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87265 C

School: **Southridge School**
District: **Independent**
State, Country: **WA, Canada**
Program Manager/Teacher: **Colin Morris**

STEM Project-Challenge: **National/International STEM Competition - VEX ROBOTICS COMPETITION - VRC**
Team Number:
Team Name: **87265 C**
Project Team Members: **Independent**

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IDENTIFY PROBLEM(S) **Entry #1 by Amari G on Tue Sep 12 2023 12:15:10 PM**

Add Comment

Team Profile				
Team Members:	**Experience:**	**Interests:**	**Team Goal:**	**Personal Goals:**
Amari Gill	**Took Grade 9 and 10 Robotics, was on VEX robotics team in Grade 10**	**Robotics, Economics**	**To build a functional VEX robot that is capable of completing all the given tasks in over-under successfully**	**To expand my knowledge of robotics within VEX and in general**
Joshua Hodson	**No VEX experience**	**Robotics, tbd**		**To learn about different aspects of vex robotics (planning/designing/building)**
Tbd				
Tbd 2				

IDENTIFY PROBLEM(S) **Entry #2 by Joshua H on Tue Sep 12 2023 12:42:10 PM**

E.D.E.N. by H.E.A.T. CORP

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Priority Ranking for problems:

1. Meet the requirements for the project
    a. Functions as a robot
    b. Size requirement (before beginning)
    c. Size requirement (after beginning)
2. Transport balls in some fashion
    a. Drivetrain to transport the balls
    b. Be able to manipulate balls rather than push them
    c. Be able to get balls under the net
3. A robot that can do multiple tasks (scoring points, transporting balls, lifting itself up)
    a. Be able to be helpful on both the offensive and defensive sides of the arena
    b. Be able to lift itself up
4. Reliable autonomous code for both sides
    a. Be able to score points (for offence)
    b. Be able to get good positioning (for defence)
5. Be able to traverse the entire arena
    a. Fit under bars on the side
    b. Able to go over the middle bar

DESIGN BRIEF **Entry #3 by Amari G on Tue Sep 26 2023 1:29:41 PM**

Add Comment

Please fill out the table below in the blue cells.

1) Time (how long to complete)	2 months
2) Tools Needed	-
3) Materials Needed	-
4) Cost and Budget	-
5) People (how many, skills and knowledge required)	-
6) Deadlines (be specific)	Completed by November

BRAINSTORMING **Entry #4 by Amari G on Tue Sep 26 2023 1:39:53 PM**

Add Comment

Base:

- 4-wheel drive made of aluminium, because there is no stress, so aluminium is light and won't break.

Possible features:

