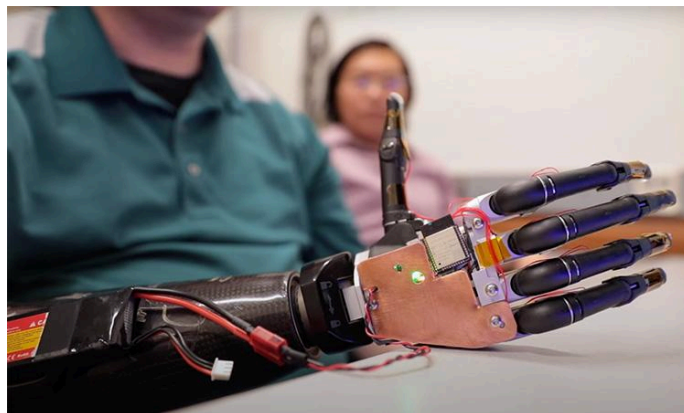


Team: Hand It Over & Run

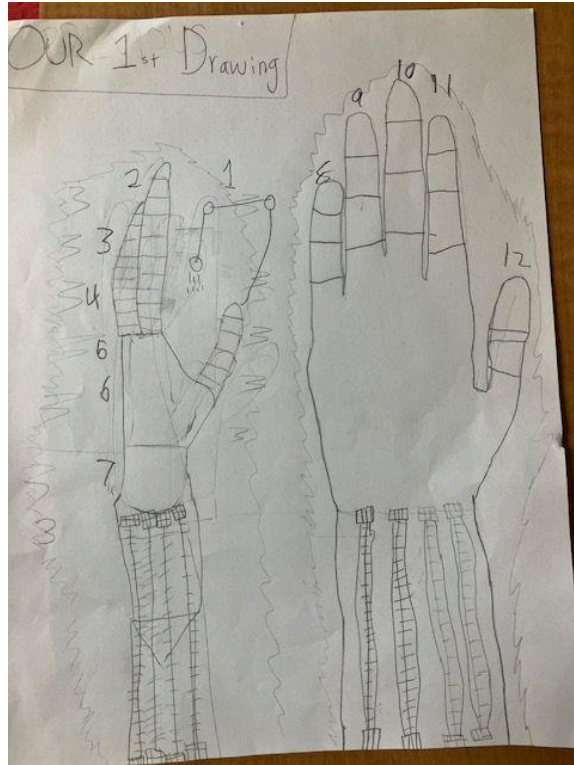


Team Members and Mentor: Luqman Muhamed (Mentor), Suleman Muhumed, Zayed Alhoshan and Abdullahi Hussein

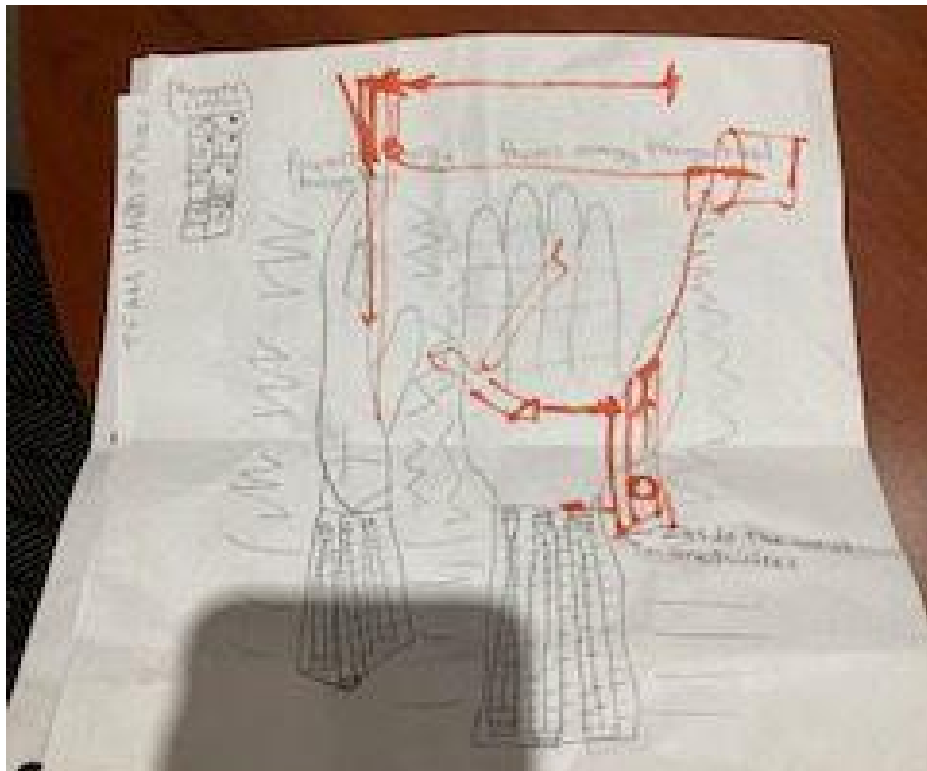
Photo Taken: Mankato (State University)



