Sweeping the competition

An intake walkthrough

Tom

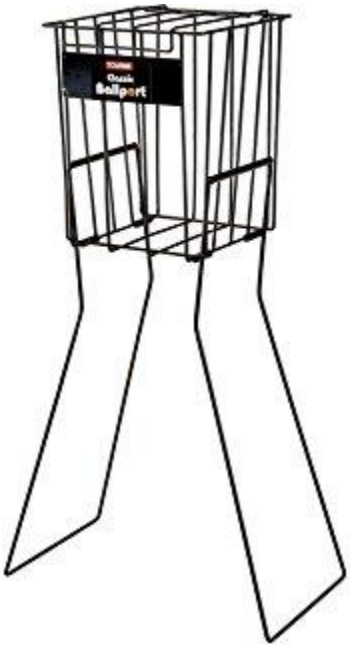
Brodesser

Flying toasters

First Steamworks

In the FRC 2016-17 season we have been given a unique game that has opened a variety of different opportunities. From team members being allowed out on the field to new field dynamics, this game had given our team a lot to think about. Through QFD along with game and rule analysis, we found that being able to shoot fuel into the high goal would be an essential strategy, as we would be able to go for the 40 kpa ranking point option.

We were then put into groups to come up with an ideal robot, and my group came up primarily with designs for a floor intake. After QFD and analysis we then chose groups to join in order to work on prototyping certain aspects of the robot. I joined the floor ball intake in order to further my ideas about the intake and be able to construct and make those ideas a reality. We disregarded the low goal and realized that the smaller, wider, robot was the best bet for being able to accomplish goals quickly and efficiently. Our group making the intake then had to adapt to the size requirements and come up with a system that could best carry out the tasks of intaking balls and bringing them up into the hopper.



Brainstorming different designs

When looking to see which fuel intake would be the best option, we had to look at a variety of different variables that would in the end reveal the most desirable intake that we would create. These variables were efficiency, the robustness of the design, simplicity, capabilities, and effort vs impact. When considering the needed efficiency of the intake we went over the ideas amongst ourselves to find what had the largest impact on how the game is played with as little effort as possible. When considering efficiency we also considered hopper placement and what would be the most efficient

way of transferring the balls from the ground, up the intake, and finally into the hopper. As time went on we also took into account the variable of design strength or robustness. Through this principle we weeded out some ideas shown below since they might be efficient, but easily jammed or damaged. We also considered design simplicity, as we realized that the more complex the intake system was, the more susceptible it was to things such as jamming and wearing out. With this in mind we considered the designs ever more carefully and compared the different principles through deductive reasoning, to determine the best solution to the challenge of designing a good, strong, intake. Through this we came up with a bunch of different ideas, some good, others not so much. One of our ideas was to have a set up similar to one of those old fashion lawnmowers, with a bunch of blades set around an axle. We also came up with a design that had a hopper that could move vertically up and down with flexible wires of some sort running across it that would bend in to let in balls when pressed upon them but then snap back into place after the pressure is gone. These were our primary ideas, but after much thought and speculation we deduced that the “lawn mower” design was the best design to carry out the task, because it was simpler, more robust, and in general satisfied our variables considerably better. The pros to this first design, were that the “blades”

(made out of surgical tubing) efficiently grabbed onto the balls and hurled them up the ramp and into the (theoretical) hopper. Plus this design was more likely to work, as there would be little to no jamming, and the design was very efficient in doing its job.

The design of a prototype

After choosing the design preferred to build a prototype, we began drawing up the dimensions in solidworks and coming up with a plan on how we were going to build it and the materials we were going to use in order to do this. After making print out templates for the drums of the intake we then scoped out some scrap that we would use to actually make them up. We also looked around

the shop for materials that would be of use to us in order to make a good, wellmade, prototype. We then glued the templates to the scrap wood and went through the different processes associated with cutting the wood into the preferred shape of a circle and drilling the holes needed to thread the surgical tubing through in order to have that grippy substance we needed. Then, keeping the size dimensions and requirements in mind, we cut the axle that the drums would be centered on in order for the intake to spin and actually do its job as an intake. We then put it all together in order to create our first prototyped version of an intake. But as we looked it over, we realized that we could make this prototype a lot better by small grippy wheels, since then the balls would be sent up the ramp faster due to a faster rotational speed.

