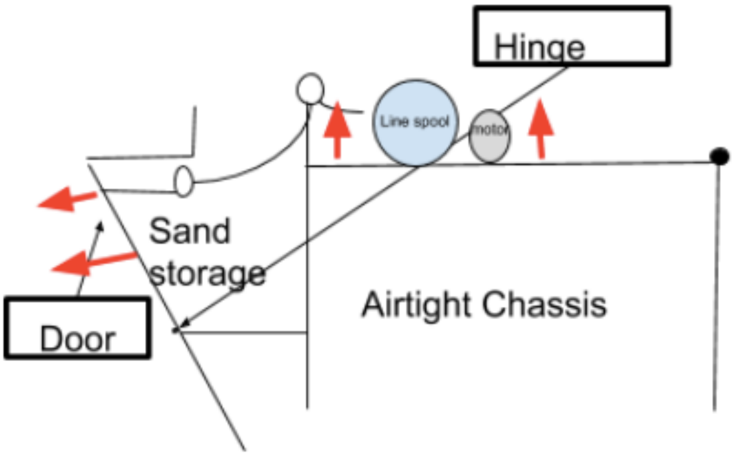


The motors powering each of these wheels individually (through axles), are of course connected to the computer inside the chassis, as well as the power source, a 9 volt battery, to allow for many, many minutes of remote controlled access to the wheels before the battery runs out.

Door

As putting out fires is vital to the success of our robot, the mechanism for this design feature needs to work extremely well. Firstly, as mentioned before, the door needs to be slanted along the chassis, so when the door is opened, the sand can easily leave the chassis so put out the fire.

Moving on, to actually open the door, the top of the door is connected to a line, which is at the end of a line spool. This line spool will either expand or contact based on whether the motor that it is hooked up to is moving clockwise, or counterclockwise.



The door will open or close depending on whether the line spool is expanding or contracting because the bottom of the door has a hinge that will allow the door to open and close at will without falling out of the chassis. This design is very similar to that of a drawbridge. Both designs include a door that is opened or closed through the expansion or contraction of a spool powered by something (whether it be a motor or people working a pulley).

The motor is hooked up to the computer inside the airtight chassis, which is connected to the remote control used by the “firefighter”. This allows the opening and closing of the door to be directly controlled by the user. Not only that, but the motor is connected to the battery in the same chassis, allowing the door to be opened and closed multiple times. Not only that, but the door is also on the same side of the chassis as the camera, allowing the user to see whether the door is opened or closed before moving onto the next fire that needs to be put out.

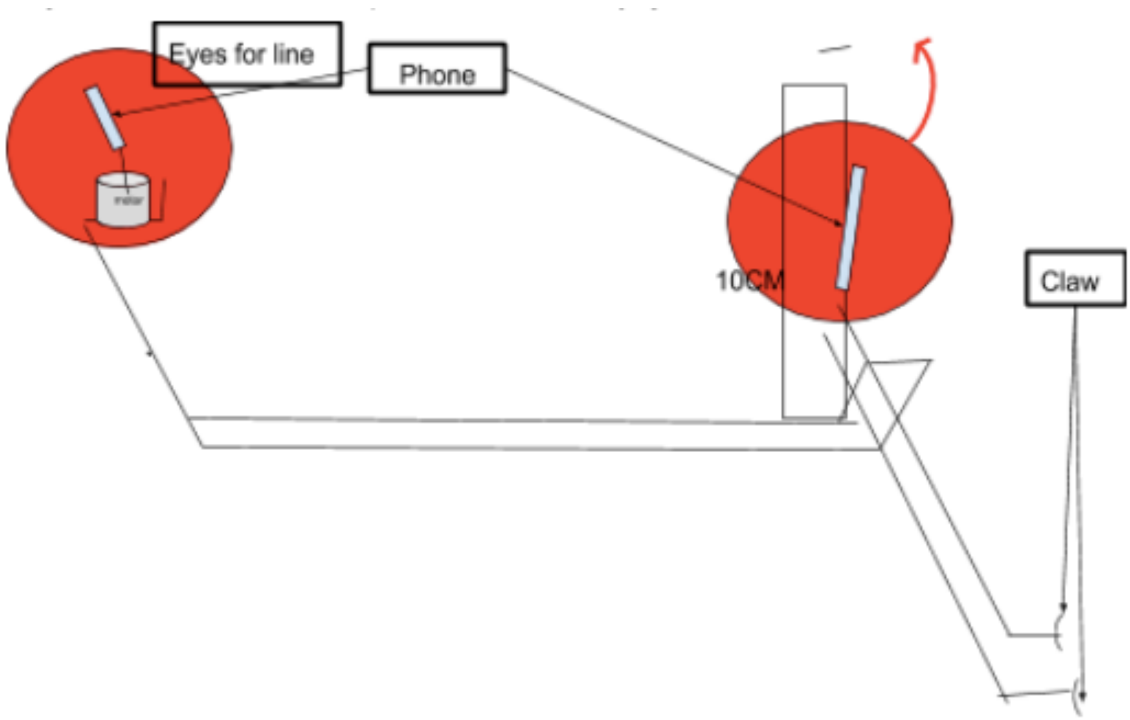
The reason this method of fire-stopping is used as opposed to any other is because it works very efficiently at dropping sand where it needs to without requiring the use of a piston because of the slanted design of our chassis.