Imagine the future of machine learning and bioengineering: Faster and Stronger



First drawing - Brainstorming Ideas for 12 steps

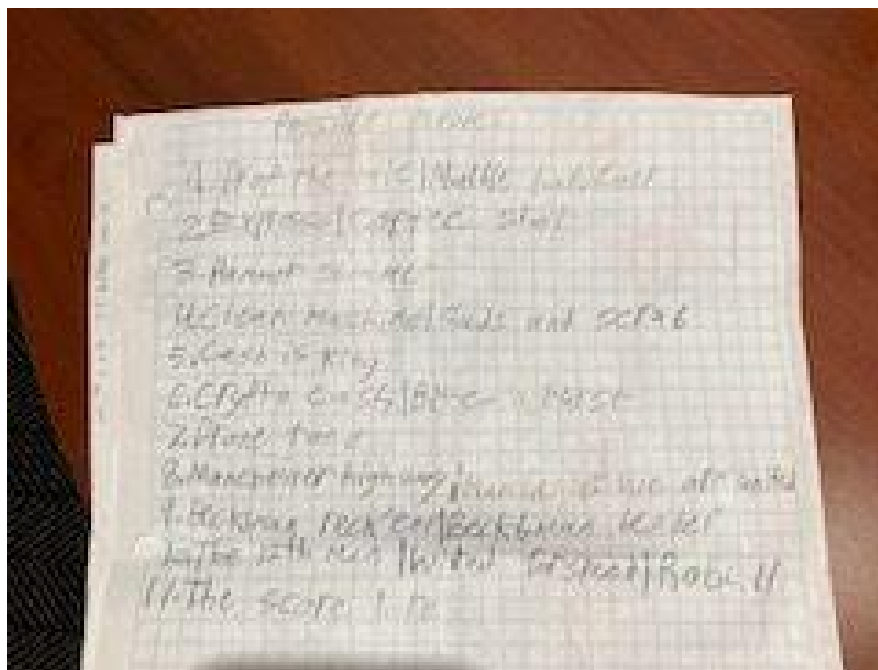


First drawing - Brainstorming Ideas for machine options

Almost Our Final drawing:



Steps - Ideas: Some steps changed and we made better parts based on new ideas.



Step 1: Let's Get Rolling



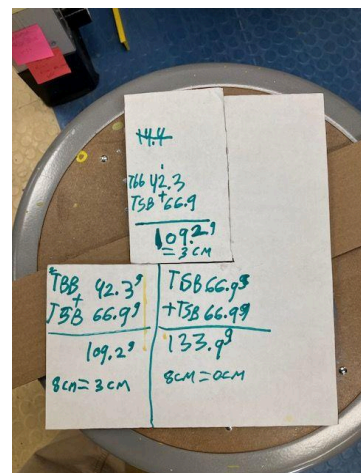
The marble rolls down the inclined plane/ramp with its kinetic energy then goes into the soap bottle.

Step 2: Shower Time



The marble goes into the soap bottle. The soap bottle is on one end of a string on two pulley wheels. The soap bottles go down by the marble's weight. This simulates the man taking a shower with his soap, not very easy with a prosthetic arm. Then, data goes down the inclined plane and is used to make the shower and soap action better in the future.

Calibrating the Pulley Weight
 In step number 2 we needed to calibrate the necessary weight in order for the prosthetic hand to lift up the coffee cup when the soap dish went down. We designed the pulley and made it better by calculating the weights.



	<p>For step number we used 2 one blue marble that was 42.3 grams and one steel marble that was 62.9 grams = 109.2 grams. This was enough to raise the coffee cup and hand by an adequate 8 centimeters so the end of the hammer lifted up and the hammer head went down.</p> <p>New science/engineering concept for us: fulcrum. Write an explanation of this concept and show a photo of the hammer and the placement of the screw.</p> <p>Create a glossary of terms, including types of energy, types of machines, important concepts like redundancy, fulcrum, etc.</p>
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Step 3: Espresso Shot



When the soap bottle goes down on the end of the pulley into the blue box (elevator), the hand and the coffee cup go up because of unbalance and the hand learns to drink the espresso and wake up from the caffeine.

Step 3 Espresso Shot 2.0

- 1.