- Wings (Pneumatics) to pop out and push the balls with a larger surface area

- Roller that picks up the tri-balls and puts them over (video) (video) <

- Launcher (Pneumatics) for balls that you can place directly into the robot

- Launcher that can attach onto horizontal pole and lift the robot of the ground

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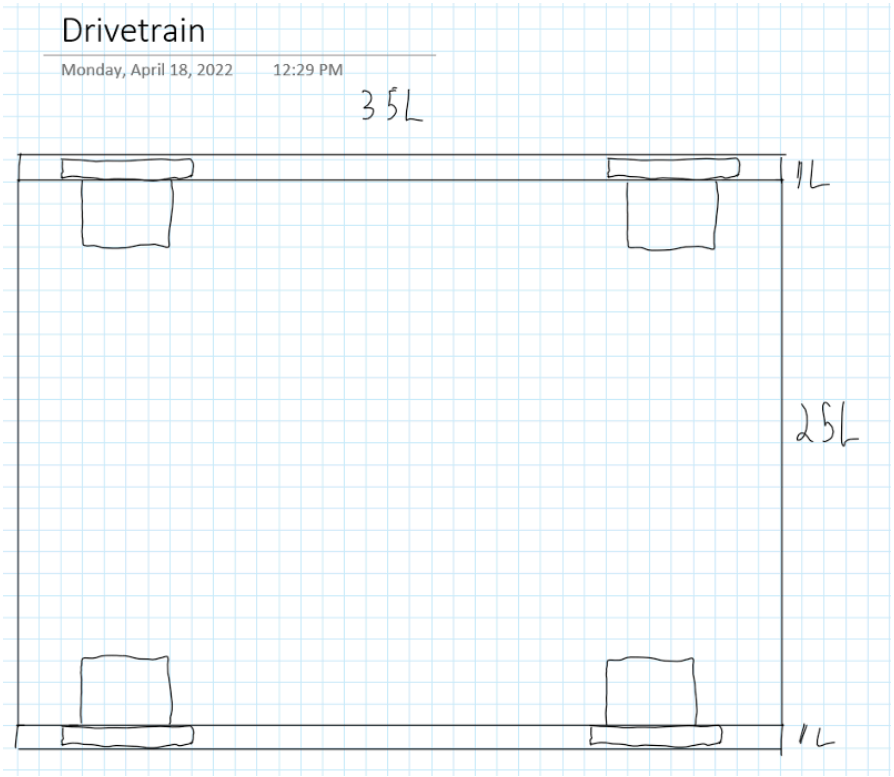
DESIGN/ DRAW **Entry #5 by Amari G on Tue Sep 26 2023 1:41:11 PM**

Add Comment



4 wheel drive made of aluminium c channels

Chosen Plan:

4 motor 4 wheel drive made of aluminium

BRAINSTORMING **Entry #6 by Amari G on Tue Sep 26 2023 1:42:04 PM**

Add Comment

Potential Problems:

4 motor 4 wheel drive

Heavy

Lots of space needed

2 motor 4 wheel drive

Can't drive over middle

Tank

Can be pushed

Rear wheel drive

Can't drive over middle

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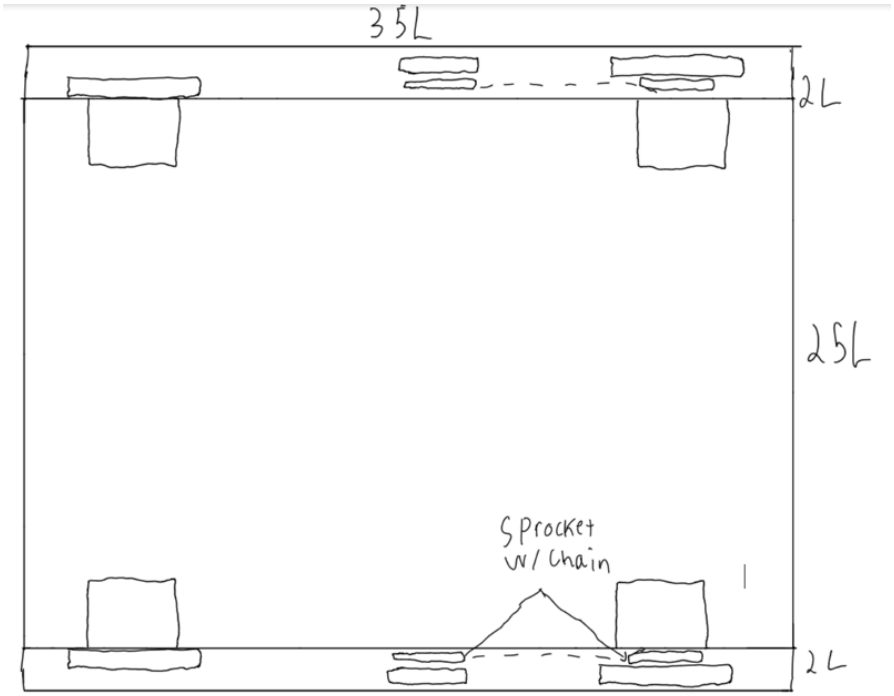
PROTOTYPING/BUILD **Entry #7 by Amari G on Tue Oct 10 2023 6:08:41 PM**

Add Comment



Added a 3rd wheel connected by sprocket and chain to back motor. This helps when driving over the middle pipe, as it was getting stuck balancing on the pipe before

PROTOTYPING/BUILD **Entry #8 by Joshua H on Tue Oct 31 2023 3:53:51 PM**

Add Comment

For the drivetrain, we started with a basic model that we had before, where we had 4 motors each controlling their own wheels, in each corner of the robot. For the wheels, we used 4" omni wheels, as they would help with turning significantly, and the larger wheels would hypothetically make it easier to go over the center of the arena. This was relatively easy to build, and we also added a c channel on the outside of the wheels to help keep them in place while driving. We used standoffs to attach the outside C channel to the main body of the robot.