Camera

To allow the user of *Rachel* to effectively see their surroundings, a camera needs to be present above the chassis with the ability to turn in multiple directions. This will allow them to make the best decisions possible under stressful situations, such as a house fire, because they will have a larger viewing angle of the situation.

Nowadays, more cellular phones with cameras are present than toilets, making the inclusion of one to the chassis of anyone using a *Rachel,* an economically and timely solution to the problem of vision. In addition, cellular service covers much of earth. For example, Verizon alone covers 70% of all land area in the USA. If this figure included the rest of the cell phone carriers in the United States of America, the aforementioned value would increase to around 95% of the surface of the USA.

This means that using an application such as FaceTime to transfer live feed from the phone camera on top of *Rachel*'s chassis to the phone that is placed on top of the remote control for the robot, makes the phone act as an effective, lightweight camera. FaceTime needs access to a carrier, whether through Wi-Fi, cable, or mobile data. With this mobile data abundantly present, there is nothing stopping a FaceTime call from being made.



This “camera” is placed atop a motor, connected to the computer and battery, that when controlled with the aforementioned controller, the same way as the other motors, can turn 360 degrees to reveal a full panorama of any given situation.

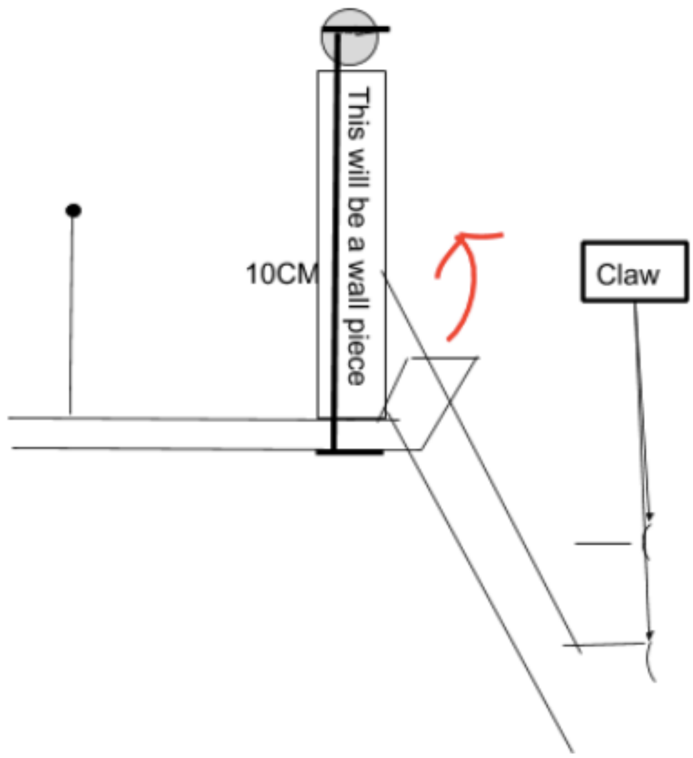
There will also be another phone camera hooked up to the claw, able to closely monitor that it is working as it should. This phone is connected to the chassis, but not to the computer or battery, preserving the robot’s energy, making it last longer on the field.

Claw

Most firefighting machines don’t include any way to remove important belongings, as well as people from perilous house-fires. Though us at team EPIC found a solution to this never ending trouble with a secure solution. To fix this problem, we’ve taken ideas from many pieces of technology across history, starting with the most recent one: The Backhoe.