The hand was inconsistent and after Mankto we decided to focus on improving the machine. One of the other teams built a machine and had an arm for calcium tests because of something called osteoporosis. We like their idea of the cast bandage but the arm was too big and way too heavy. They told us they filled the bandage with plaster. That was heavy. So we brainstormed and our teacher showed us a foam spray to fill cracks in construction. The school engineer gave us a can and we tested it and it was so great. We sprayed the foam in things - like the



extra soccer cleat and decided it would work. So we did these steps and our teacher checked with the progress:

1. Make a cast of Abdullahi's hand.
We ALL wanted to make one but we did not have enough cast material.
Hint: use vaseline so that cast can come off easily. Youtube recommendation.



- 2.
- 3.

2. Cut the cast off carefully before it is hard.
3. Let the cast dry for a class period.



4. Fill the cast with spray foam.

4.





5. Weight the cast and foam. Our cast and foam weighed 178g and the paper hand was 52.8 g with a cup.

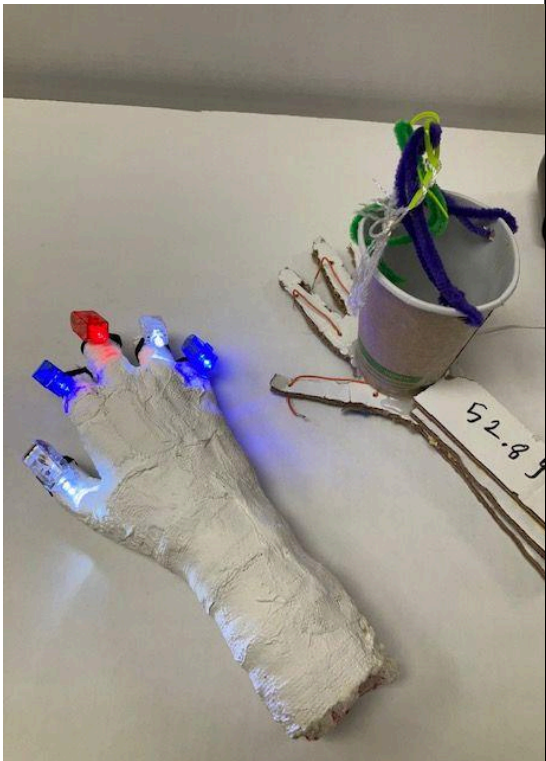
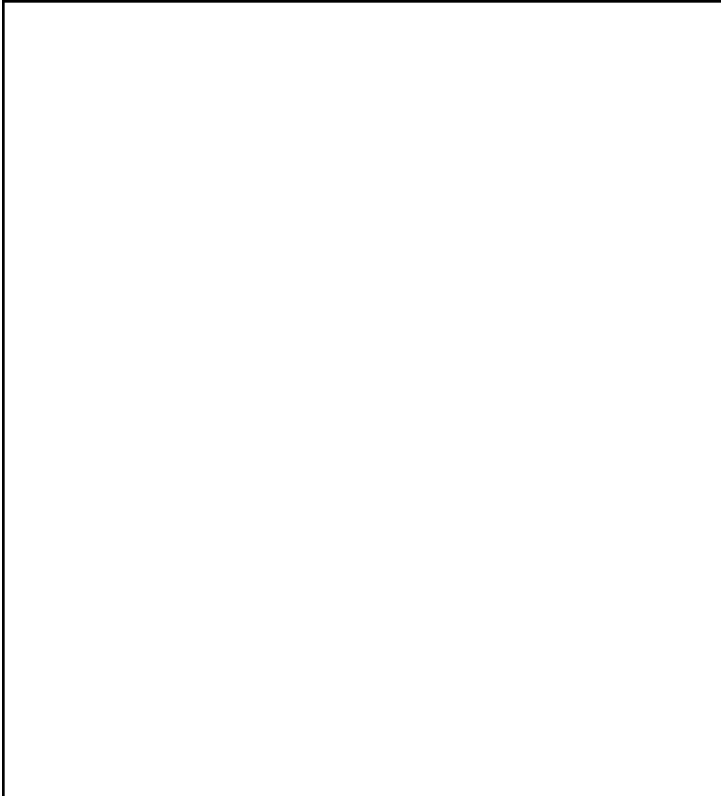


6.

6. Now we need to add some weight to the bottle because the cast and foam are heavier than the paper hand. We added glue that would hard.

Now the hand looks cool and it might work better. We need to test it but we need to give this journal to the teacher today. If it doesn't work, we have the paper hand and will make it better for our trip to Rochester.

And we added lights that we bought on our trip to Axman after Mankato because we wanted to improve the looks as well. Form and Function as we say.