TESTING **Entry #9 by Joshua H on Tue Oct 31 2023 4:01:09 PM**

Add Comment

While testing the first iteration of our drivetrain, we noticed that on flat ground, everything worked well. The turning was good, the power/speed of the wheels was good, and it was easy to control. Upon attempting to drive over the center pipe of the arena, we noticed that while it did make it over, due to the lack of wheels in the middle of the robot, it would turn unpredictably while going over the pipe, causing random positioning of the robot, and being unable to change the trajectory of the robot while driving over, because there was nothing to control the robot in the middle.

ITERATION/REDESIGN **Entry #10 by Joshua H on Tue Oct 31 2023 4:12:46 PM**

Add Comment

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For the redesigning of our first drivetrain iteration, we decided that a good idea would be to add a third wheel in between the two other wheels on each side of the robot. This would help the robot to have more control while driving over the center pipe of the arena. We decided that having a smaller wheel, such as a 3" wheel would work, because these wheels don't need to be touching the ground while driving normally, only when going over the central pipe. Because these wheels would not be used for turning, we could instead use traction wheels, or flexible wheels, for this. We decided that we would connect these central wheels via a chain, being connected to the back motor.

PROTOTYPING/BUILD **Entry #11 by Joshua H on Tue Oct 31 2023 4:18:43 PM**

Add Comment

For the second iteration of our drivetrain, we first added a sort of wedge on the front of the robot, as this would help the front wheels to climb over the pipe faster and easier. For the wheels, we added the central wheel we planned for, and connected it to the back wheel. We decided that using flexible wheels would be best, as they would have the most traction over a circular object (the pipe). For the chain, we used a simple 1:1 torque ratio so as not to overcomplicate things yet. Everything else about the robot was the same, and the outside C channel was still connected using the same standoffs.

TESTING **Entry #12 by Joshua H on Tue Oct 31 2023 4:35:51 PM**

Add Comment

While testing the second iteration of our drivetrain, while all the driving on flat ground was still functional, and as good as before when we tried to drive over the central pipe, we noticed that the robot was now incapable of driving over the center. As it turns out, this was because the robot was now back-heavy, is it would just get stuck, and the wheels couldn't push it over the center from this position. However, the front ramp that was added makes it easier to start to get over the bar, so this part was successful.

ITERATION/REDESIGN **Entry #13 by Joshua H on Fri Nov 17 2023 5:40:08 PM**

Add Comment

For the redesigning of our second drivetrain iteration, we decided that we should instead put 2 smaller wheels on each side in between the 2 preexisting wheels on each side. This would allow the robot to now be more balanced, allowing it to go over the center pipe in the arena, while also having every point of the robot that would be touching the pipe motorized, allowing it to be in control the entire time. These wheels will be small soft wheels, so that they have better traction over the center wheel, while not touching the ground during normal driving.

PROTOTYPING/BUILD **Entry #14 by Joshua H on Fri Nov 17 2023 5:44:11 PM**

Add Comment

For the final iteration of our drivetrain, we added two smaller wheels in between the two larger wheels on each side of the robot, leading to a total of 4 larger omni wheels, and 4 smaller soft wheels. We kept the front wedge on the robot, but reinforced it slightly, so that if the robot ran into a large object, they wouldn't get significantly bent. These new wheels were also motorized using chains attached to the front and back wheels, depending on the positioning of the new wheels.