Nearly everyone has seen a backhoe in a construction site, used for digging up dirt and leaving it elsewhere to set foundation for buildings. It’s ‘shovel’ effectively moves down as well as up due to the mechanics in the arm. That is precisely why we used very similar technology in the creation of the arm.

The claw and retraction systems (of which the retraction system is a continuation of the upward movement inspired by the backhoe mechanism) were heavily inspired not by a construction vehicle, but the simple occupation of trash-picking across not only the world, but the multiple centuries that came before the modern day. The simple premise goes; a man with a claw that retracts or expands with the movement of a mechanism near the hand of the user is used to pick up the trash similar to how a hand would. The exception to this is that the effects left on the



garbage such as dirt and disease will not transfer to the hand, and therefore skin, of the man picking the garbage.

Similarly, the claw will save possibly scorching hot materials from the fire that could burn the hands of a firefighter, burning which usually discourages them from saving personal belongings in the first place. With important items such as wedding rings being consumed by the inferno, this isn't a choice, hence a claw that can pick up objects as well as people. Of course, there needs a place to put all of these objects as well as humans picked up by the claw, which is why the storage compartment, or 'box' exists on the backend of the chassis.

The reason we used a claw instead of other methods of picking things up is because Needles have a tendency of poking holes in things they pick up. This gives humans a better rate of survival if they are left to burn in the fire to begin with. On the other hand, claws do not puncture people in the lungs but have very good grip (similarly to a needle). The reason a shovel won't work is, although it's safer than than the claw, it has terrible grip, and is only useful for digging resources such as dirt.

Our Code - Movement RC

```
#pragma config(Motor, port2,       motorRIGHTWHEELBACK,
tmotorVex393_HBridge, openLoop)
#pragma config(Motor, port3,       motorRIGHTWHEELFRONT,
tmotorVex393_HBridge, openLoop)
#pragma config(Motor, port5,       motorCLAW,
tmotorVex393_MC29, openLoop)
#pragma config(Motor, port6,       motorCLAWBEND,
tmotorVex393_MC29, openLoop)
#pragma config(Motor, port8,       motorLEFTWHEELBACK,
tmotorVex393_HBridge, openLoop, reverse)
#pragma config(Motor, port9,      motorLEFTWHEELFRONT,
tmotorVex393_HBridge, openLoop, reverse)

task main()
{
        while(1==1)
    {
        motor[motorLEFTWHEELBACK] = vexRT[Ch3];
        motor[motorLEFTWHEELFRONT] = vexRT[Ch3];
        motor[motorRIGHTWHEELBACK] = vexRT[Ch2];
        motor[motorRIGHTWHEELFRONT] = vexRT[Ch2];
//* left joystick y axis = left movement, right joystick y axis = right
movement
        if(vexRT[Btn6U] == 1)
        {
           motor[motorCLAW] = 50;
        }
        else if (vexRT[Btn6D] ==1)
        {
           motor[motorCLAW] = -50;
        else
```

```
        {
            motor[motorCLAW] = 0;
        }
        if(vexRT[Btn5U] == 1)
        {
            motor[motorCLAWBEND] = 50;
        }

        else if (vexRT[Btn5D] == 1)
        {
            motor[motorCLAWBEND] = -50;
        else
        {
            motor[motorCLAWBEND] = 0;
        }
    }
}
```

Safety Protocols

While building model one of Rachel, we dealt with many hazardous pieces of equipment. As using them was necessary in putting our robot together, we had to invent useful safety protocols that would not only keep us safe, but keep us in check, making us build the robot faster.

- We used the Gantt chart. This may seem to just help us with productivity, though it also helps us with safety. This is because when looking at our “daily agenda”, we’re able to see what we need to do for that set day. Through this, we can learn what equipment, hazardous or not, we need to use for that given day and how to use it. This is to save time and also learn what to do with hazardous equipment, lowering chances of injury.
- When using loud equipment, such as the woodcutter and the metal cutter, we have to use headphones to preserve hearing. In our modern world, hearing is very important, since more and more of us are getting collaborative jobs. A permanent loss of hearing would be damaging to future careers, especially in fields like engineering.
- When using any equipment in the room, especially equipment that spews out shrapnel and wood shards, using safety goggles is vital to retention of vision. A loss of vision is just as bad for functioning in society if not worse than a loss of hearing. Blindness rids of one any job opportunities and puts you on a disability check for the rest of your life. In conclusion, safety goggles are paramount to using any equipment in the robotics department.
- When using equipment, we would always mark off the areas around said equipment for passersbys not to walk by when we were using the machines. This stops people from walking by when a woodcutter is being used and an unfortunate accident occurring involving the other person getting hurt by our equipment.