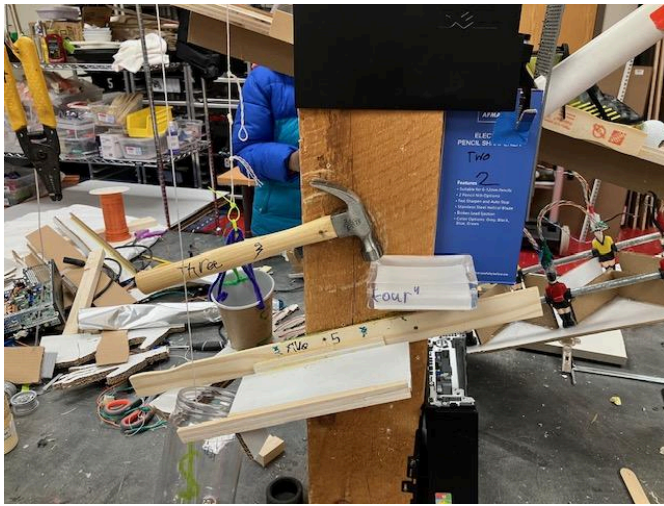
Step 4: Hammer Slammer



After the coffee cup and hand lifts the hammer on the axle, the hammer head pushes one end of the soap dish down because the weight on the soap dish is unequal and is on an axle. The heavy end goes down and the marble on the dish rolls off and into a piggy bank which is simulating that the man is at work and his prosthetic arm is learning to work with tools and he is making money - falling into the jar = the bank

Step 5: Cash Rules

Then the money that he earns from work is going to be placed into the jar/bank and that's how he makes money into his bank. Which stimulates the man making money from his job. The money is the steel marble and it rolls down the incline plane. When it is on the dish it has potential energy then kinetic energy when it rolls down.



Step 6: Crypto Cash



Calibrating the Pulley Weight
In this number 6 we are trying to find the adequate weight to activate the switch to turn the electric motor on and in order to do that we need to find the adequate weight to lift the DVD hard drive on the other end of the pulley. The steel balls in the bank DVD hard drive each weigh 62.9 g and there are 2 balls. So we need something lighter than 125.8 g. We found options and weighed them. The hard disc was 35.7 grams which was so light it went up too fast and with too much force and could damage the electric switch. The mother board was so heavy and 143.2 grams. So instead we used a smaller computer board which was 83.4 grams which was sufficient to activate the electric motor and went up at a good speed.

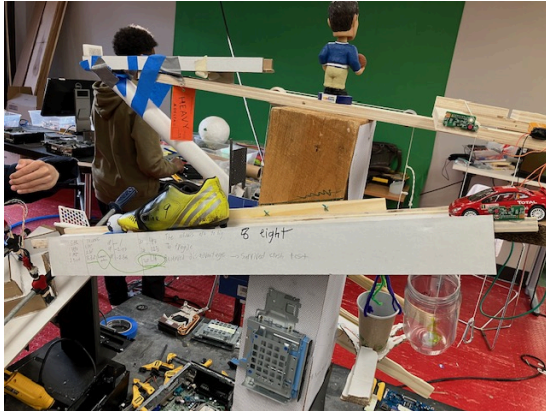
Step 7: Drone Tone



We need to turn on the electric motor and push the car down the inclined plane. The circuit has two connections for the switch. One is on the bar at the top and the other is on the pulley string attached to the jar bank. We want bonus points because the high school teams must have an electric step and we are in middle school.

When the computer board that weighs 83.4 grams goes up on the string on the pulley because the balls in the bank weigh more than the aluminum foil on the stick and a wire connected to a circuit touches the wire on the top the electric circuit is closed. Then the energy from the battery turns the potential energy to electrical energy and the stick goes around on the axle of the motor. This is a good step and looks cool with so many wires and connectors.