Intake Mark II

Fully committed to making our previous prototype even better and more efficient as acting as an intake, we begin questioning what materials we want to use, how much of a material we need, and how to maximize our use of materials. In the end we knew we had to have an axle, a mount for said axle to spin on, bearings for smooth rotation, and a flat surface to be mounted to, to act as the bottom of the intake. We then “raided” the shop

and found the material for the wheels, axle, mount, and the bearings for maximum smooth spinning. The wheels, were plastic with polyurethane treads that would masterfully grip the balls. The axle was a hex rod made of aluminum, as were the bearings, and the mount. We also found sheet metal that we bent into a ramp for the intake, in order to test the ability and efficiency of it. We went through the different processes of construction, including using a lathe in order to be able to fix the bearings onto the hex axle, and a variety of other important processes such as cutting with the compound miter saw and drilling with the band saw. In the end we constructed our prototype, which had 12 polyurethane wheels, an aluminium axle and mount, and a wood surface that it was fixated to.

Simulations Galore

In order for our partially completed, non-motorized intake to actually be tested, we had to substitute the motor for something else. We realized we could just go grab one of the drills with an adjustable chuck and use that to simulate the rotational motion that would occur if we had used a motor. We used this method to present our ideas to the team and to get feedback to analyze what went wrong, and what went right. In doing this we found that our idea was a sound one, however we should start getting ready to use actual motors to even better simulate the motion, however this idea was abandoned as the “final prototype” was made.

Making the Real Thing

Soon after we had presented our ideas, Mr. Burkowski came to robotics with the wooden robot design and asked us to cannibalize our prototype in order to make the real thing. Unfortunately this meant deconstructing our prototype (which is the reason that no pictures were ever taken of this

intake) and using the materials in order to help construct the intake. However in the end, a variety of design changes were made. We exchanged the polyurethane wheels out for tubing, and incorporated a variety of new design features into this project.

The final product

As the final week of build season came to a close we built the intake into the competition bot, and tested its capabilities to see if anything had to be tweaked last minute. The intake worked well at taking in a large amount of balls in a very short amount of time and transferring it effectively to the shooter. The final intake was composed of the following; pipes with polyurethane tubes, o-rings to move the balls up, and other things.

What was seen at the competitions?

When competing we saw a variety of intake and shooter designs that blew our minds. One of these was shown by team 27, Rush. Their robot had a dual shooter system, both of which were a pivot table turret that optimized the usage of balls to increase efficiency. This also allowed for more loads

to be taken in as they were put out twice as fast as a normal turret shooter. However this design often jammed, and at Howell they were well behind 20th place and struggling to do well. We also saw other teams with unique designs, including team 1, the Juggernauts, and other teams.

Is This The End?

This year I was happy to be able to contribute greatly to one specific part in my group, it may not have come out the way it did. If there was one thing I could change about it, I would put the intake closer to the on the robot. However without the mentors who oversaw us and the other wall that the balls roll up via the O-rings. This has been a walkthrough on the subject of fuel intakes, for the 2017 game, first steamworks.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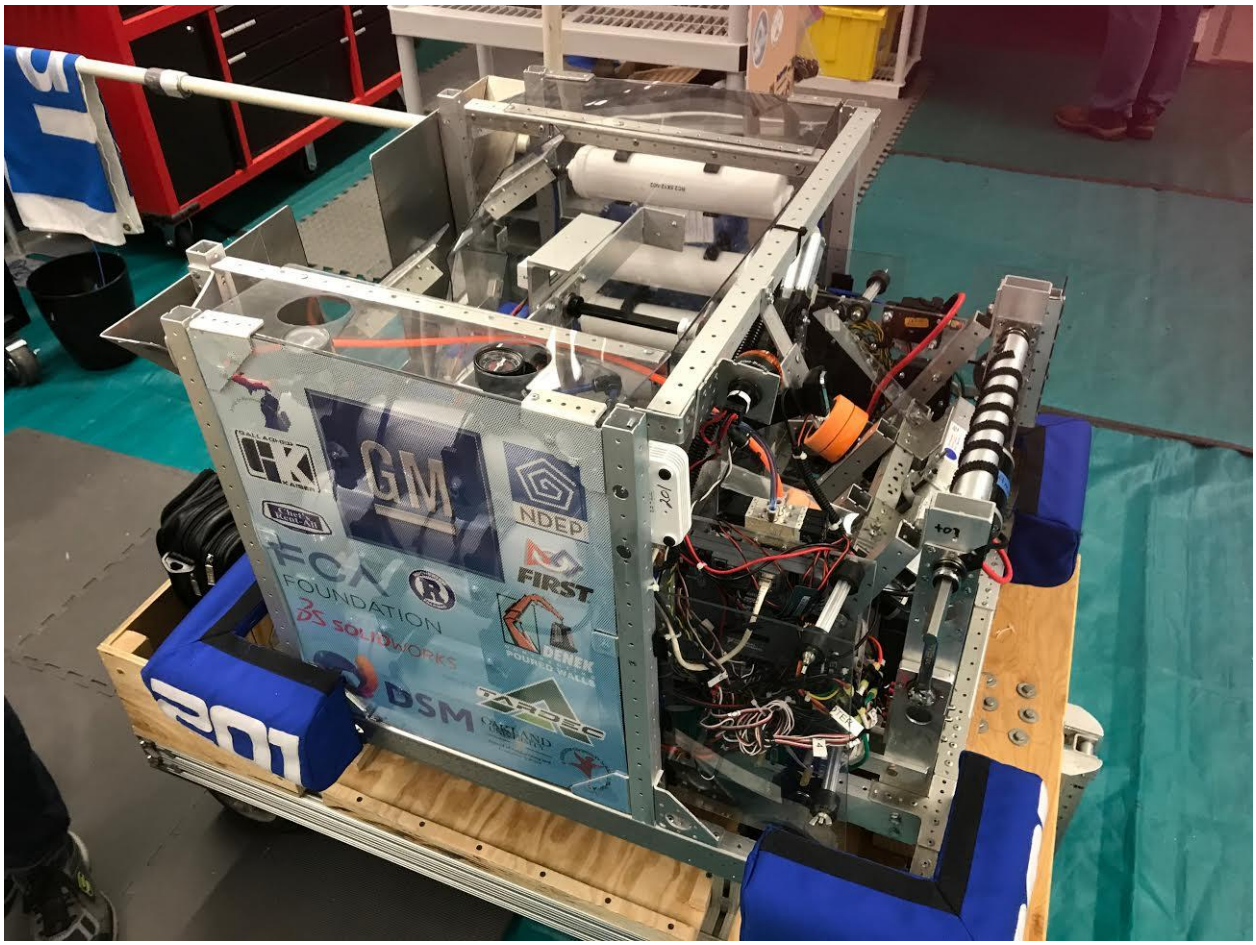
COMPETITION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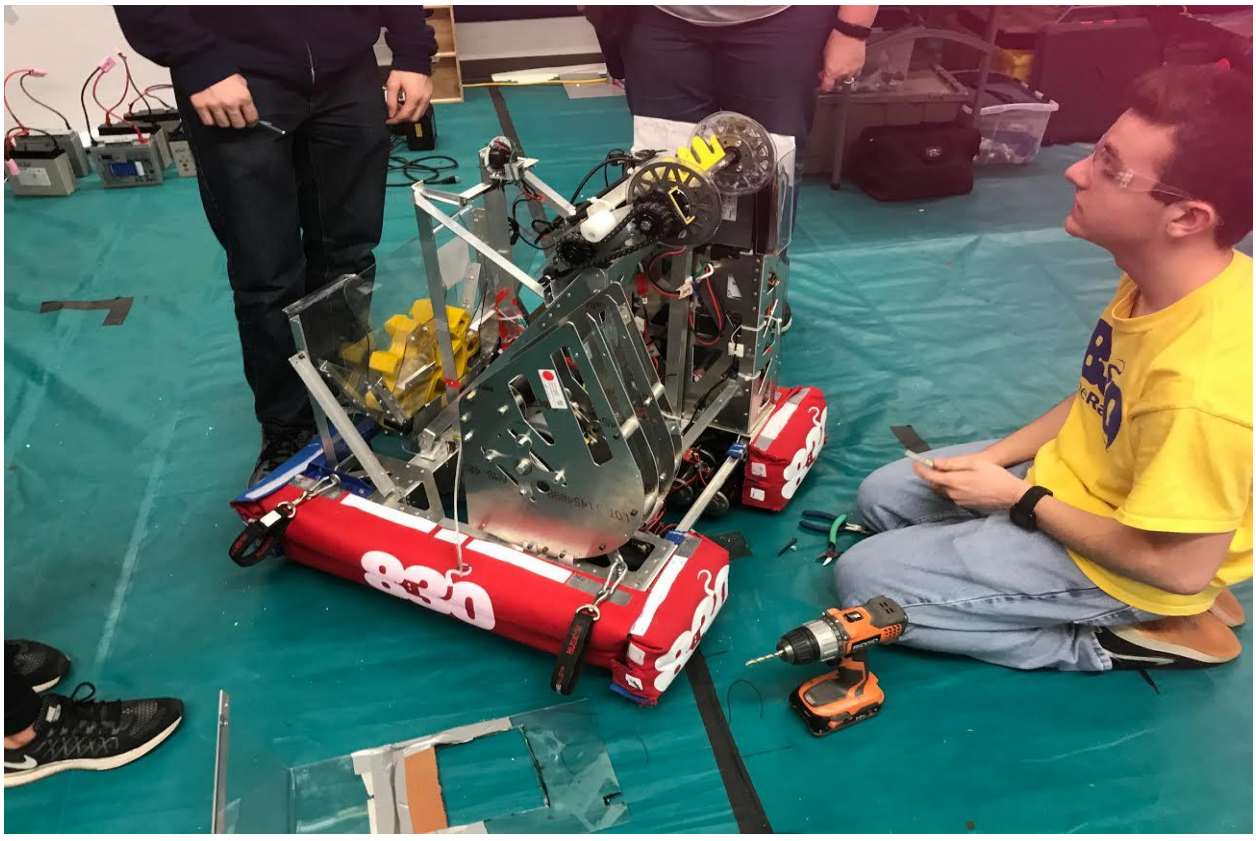
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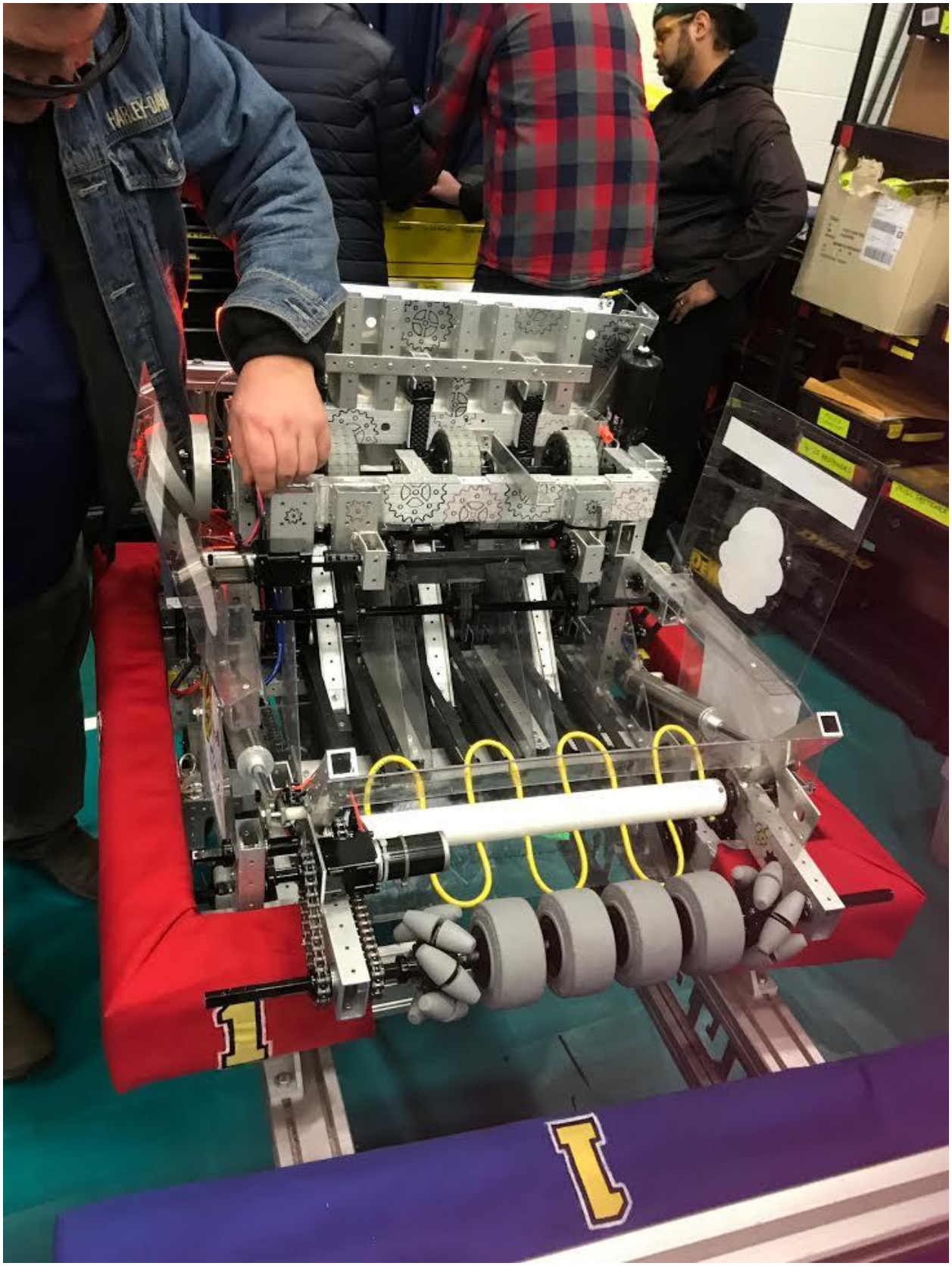

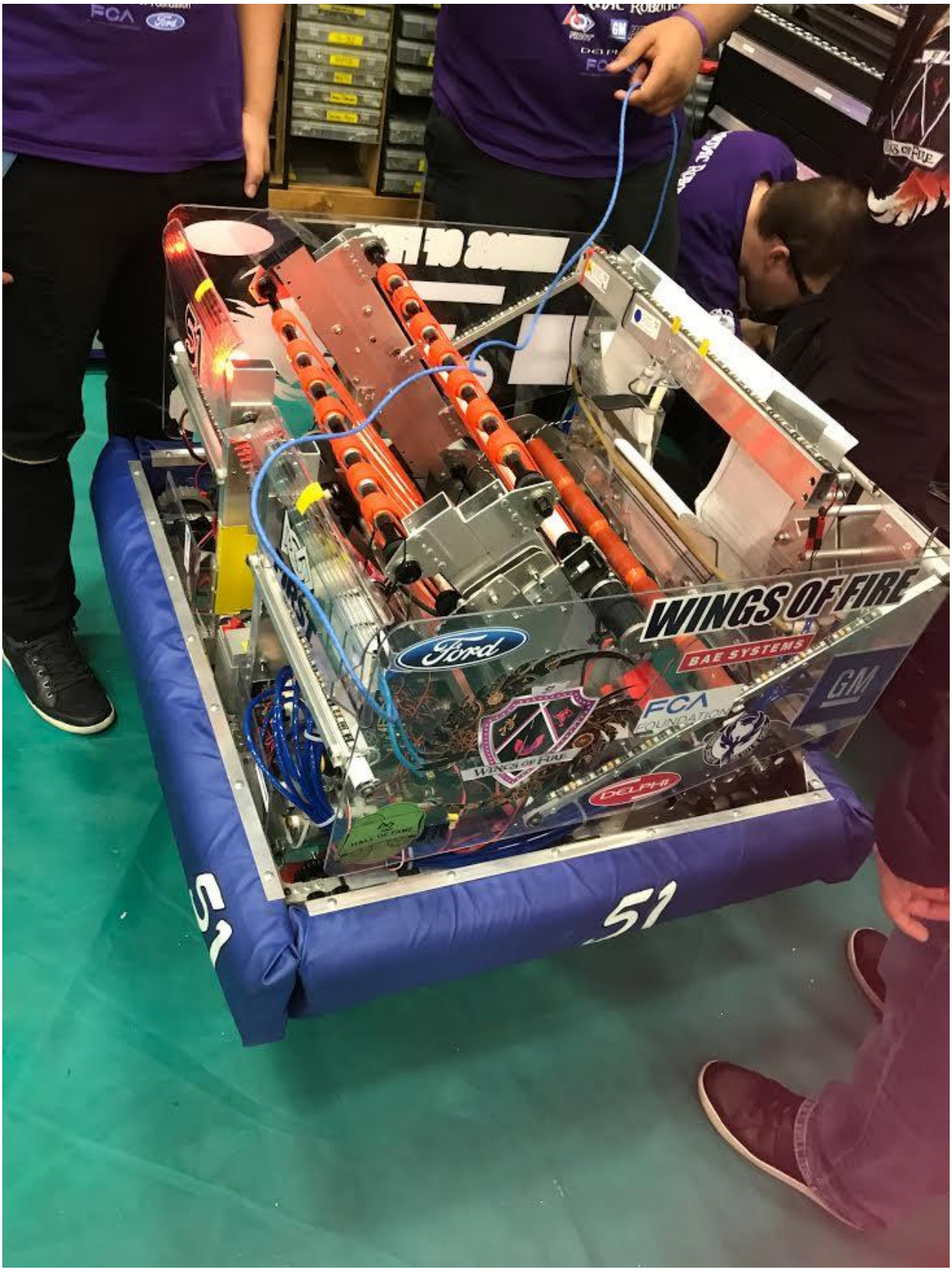
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