Even our robot itself has safety features. Inside of building time, we spent extra effort to make sure there were not any protruding, sharp metals coming out of the sides of our robot, as to not poke anyone.

Along with that, we have the safety mesh in the storage box used protect those that end up inside of the storage unit to escape the fire. It will protect the organs of humans and animals that are put in there quickly because of padding.

Though, operating the vehicle also needs safety added to it for the driver to add maximum efficiency in saving those in danger. This is why one has to go through extensive training to operate Rachel under real life, and even prototype conditions. If a newbie were to use the robot, they would likely destroy more than they would help. Such as in prototype conditions, they could demolish the model home and run over the barbies. Only god knows what a newbie could do in real life conditions with stress applied.

Using equipment in the room has led to situations such as when Chris left pliers on the side of one of the workshop tables and knocking it off for it to nearly land on his foot, possibly breaking a bone of his. The same occurrence happened when Devan nearly dropped a hammer on a member from another group. From this we've learned to keep our equipment further into the table than the comparatively lighter and less dense parts.

Troubleshooting

In the creation of Rachel

When initially powering on Rachel, the robot went AWOL. It was moving across the workshop with no aim, and without the controller telling it to. Since the first step of our troubleshooting process was to check the code, we looked at the written script/program and sure enough, one of the variables wasn't working as it should. After repairing this we retried to use the controller to find that it worked as it should

However, we noticed that only 3 wheels of the 4 wheel drive were working. This was because one of the wires going into the motor was somewhat disconnected. After going back to the code, as our first step in troubleshooting, we noticed there was nothing wrong. Then, we looked at the actual prototype only to realise one of the motors connected to their respective wheels was disconnected from the cortex. After adjusting the wire, our robot worked fine.

Challenges and Solutions

Technical Problem

Problem - Fusion 360

Fusion 360™ by Autodesk has proven time and time again to be a very hardware demanding software. Not only that, but it has also shown to be a very demanding software for Mac OS. Because of this, many of our group members, not only in the previous Autodesk unit, but in the current Robot Construction unit have found it challenging, to say the least, to make 3D models of Rachel and her parts inside of Fusion 360.

Solution - Fusion 360

Instead of ignoring this problem, and letting our Autodesk division keep working with technology too slow to render the hardy models efficiently, we decided to supply the lead of 3D modeling with the very capable Windows laptops, stored in the dust of our large classroom. As not many of the other groups would be using these, we ensured out 3D models would be done quickly and efficiently.

Non-Technical Problems

Problem - The Wheels

Rachel's wheels have always been a topic of debate at Team EPIC. This is because we ran into the design limitations that Vex robots nearly always have as well as a complete lack of the materials we needed for the original wheel designs.

Solution - The Wheels

Because of this, we decided to change our wheel designs to something much less costly. By changing our designs from being inspired by something very difficult to build in large scale (tank wheels) to something far easier to build (car wheels), we made our robot infinitely easier to manufacture. Though, our new wheels still function just as well as the old ones, which makes our design not only more cost effective, but clearly functional as well.

Problem - Our Ideas

Being a group of five experienced people, whether in the fields of CAD, coding, manufacturing or otherwise, we obviously came into the projects having different ideals and expectations of how Rachel would end up as, in scheme of a final project. Because of this, it started to become very difficult to push forward new ideas without getting shot down. We ended up with a pretty mediocre robot because of this team design originally.

Solution - Our Ideas

To fix this, we allowed ourselves to speak full ideas without having the chance of being ‘shot down’ like before. The full team decided to vote on ideas after letting the person presenting fully flesh their ideas out to the group. Because of this, we ended up with a better robot as we combined the otherwise negligent levels of genius of every member in the group.

General Reflections, Lessons Learned and Future Improvements and Teamwork

Lucca Anthony Marcondes Browning

General Reflection

I started this semester long Robotics course knowing nothing about robots except that they move when a computer tells them to. Though through hard work and dedication, I spent many hours both inside and outside of class learning information our class needed to know for this final project to the highest degree I could. From learning coding languages such as Ruby, to learning skills such as making 3D models of robots in Fusion 360, I slowly amassed the knowledge I needed to for the final project of this class. The combination of all of these skills allowed me to effectively contribute to the success of our group.