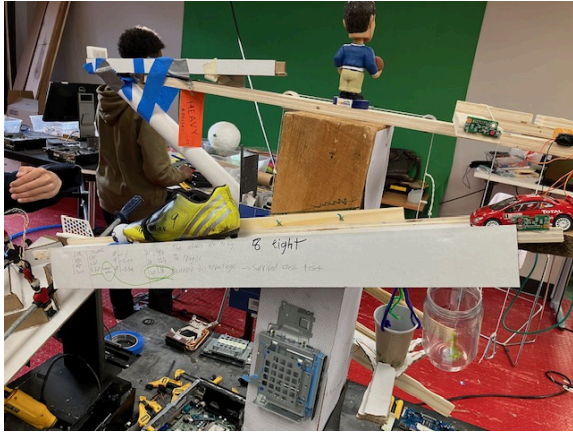
Step 8: Manchester United Highway



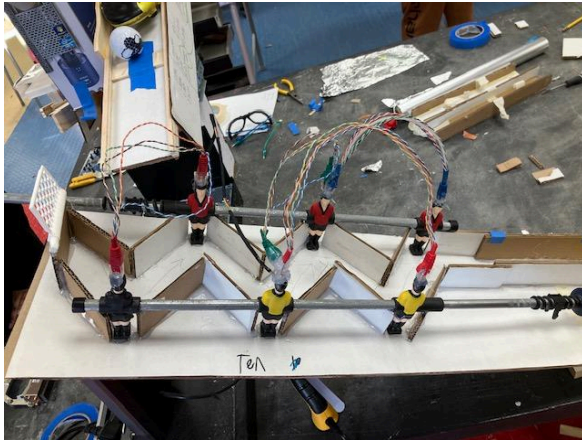
The spinning motor pushes the car down the inclined plane toward the soccer game. The prosthetic leg is strong and has learned how to walk and run and he can drive and hang out with his friends. He can do so many normal things and his legs and arms are better and smarter every day because of technology.

Step 9: Beckham Reck'em

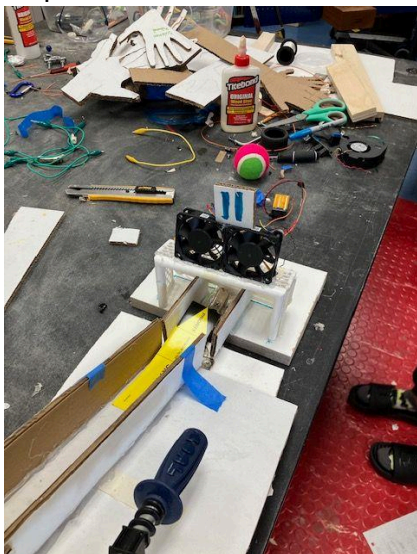
The kinetic energy of the car goes down the inclined plane and hits his cleats. The energy transfers to the cleats and the cleats move down the inclined plane with kinetic energy. This means the man can get dressed for the game and play a great game of soccer by kicking the golf ball or the "soccer ball".



Step 10: Crossing Players



Step 11: Scores!



Then the soccer ball rolls down the inclined plane with kinetic energy because it was pushed by the cleat - like potential energy waiting on the inclined plane. The ball will go through the maze and go through zig-zags. Which is simulating the man crossing players and is a very adequate player.

All of the wires simulate the learning and the prosthetic leg is stronger and better because of the information and machine learning. And we might be successful sending marble though the inclined plane to the data center.

Then the soccer ball strikes a goal. Which means that the man is a very excellent player and he scores a goal. The ball rolls onto the hinge from a cabinet and the hinge touches aluminum and the two wires touch and complete another circuit. The electric energy starts from 2 fans from a computer. This simulates the soccer 'fans cheering the goal.

The technology means can have a normal life and play soccer with his friends after work.

Overcoming Obstacles using the Design Process

Step 4 was a challenge, our idea was to use an axel to support the platform. A heavy ball would balance on the platform until a weight from the hammer caused the platform to tip.

The ball would then go down the inclined plane into the jar and raise a wire cutter to cause electrical energy and go on from there. Our previous idea didn't work as well. It was floppy and the ball would roll off the platform. It was unstable and did not always work.



This is our new and more stable idea. Now, the wood platform is changed into a soap dish. We used the same kind of perspective but changed the platform so it is one piece and is concave so the marble is lower and stable until the hammer hits the dish. And it looks better and fits with the soap in the bottle.

3 Main words:

Consistency, Redundancy, Organization:

These words define what we use all the time and how it helps with our machine.

These words are how we stay productive and how we always don't get lost. We all memorized these words and what the words mean.

Consistency: means being self-contradictory, our views and actions were always consistent.

Redundancy: means something that's not useful but more than needed because things were very unnecessary in the beginning but it became more than needed.

Organization: is something that we were struggling with in the beginning. Now, we use bins and boxes to store our materials and stay organized as a team.

Data Collector:

Our data goes down the ramp which we made many holes in, we resemble that as a filter. The filter is what processes the information or the marble because all of the data is not equal, they are not the same size. Therefore, the holes or the filter will process that. We use a data bank to collect all the data, it can get that information with the ramps.

Axeman Surplus: We went to Axman and bought very cheap but very useful items. We enjoyed the items we bought such as, a long plastic tube we used as a ramp, a soccer ball because the man loves soccer and we included that, a prosthetic toy which is very similar to our project, and many blue lights at the end of his finger to resemble prosthetics.