Final Drivetrain

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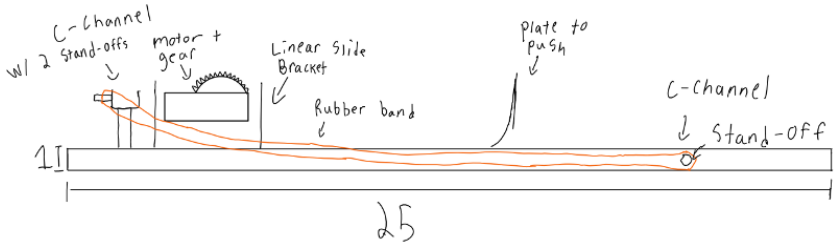
TESTING **Entry #15 by Joshua H on Fri Nov 17 2023 5:46:19 PM**

Add Comment

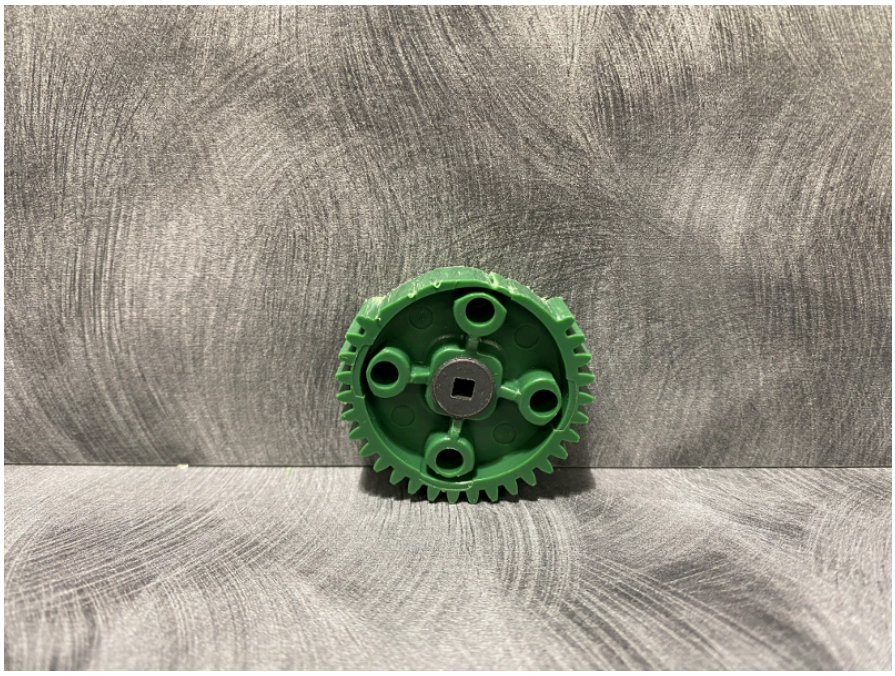
Upon testing the final iteration of our drivetrain, we found that it did everything we needed it to do successfully. It was able to get up onto the bar easily using the wedges on the front, it was able to drive over the center while maintaining control, and it could drive normally on flat ground as it could before. The only slight issue we had was that the robot was bouncing a bit while going over the center pipe, but this would likely be remedied as we added more weight on the robot, as we added more features to it. Even if it wasn't fixed, it was still a minor issue anyway.

PROTOTYPING/BUILD **Entry #16 by Amari G on Fri Nov 17 2023 6:09:22 PM**

Add Comment



We added a puncher to our robot so that we are able to launch the match-load balls to the other side at a high rate. For the puncher, we used a linear rail system to push the ball with a lot of force. The rail is able to slide freely, but we used rubber bands attached to the large c-channel and a holder at the back of the rail so that it has tension, wanting to push forward. The slide bracket is equipped with a motor attached to a gear, that moves along a rack gear. To be able to release the rail when it reaches the back, we had to cut some teeth out of the gear so that nothing was contacting the rack gear and the rail slid forward.



IDENTIFY PROBLEM(S) **Entry #17 by Joshua H on Thu Dec 14 2023 12:01:20 PM**

Add Comment

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One problem that our robot has is that it cannot climb. Climbing is a central aspect of the game, and having a robot that can climb is necessary for success in the game. Ideally, our robot will be able to climb to a good hight, considering the simplicity of our current robot, that allows it to get to the second or the third tier in height

BRAINSTORMING **Entry #18 by Joshua H on Thu Dec 14 2023 12:05:33 PM**

Add Comment

Some possible ideas for a climbing mechanism are:

- An arm to latch on to the verticle pole, and pull itself up
  - Difficult to create, and takes lots of force. Might take a long time to create a successful prototype of this.
- Balancing on top of the black bar
  - Easy to do, but it gives just about the bare minimum height, and it is easy to get knocked off.
- Linear lift(s)
  - By putting motors on verticle poles, and moving them up and down along those poles, we can get something to catch on the horizontal bars, so the robot can then pull itself up. Should be relatively simple, and possible to get good height with this method

PROTOTYPING/BUILD **Entry #19 by Joshua H on Thu Dec 14 2023 12:08:46 PM**

Add Comment

For creating our lifting mechanism, we created a single verticle bar with rack gears lining the inside. A motor with a gear attached would then move up and down along this bar, and a horizontal c channel attached to this would allow it to hook onto the horizontal bar in the arena, and pull itself up. We placed this bar on the side of the robot, because of the launching mechanism that was in the middle of the robot.

TESTING **Entry #20 by Joshua H on Thu Dec 14 2023 12:11:50 PM**

Add Comment

While testing our lifting mechanism, we found that it wasn't strong enough to lift itself up. So we changed the motor out for a stronger one, and tried again. In our next test, our robot could get off the ground, but because the lifting mechanism was so far off-center, it was incredibly off-balance, so once the robot climbed higher, it would get more and more sideways, until the motor couldn't lift anymore because the robot was too sideways. Additionally, the horizontal bar was hitting our launching mechanism, stopping the robot from climbing too high.

ITERATION/REDESIGN **Entry #21 by Joshua H on Thu Dec 14 2023 12:13:10 PM**

Add Comment

To redesign our lifting mechanism, we decided that we should move our launcher from the center off to the side, to allow us to mount the lifting mechanism at a more central location. This would allow the robot to be more balanced when lifting itself up.

PROTOTYPING/BUILD **Entry #22 by Joshua H on Thu Dec 14 2023 12:15:15 PM**

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Add Comment

For redesigning our lifting mechanism, we moved the launcher from the center of the robot, to the side. However, while doing this, we noticed that many of the motors and the brain were in the way of the launcher being moved all the way to the side, so we moved it as much as we could without redesigning the entire robot, and mounted the lifting mechanism closer to the center.

PROTOTYPING/BUILD **Entry #23 by Amari G on Fri Dec 15 2023 4:36:49 PM**

Add Comment

The puncher originally used the outer slide for the linear rail, but we found that it was too loose and was creating too much friction, therefore it didn't have enough power to launch the ball. When we tried adding more rubber bands, but then the motor was not strong enough. We decided to switch our design to use the inner slide. We switched to this design which had significantly less friction and was also more stable. We were able to constantly shoot the balls over the middle bar with no problems.

IDENTIFY PROBLEM(S) **Entry #24 by Joshua H on Mon Dec 18 2023 1:57:22 PM**

Add Comment

During our first VEX competition, there were some major things that we noticed that would be important to change in the future. First off, after several of our games, our front wedges that allowed our robot to move over the central pipe were very bent, and reinforcing it in some capacity would be important. Secondly, our autonomous code was very lacking, has it was slow, inconsistent, and scored few points. Compared to many of the other teams there, ours wasn't good. In the future, it needed to be faster, more efficient, and ideally score more points. Another thing that stood out was the number of teams that had expandable wings, which allowed them to push a lot more tri-balls. This would be a relatively simple addition to the robot, and one that would benefit us immensely. Finally, we noticed that some robots had a colour sensor on their match loader, which would allow them to not miss any launching of the tribals, as the robot would automatically wait for the tri-ball to be placed before launching.