I took the skills I learned earlier this year, not only to effectively create this technical paper with the full understanding of the subjects I was referring to in the paper, but to also help my teammates with their workflow.

Lessons Learned

Over the course of this project, I learned quite a few important skills, not only useful for individual work, but useful for both running and participating in teams. These go as follows:

- I learned that not everyone works at the same pace as me, and just because they aren't doing their job quickly by my standards does not mean they won't get their work done to the best of their abilities.

- I learned how to use the flattening and flexing tool. Earlier in the project, I was asked to flatten some aluminium. I used the tool to make the bent strips of aluminium as flat as a pancake. These components were used later on in the creation of the chassis for our robot.

Future Improvements

I know I wasn't a perfect teammate in this project, no one in the world ever is. However, I want to learn from my mistakes to not make the same mistakes in the future, and to make myself a better teammate overall.
I learned how to cope with failure. I now know that I may need to change the designs I noted down in my technical paper in the future based on the limitations of our group. For example, Christopher changed the design for the wheels after I had finished the section for the wheels on the technical paper, and I needed to incorporate it into our paper. Because of this, in the future I will have a more open mind to design changes that will make an overall improvement in the efficiency of our group, as we'll be working more like a machine with a sole goal and purpose.

Christopher Masuda Lee

General Reflection

This semester was very educational for me as I had begun this year knowing nothing about robotics to learn a little about robotics. As this semester I learned things such as coding and 3D modelling on fusion 360. Even though being in this course hasn't taught me a lot about robotics I have been able to learn about leadership skills. This allowed me to help keep everyone in my group moving in the right direction by keeping everyone on the same page in my group. This allowed me to effectively guide my group and to keep everyone on task.

Lessons Learned

In this unit some of the things I learned about leading a team was that:

- People in a group sometimes people need help or a break when they have a overload of work. With this help being in the form of a break or physical help in a task.
- I also learned that sometimes personal standards can be impractical in a group. I learned this through seeing the lack of progress my group had made along with the the lack of quality in some of my groups work.

Future Improvements

I think that I personally found this project to be a very good learning experience in learning about how to manage people; however, I think that as a team mate I was lacking. As I personally feel that over the project I lacked proper communication with my group members; because, I wasn't very proactive in communicating with my group. So to further improve I would have been more communicative with my team members. An example of my failure in communication being my lack of communication when we changed the design for the robot without informing my group member doing the technical paper. This shows that I lacked proper communication skills. My lack of communication skills I believe is something that I would try to improve by being more proactive in communicating with my group members.

Avya Suteku Kohli

General Reflection

This semester was really a journey that took me all across the robotics world, from simple coding to building a robot it was a real roller coaster. Coming from a background with no knowledge of electronics or Robotics in general. I had learned so much actually working with a robot hands on. I never before built a robot and never really knew the struggles that came with it. The hardships of painstakingly attaching every nut and bolt to another piece of metal. I found a new respect for engineers. The design aspect was extremely difficult as getting an idea that would satisfy everyone and be able to accomplish its a task is hard. I found CAD to also be a great learning experience in the design section working CAD gives you a new look in something and a different view to your design and how it would look in 3D rather than on paper. I had done some minor coding in Scratch that's what the extent of my training in coding was. So Python was a fun challenge that I continued outside class as well. I skills I implant on the design mostly came from previous skills I had developed over the years from art course and youtube videos. Though my greatest strength was communication and I never knew that before this project because I think this was one of the most collaborative things I have ever done.

Lessons Learned

- People around us have different values, ideas of hard work, and what drives them. This project taught me to harness these things from people to help bring out their best work in the project.
- I learned the difficult and hard work required to make a robot. Especially thinking about every small detail on what goes where which part goes with what piece. I found myself relying more on my team. As a collective knowledge is always better. At the start, I didn't know that I tried to work more independently. I found that my team had knowledge that I lacked and I need them more than ever.

Future Improvements

I think I could work on my frustration. I found myself this project wanting to quit at certain points and extremely frustrated. I need to find a way to improve on this especially my frustration and stick through because I know at the end of the day there will be a good outcome. I didn't use my team to the fullest of its ability. My team was a powerhouse people had so many strengths. I could have used them way more. I could spend time learning how to do something rather than trying to do it by myself. I found myself lack some communication skills to able to ask for help thinking I could do it all in some parts. My ego was too big. I need to not worry about what people might think about me asking for help.