Bibliography:

1: [Engineering Machine Design Contest Team Resources:](#)

This resource gave us examples of machine videos, of how machines run, energy transfers and some good impressions of their machines

2: [2024 Engineering Machine Design Contest Official Handbook](#)

This is the handbook that told us all the rules that were required to follow. This site was very mandatory and was a good essential guide we used in our machine.

3: [Human Body 101 | National Geographic](#)

This video shows how the human body works. Also explain the roles of the neurological system and the muscular system that we added into our machine:

This site was very helpful! It helped us with our machine showing us our body and what is prominent for our body. It was very helpful because it had a major relation to our machine.

4: [EMDC 2024 Theme Introduction](#)

This video was very exceptional! It had a part where it talked about prosthetics and how they function similarly towards our body. We really enjoyed this fascinating video because it was very interesting.

5: [Research Spotlight: UMN Allows Amputees To Control A Robotic Arm With Their Mind](#)

This video was 95 percent of what our machine mostly does. Their machine is controlled by a neural chip inside their arm to read the person's brain. Our machine is controlled by a data collector which collects data for everything he does. This fascinating relation had to be part of our bibliography and it was a very interesting video to learn about modern technology and the human body.

6. Fedja Kecman presentation. He is a 3M engineer and immigrated from Bosnia. He explained the engineering process and things he has made with teams. And he let us sit in his Tesla. He was very smart and nice and young. He visited our class after Mankato to help us get ready for Rochester.



02-15-2024	Description	Our team was brainstorming, We had to find the right materials and mentally prepare for what we were getting into. We also started a Journal where we had to write everything from the beginning through the end of our project. And created a Google sheet with date validation to track our project since this is required and a good idea.
02-16-2024	Description	Our team was brainstorming, We joined calls every Friday which was required for our team. We told and inspired ourselves how we can do better and mentally put into our brain this quote that Dr.Blue mentioned to us, which is "YOU GOT THIS".
02-17-2024	Description	Now, we had to draw our ideas and kind of vote how to start as a group. We would say and explain our first ideas to our team members. We thought of a prosthetic arm and cool technologies.
02-18-2024	Description	Once after that, we had to originate our idea. We had to break it up into steps and make up what it would do and sometimes we disagreed but after some time, we finally found the best solution.
02-19-2024	Description	Then, we drew so many times which reminded us of another quote "PRACTICE MAKES PERFECT" and we never gave up. We were very dedicated to our project. We always used to come to the engineering lab where we were making the projects once we finished our assignments for school.
02-20-2024	Description	Once we drew our steps we now had to make our prototype. We learned about simple machines which we had to memorize and add some of the simple machines into our prototype. We also practiced making the simple machines before we started.
02-21-2024	Description	We then started with our first prototype which was not as we expected, we always remembered "PRACTICE MAKES PERFECT". So we kept moving on but always worked on the 6 simple machines and motivated ourselves.
02-22-2024	Description	We made a lot of prototypes and improved our prototypes we kept building, which gave us even more confidence to keep going and we never stopped building the prototypes because they were very mandatory. That was our key to perfecting our machine.

02-23-2024	Description	We then thought we built enough prototypes and discussed them. Once we discussed the prototype building. We thought and improved by a lot and we should now get started on our actual machine.
02-24-2024	Description	At first we made a prototype with some pipe cleaners and pencils . Suddenly we knew that would take too long and decided that we will think of something else.
02-25-2024	Description	We were looking at some ideas from Youtube and looking at some prosthetic hands and how they function. We assembled and talked about how the machine could work.
02-26-2024	Description	We thought of using used materials. We looked at some tutorials on Youtube of prosthetic arms and how they function. We also had a very significant quote that Dr.Blue told us, "FUNCTION IS BETTER THAN FORM".
02-27-2024	Description	Once we watched the video, we got the big wood block and put it into our table. We also used some cardboard and tried to use that for ramps and we also used some strings. Now we thought that we had some essentials and that we started building.
02-28-2024	Description	We discussed our Friday meetings for our group. We had discussed our ideas to do with the essentials.
02-29-2024	Description	Our team found more materials such as a soap bottle and some screws which were part of the 6 simple machines. We practiced cutting cardboard and making ramps/inclined planes.
03-01-2024	Description	We finally started attaching some of our used materials into our huge wooden block or our base for our prosthesis. We then got used to doing some of things we thought were challenging such as hot glue and some drilling but soon enough, we knew that we underestimated it.
03-02-2024	Description	After that, we started making a lot of improvements and went to being a very stubborn group and now expressing our ideas truthfully as a team and remembering the quote "no matter what you got this". We tried using an electric bench drill machine and a few days later we got the hang of it.
03-03-2024	Description	We then started using a lot of machines and always loved it. We now knew that we got the hang of it. We had a lot of machines and always enjoyed every second of it.
03-04-2024	Description	We practiced making ramps because that was a very significant essential we needed in our project. We also discussed 6 other simple machines.

03-05-2024	Description	We then added tubes for the marbles to go down through and added a circuit which will start the very own machine itself. Once it does that it will lift down the oil can and raise the prosthetic arm stimulating it drinking coffee. We then thought of building ourselves and discussing even more.
03-06-2024	Description	After that, we thought of attaching a hammer because while the hand with the coffee cup goes up it will push the hammer down which will release a marble down into another cup
03-07-2024	Description	Today, we fixed the ramps and used the machines even more. We are also working on this project that will explain every little detail we had in our thrilling journey to stimulating a prosthesis.
03-08-2024	Description	Today, We made a step journal in google docs. We recorded everything we did and also added all the energy transfers we used. We discussed all the steps and how much more we needed. We also practiced drilling some more and made more ramps.
03-09-2024	Description	We just focused on the step journal. We also tried to fix our punctuations and grammar. We practiced our speeches before we head to Mankato, which we are very excited for.
03-10-2024	Description	Today we were working on our journals and added an electric motor into our machine. We also added foosballs into the machine and the function is almost done and the form is gorgeous.
03-11-2024	Description	We worked on our journals today because we were going to start another one on Monday. Also, It was a weekend but Zayed, one of our teammates stayed after school for 6 hours on Saturday and 6 hours on Sunday.
03-12-2024	Description	Today we made 2 other journals and one of the journals had pictures and the other had materials listed. And adding some new features onto our machine. And today was the FIRST successful machine run.
03-13-2024	Description	We then added a soccer goal onto our machine and electric fans that simulate the crowd. It looked very beautiful and amazing.
03-14-2024	Description	We took the machine apart and organized the parts for Mankato. Our machine is ready.
3-15-24	Description	We went to Mankato and learned a lot about our strengths and weaknesses. We learned how people judged us on our perspectives and how we do things differently. The positive result was that we won first place and we were very impressed.

3-16-24	Description	Saturday, NO SCHOOL
3-17-24	Description	Sunday, NO SCHOOL
3-18-24	Description	Monday, we reassembled the machine and identified damaged areas and had a team meeting and discussed the judges giving us our scores. We also talked about our strengths and weaknesses.
3-19-24	Description	After we discussed our scores we had to go back to our journals, our machine, our drawings and original ones. We also try to identify some errors in our journals, drawings and machines.
3-20-24	Description	We had to keep working, and make sure that we identify our errors and discuss our rights and wrongs.
3-21-24	Description	Today, we stayed focused and made sure that nothing distracted us from our working time and made sure we were consistent.
3-22-24	Description	Now we found the errors such as in our maze the cardboard was ripped apart in some areas but not too deep. We also tried to find some more errors in our machine.
3-23-24	Description	Saturday, NO SCHOOL
3-25-24	Description	Sunday, NO SCHOOL
3-26-24	Description	Today, we tried to add some more ideas into our machine and also decided to make new roles for our teammates. Suleman took the painting for the machine but that is at the end for now he is working on the journal and fixing errors. Nuh is working on our first drawing of our machine because unfortunately we lost that and at the end of making our drawing, Suleman will help him. Zayed is working on the word "Organization" which is key, he will organize our items so that we don't worry about organizing our machine at the end. CONTINUED
3-27-24	Description	We worked on the roles we got chosen from our Captain, Abdullahi, he told Suleman to do the journal and told me to fix errors and add some details in our journal. Nuh was drawing the hand and adding our old steps we wanted to add.

3-28-24	Description	Once we figured out our roles we wasted no time and worked on what we were tasked on. We made sure this time it was perfect, especially reviewing our scores on the Mankato competition.
3-29-24	Description	We visited a place called AxMan, their products were very cheap but useful tools that were just known as the word "junk". Since that was a significant part of our machine design and operation we had to use those items in the store. We got items such as a long tube to use as our ramp for the data collector. We also got a soccer for the machine design knowing from visualization that the man loves soccer. We also got a toy man in a war from our perspective, and since the man was injured in the Ukrainian war that was a big relation in our machine
4-2-24	Description	We worked on our roles very much which we are going to be more focused on this week and next week, our goal is to improve our machine and make sure we stand out. We improved a lot and we can tell our team is going to go from zero to one hundred in a matter of seconds.
4-3-24	Description	Now we had to work harder on our journals because the journal was due next Monday, therefore we had to work on our machine 2x as hard and our drawings and scripts and more.
4-4-24	Description	Now we had to stay organized. That was one of our key words we always had to include in our machine so we built a box where we stored all of our materials for Rochester.
4-5-24 to 4-14-24	Description	Spring Break
4-15-24	Description	Today was a very significant day for our journals because we had to complete our finishing touches of our journal and we also had to prep for Rochester because we had 4 days left.

Component	Description	Cost	Quantity	Type	Type	Reusable
Cardboard	Inclined plane	Free	4	Regular Cardboard	Donated	Yes
Duct Tape	To make it stable	\$4.00	1	Regular Duct Tape	New	No
Tile Sample	To make it go down the ramp	Free	1	Regular Tiles	Donated	No
Computer Grill	decoration	Free	1	Dell	EMDC	Yes

					Component	
Soap Dish	To get hit by the hammer	Free	1	Acrylic	Recycled	No
Hammer	To hit the soap dish	\$5.00	1	Wood	EMDC Component	No
Wood	To make the whole machine stable	\$0.00	1	Regular Wood	EMDC Component	Yes
Lego Hubs/Wheel	A important part of the machine	\$3.00	4	Lego Hubs/Wheels	New	Yes
Wire Stripper	A pulley	\$8.00	1	Regular Wire Stripper	EMDC Component	Yes
Plastic Jar	A pulley	Free	1	Peanut Butter Jar	Recycled	Yes
Soap Bottle	A pulley	Free	1	Regular Soap Bottle	Recycled	Yes
Aluminum foil	the two aluminum foils have a magnet that has potential energy and when bringed together they turn into kinetic energy	\$4.49	1	Made of steel	Salvage	No
Zip ties	A pulley	\$0.04	2	Regular Zip Ties	Salvage	Yes
Pipe Cleaners	A pulley	\$0.06	3	Colorful	Salvage	Yes
Fans	Resemble as fans in the crowd (Ax Man)	\$2.50	1	Black and Smooth	EMDC Component	Yes
FoosBalls	Resemble as the players in Manchester United (Foosball machine dumpster at school - broken	\$0.00	1	Attached to wires on top	Salvage	Yes
Computer Board	Perfect weight to cause potential kinetic energy (dismantled a computer)	Free	1	Perfect weight to activate switch	Salvage	No
Electric Sharpener Box	Use it to guide the marble into the soap bottle.	Free	1	Made of Box and some designs on the front	Recycled	Yes
Toy Car	Drives to Manchester United	\$5.99	1	Red toy car	EMDC Component	Yes
Soccer Cleats	Used to stimulate	Free	1	Green with some	Donated	Yes

	man wearing cleats			designs on it		
Golf Ball	Donated but would cost is we bought	\$2.00			Donated	No
Plastic goal	Made the soccer ball or "Golf" into the goal (Foosball machine dumpster at school - broken	\$12.00	1	Simple Gray	Recycled	Yes
Electrical Motor	AxMan	\$2.50	1	With wires attached and a popsicle stick to spin	EMDC Component	Yes
Hinge	From a broken cabinet door at school. There were three but we only needed one.	Free	1		salvage	Yes
9V battery	Amazon	\$3.00	2			
Marble	For inclined plane	\$8.00	11		EMDC Component	Yes
Cast Bandage	For cast hand	6.40	1	For hospitals	Amazon	No
Finger Light	For cast hand	.95	5	For looks	AxMan	No
Army Man from AxMan	For looks	.25	2		AxMan	No
		\$72.43				

Reflection:

We heard about the Machine Design Contest from previous students who went to Mankato and saw some of the machines they built and immediately wanted to join. At first, we all argued about one thing until our teacher showed us that there were so many things to do. Our strategy was to divide and conquer and it worked because we all had something to do. Also, we worked better every day because we made progress. About halfway in our machine, one of our teammates had to quit the team because of behavior issues in other classes. That was a positive impact for us because he was not focused but also had a negative impact at the same time because we needed more people in our team. So, our coach helped us find a 6th grade student who was respectful, smart and focused. His name is Zayed, Zayed is a hard worker and is always catching up to his work as soon as possible and going to school to work on our machine on the weekends which we were all impressed by.

Some things we loved about our coach, Dr.Blue, is he always said "You Got This' ' and now we have a machine and are finished with MANKATO finishing FIRST PLACE . We are very proud of our machine and our team. Thank you.

List

How to:

1. Create a Hyperlink
2. Create auto pages in a Google doc
3. Insert photos and drawing into a Google doc
4. Create data validation in a spreadsheet
5. Program a sum function in a spreadsheet
6. Create a table in Google sheets
7. Wire a circuit
8. Use a digital scale
9. Organize parts by making a system
10. Cast model a hand and arm