Erik Rolskov Rosenbalm

General Reflection

I took Intro to Robotics this semester because I felt like with another elective slot open I should pursue my interests. Intro to compsci was interesting but not super challenging, so I know for sure I ought to further that area of education or else I am cheating myself, especially in the world of today. Robotics has been something I knew I should get into what with my knowledge of legos bordering on the esoteric and my interest in shiny moving objects greatly exceeding that of the mentally healthy. I was interested to note that the class seemed to emphasize self-study as did the US History class I took with none other than Bart Millar in the tenth grade, except more so. I found myself a bit more interested in the learning process itself than showing something with it which in turn showed some effect on my regular habit of not putting printed pictures in my engineering notebook. With hard work and determination, I recently overcame that habit. Overall, I enjoyed the class but ended up getting a bit shafted when it came to the delegation of responsibilities. As I seemed to be the only member of our group willing to put up with the abuse Fusion 360 would dole out, I was assigned to do the CAD and later all of the coding. I originally thought that the CAD would not be too much trouble and that I could move onto my real passion: tinkering. This was not the case, sadly enough. I was later saddled with coding and got away with the compromise of modelling the frame and letting Devan Dooling, our new grunt, do the modelling for the claw and internal apparatus(es). With Devan, Avya, and Chris all slaving away at the robot, it barely got completed on time.

Hooray! However, Dooling could not find it in his power to muster up enough courage to look into solutions towards the issue of assigning resources which could be allocated to the purpose of setting up a council that would decide how to best go about approaching thinking about the issue of considering the vast depths of the horrors of Fusion 360, so I ended up doing all of the CAD modelling anyway. And the code. And not doing any hands-on tinkering. This made me a bit sad.

Lessons Learned

- Don't be a passive wallflower, even if it is your emotionally unbalanced friend who is not quite but almost trying to overwork you to the point of death.
- Communication is key.
- Always plan in cushion time.
- Hope for the best but expect the worst.
- Social loafing isn't as fun when you aren't doing the loafing.

Future Improvements

- Following the Gantt chart might help.
- Delegating responsibilities evenly might help.
- (for myself) Promoting my own interests a bit more might help, at the expense of other team members who really honestly just can't figure out fusion 360, honest.
- (for myself) Writing a reflections with less passive aggressive intent.
- (for myself) Knowing my own limits and keeping an eye on time so that I can proactively alert my team leader to future issues with efficiency and delegation instead of typing about it weeks later in a reflection document.

Devan Dooling

General Reflection

Over the course of this semester, robotics has been a very fin challenge to complete. At the start of the year we started to work on coding in Code Academy, I was already pretty good at this because I have taken computer science previously. However, building robots were the real challenge. I have never built robots before so this was definitely a challenge. When we started out it was though, we were behind and we couldn't figure out how to put our own wheels on. However we grew from this, I made a significant progress towards our groups robot. I helped make the frame of both the top and the bottom of the robot. This wasn't too hard but finding the right screw and the right bolt were definitely a challenge. However I learned from this again. I made the entire claw. The claw was a bit hard to build because of the small bolts and the motor. However I had Mr.Millar by mis side to help me figure out the correct way to meet my goal. Overall me and my group started a bit behind but as we finished up everything started to come together to the great robot we have today!

Lessons Learned

I think that in the future of robotics I can work a bit harder to understand the CAD components of the robot and a bit less of the building. Because I am quite fluent with the building of the robot i need to branch out to get other skills that will help me in the future.

Future Improvements

- Teamwork is key- not one person can carry their whole squad to victory
- Work hard! If your not working at your max potential at all times things will not always come your way.
- Believe in your teammates- with assigned roles do what you need to do and let your team do the rest, if your not focusing no one else will!

Sources

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b. Supplier of Materials
c. Supervisor
d. Gave feedback on Working Technical Paper

Mr. Harvey

a. Gave us Workshop Space
b. Suppler of Tools

Singapore American School

a. Funding

The Rubric

TECHNICAL REPORT	MAX SCORE = 81	
1 0 = Yes (1) or No (0)		
3 2 1 0 = 3: Exceptional, 2: Excellent, 1: Good, 0: Poor or missing		**SCORE**
Overall Presentation	**13 pts max**	
Report is 10 pages or less	1 0	
Measurements are in SI units (exceptions include 1/2-inch PVC, etc.)	1 0	
Report is well thought out, logically organized, and concise	3 2 1 0	
Note: The report should follow a logical flow and not necessarily the order presented in the specs, where budget comes before the rationale.		
Report is professional and well written (e.g. attention to spelling, grammar, sentence structure)	2 1 0	
Includes a table of contents	1 0	
Report clearly describes how the vehicle was designed to accomplish the missions	2 1 0	
Report demonstrates an understanding of the technical and scientific concepts behind designing and building the vehicle	3 2 1 0	
Title Page Contains	**4 pts max**	
Includes all elements as specified in the guidelines	2 1 0	
(Team name; school, club, or organization's name, location; lists members of the team and their role; name of instructor/ mentor)		
Presents a professional view of the team	2 1 0	

Abstract	**3 pts max**	
Is 250 words or less	1 0	
Concise and clear summary of the team's work	2 1 0	
Photos of Robot	**5 pts max**	
Photo of the vehicle is included	1 0	
Includes additional photos to help fully capture the design of the robot	1 0	
Photo captions or descriptions accompany photos	1 0	
A mechanical drawing or sketch is included (may be of a sub-system)	2 1 0	
Note: A mechanical drawing is defined as a scale graphical representation of the part or system to convey manufacturing information. The intent is to deem excellence if the drawing/sketch is particularly well done.		
Bill of Materials	**2 pts max**	
Parts are listed accurately	2 1 0	
System Integration Diagram (SID)	**4 pts max**	
Is a system-level, connection diagram (not a board or component-level schematic)	1 0	
Makes a clear distinction between the controls and the robot	1 0	
Created using CAD	1 0	
	1 0	

Design Rationale	**14 pts max**	
Presented in a clear and logical manner	3 2 1 0	

Demonstrates step-by-step planning and design process	2 1 0	
Describes how the team brainstormed ideas to solve the mission tasks and evaluated those ideas against competing alternatives	3 2 1 0	
Effective (and not over-) use of images, schematics, and data to communicate their "story"	2 1 0	
Demonstrates acquisition and application of technical skills	2 1 0	
A flowchart describes the software flow OR rationale is provided describing why a hardware only approach was selected	2 1 0	
Troubleshooting Techniques	**4 pts max**	
Explains a troubleshooting technique(s)	2 1 0	
Describes any testing done on1 components or the robot	2 1 0	
Note: Two points if whole vehicle was tested; one point for component testing only		
Vehicle Systems	**2 pts max**	
<u>Original vs. commercial design</u>		
Are any components built by the team?	2 1 0	
Safety	**8 pts max**	
Includes a safety section	1 0	
Describes team safety philosophy and practices during design and development of robot	2 1 0	
Describes specific safety features of robot	2 1 0	
Describes safety precautions necessary while handling/operating the vehicle	1 0	
Includes examples of safety incidences (from band-aids to accidents avoided)	1 0	

Team shares a copy (preferably as an appendix) of its own safety checklist that is organized and well-thought through	1 0	
Challenges	**4 pts max**	
Describe at least one challenge faced	2 1 0	
Note: Two points if both a technical and a non-technical challenge are described		
Method(s) used to overcome the challenge(s)	2 1 0	
Note: Two points if both a technical and a non-technical method are described		
Lessons Learned	**4 pts max**	
Lesson learned or skill gained relating to the process – technical	2 1 0	
Lesson learned or skill gained relating to the process – interpersonal	2 1 0	
Future Improvements	**2 pts max**	
Thoughtful and logical discussion of a least one improvement	2 1 0	
Reflections	**2 pts max**	
Thoughtful personal or professional accomplishments from competition process presented as a team or as individual team members	2 1 0	
Teamwork	**7 pts max**	
Team demonstrates that the robot (and the report) was a team effort	2 1 0	
Team demonstrates that its members, and not mentors or working professionals, designed and built vehicle, particularly electrical and software	2 1 0	
Team developed specific assignments to design/build the vehicle	1 0	
Team developed a schedule to aid in building the vehicle and describes how they kept to or strayed from it	2 1 0	
References	**1 pt max**	

Lists any books, journal articles, web sites, etc. used as sources of information	1 0		
Acknowledgements	**2 pts max**		
Companies, individuals who contributed funds, equipment, and/or technical/moral support are acknowledged	1 0		
Team acknowledges organizations and/or individuals who contributed funds, equipment, and/or technical/moral support	1 0		
Technical Report Score:			

Comments: