Business and Outreach Plan

FTC Team 4278 de.evolution

Contents

1 Business Plan

1.1 Team Mission

Our mission is to create a community of student and adult leaders passionate about science, technology and engineering. We aim to provide an environment centered around fostering intellectual creativity, cooperation, and competition, as we all work together to develop critical thinking, problem solving, and team building skills. In addition, our goal is to make a positive impact in our school and general communities, while promoting the ideals of FIRST.

1.2 Team Origin

Our team was founded in September of 2010 at Canyon Crest Academy in San Diego, California as part of the CCA Robotics Program and meets afterschool in a team members garage. De.Evolution Team 4278 has maintained between 7-10 members over the last four years but actually functions as part of a greater business model including three FTC teams and One FRC team. Thanks to combined resources and team coordination our influence in the community has skyrocketed, allowing us to acquire more resources, better workspaces for our class and FRC teams as well as awesome mentors. In addition, alumni team members have come back to share their knowledge and experience with both FRC and FTC teams.

One of the challenges our program has had to overcome over the years is a lack of facilities and resources. Throughout the lifetime of our team, weve had to make do with small spaces and a lack of access to more advanced tools. Thanks to a robust model for sponsorship and fundraising we have seen significant growth in our design process this year, in which the vision for our robot was completed quickly and efficiently using 3D modeling/design and advanced materials. While we began with a limited set of skills and experiences, through our failures we have been able to come up with better designs in a much shorter amount of time. Weve successfully developed a program that promotes the values of FIRST to students and our community, and will continue to for years to come.

1.3 Organizational Structure

[Insert orgchart]

1.4 Relationships

As part of the Canyon Crest Academy Robotics Program our team takes the relationships between our students, mentors, and community very seriously, and we aim to be continuously improving our connections with them. Team 4278 leaders work within the organizational structure above to expand access to STEM within our entire school and the community. As part of this business model we plan to offer nights during the year in conjunction with our other teams where students and parents can come on campus to our student-run cafe to enjoy food and beverages while seeing demonstrations of robots and learning more about the different robotics programs at our school. Furthermore, we plan to sell special fan shirts to enable fellow students and teachers to show their support for the teams, serving the teams financially as well as fostering school spirit.

We often partner with the Humanities Conservatory at our school for assistance with writing grants and seeking out sponsors. Corporate support is allocated to each of the four teams within the program. We are grateful for the continued support of our veteran sponsors, and are actively looking for new contacts through our local community. This year, weve reached out to four additional companies and are continually seeking more in pursuit of this goal. We also join with other facets of our school during the annual pep rally and Quest/STEM Nights to get people excited about STEM. In the spirit of Coopertition, we often partner with various FTC and FRC teams in our area; as we exchange knowledge, resources and experiences, we gain valuable input and perspectives that benefit everyone.

We are constantly on the lookout to plan awesome team building events and trips that give us the chance to grow closer as a group. Overall, we really value the relationships within our team and in our community, and we hope to strengthen these over time.

1.5 Deployment of Resources

Our team greatly values our community and aims to engage it in activities that further the appreciation of science, technology, engineering, and mathematics. Because of this, we have specifically organized our resources to maximize our ability to both inform and involve our community in STEM subjects. We regularly excite members in our school through events like Club Day, Quest Night and Parent Night, where we show our robot to a large amount of people and get them interested in robotics. Furthermore, we plan and participate in school-wide events like our schools biannual pep rally to stimulate fascination amongst the student body.

We also aim to spread the word of FIRST to middle and elementary schools with a goal of exposing students to STEM. Our objective in demonstrating at schools is to both start new FLL and FTC teams and get kids interested in robotics, as well as partner with already existing FTC and FLL teams as mentors. By mentoring others, we challenge team members to expand their skillsets and solidify the knowledge theyve already acquired. As a team, our goal is to spread the message of FIRST everywhere we can and to create communities for students, parents, and teachers aiming to improve their critical thinking, team building, and problem solving skills, and support science, technology, engineering and mathematics.

1.6 Future Plans

While planning our next three years, our teams main goals are to promote the core values of FIRST, to encourage the growth of a supporting and excited community, and to make an impact outside of robotics and engineering related areas. For instance, in order to establish connections between people through robotics, we plan to host fundraisers at various restaurants on the first Tuesday of every month. By doing this, we aim to not only raise funds to continue the impact of our team, but also bring together a community focused on STEM by being a reliable location for friends and family to meet each other while actively supporting the team. We also plan to continue to grow our relationship with the art programs at our school, to involve them in actively supporting our team and FIRST.

We plan to partner with our cinema and art conservatories to help our marketing team expand its capabilities in the realms of graphics and videography. Outside of competition and robotics, our team values making an impact within the community. We plan to partner with other teams in our area to organize regular beach cleanups along the coast in order to help the environment. Furthermore, we plan to continue to reach out to companies for grants to allow us to grow our team and reach even more students in more diverse ways. Our team is focused on engaging our community both inside and outside of school, all in the name of STEM, and over the next three years we believe we can build relationships more effectively with the people around us.

1.7 Financial Statement

Income:

Starting Balance	$3,795.78

2 Outreach

As a team, de.evolution believes that robotics is more than just the engineering. Our first year as a team we saw that the other FTC team at our school, Domo Arigato, was entirely seniors and we were sad that it was going to disappear. This inspired us to try and spread robotics to the younger students and have people involved to keep robotics teams going and to propogate the message of FIRST throughout our community. We have started a robotics class at our high school which has turned into the team Domo Arigato. Due to the popularity of the class a second class, and subsequently an FTC team, has been started. Both the Robo Ravens and Domo Arigato, along with our own team, de.evolution, work hard to start a robotics and engineering culture at our school.

2.1 Community Outreach

As a team, de.evolution has tried to do a lot to help spread the ideas of FIRST, robotics and engineering. The following is an extensive list of some of the community outreach that we have done:

1. Robotics demos to elementary school students at Solana Pacific Elementary, Del Mar Heights Elementary, Rancho Santa Fe Elementary
2. PTC World demo in June 2013
3. Mentoring of the three Islamic School of San Diego FLL teams
4. Sister team of the San Dieguito Academy FTC teams Paradox Squared and Paradox Cubed
5. Demo for school board & superintendent sponsored building/engineering production district-wide with bond measure
6. Hosted Robotics Week at CCA in coordination with Domo Arigato (3513)
7. Publication in newspapers & press releases about STEM/robotics
8. Publication in school's magazines
9. Over 20% of school has become involved with the FIRST robotics programs after the inception of our team
10. Inspired the FIRST robotics classes
11. Incorporating art and conservatory at CCA with the robotics program
12. Incorporating the humanities conservatory at CCA with the robotics teams
13. Working with TEDxYouth@SanDiego to spread robotics to the students in San Diego
14. Attended and presented at Rotary meetings to show our community the influence of robotics

Additionally, in the pits, we offer to help any and all teams who are in need of assistance - including offering our contact information to pit admin if any team needs help.

2.2 In-person demos at middle and elementary schools

We have presented the FIRST Tech Challenge to three separate elementary schools: Solana Pacific Elementary, Del Mar Heights Elementary, and Rancho Santa Fe Elementary. We inspired the creation of teams at these schools this FTC season, and will bring them into our robotics program at Canyon Crest Academy if they choose to attend our school.

> Ever since last spring, when their team members did a presentation at our school for Science Discovery Day, they have been an inspiration to our robotics students and are chiefly responsible for encouraging our 8th graders to start an FTC team this year.
>
> –David Warner, Coach for the RSF Eagles FTC Team

When we showed our robot to the students at these schools we had their teachers drive the robot. The kids loved it! It was definitely a great experience for us to be able to show so many students how much we loved robotics and the subtle beauty that is found in engineering and FIRST competitions.

The students at the schools are interested in robotics, and are now aware of what the FIRST program can provide. We are thrilled to have the opportunity to interest more students in FTC, and look to continue doing so next year!

2.3 Helping other teams online

As the majority of the members on our team are also on the FRC team The Aluminum Narwhals we realize that having online support is one of the best ways to debug and learn about robotics. Chief Delphi, one of the prominent places for online FIRST discussion, is very popular among FRC teams. However, FTC teams do not have nearly as much online support as they may need or like. As a team we have shifted a lot of our focus to helping teams online. We have open-sourced all of our code and have created code tutorials to help out many other teams. We have helped teams in the following ways

2.3.1 Syntax Error code optimization assistance

At a San Diego regional qualification competition, we entered a discussion with team 6077, Syntax Error, about code optimization. We were sharing our varied tricks which were used in code, and through discussion, it became clear that there were a couple points they were particularly interested in implementing. We passed them some contact information, and later received an email from them:

> Hey Noah,
> We're interested in optimizing the speed of our teleop code, and I know you had mentioned at the tournament that you guys XOR-ed the joystick values to determine when the values had changed–allowing you to skip checks when things weren't changing. Could you please go into more depth as to how you achieved this? Did you directly modify joystickdriver.c? Which values should we be XOR-ing exactly?
> Thanks,
> -Collin

We wrote out a document generally detailing the approaches we took when optimizing our teleoperated code. My response was the following PDF file:

Hello Collin/Syntax Error/6077!

There are a couple main things that we've done to improve our teleop code's responsiveness. The first has to do with button checking and stateless button operations, and the second concerns significant, er, *improvements* to the JoystickDriver file.

First, if you'd like to view our source code, all of it is available on Google Code (project ftc-team-4278). This will link you to the file browser, but if you use Subversion, feel free to checkout a copy and look through it! It might help to see specifically what I'm talking about in the files.

The first improvement to teleop comes from the simple idea that code run fewer times runs faster. Cut down on the number of iterations and checks, and you simultaneously cut down on the number of cycles used for dead processing. Our teleop code is laid out in a pretty simple structure:

```
task main() {
    unlockArmMotors(); clearEncoders();
    waitForStart();

    while(true) {
        getJoystickSettings(joystick);
        checkJoystickButtons();

        setRightMotors(powscl(JOY_Y1)-powscl(JOY_X1)/1.1);
        setLeftMotors(powscl(JOY_Y1)+powscl(JOY_X1)/1.1);
    }
}
```

We do two things: check to see if the buttons have changed, and set the motor powers. The core principle here is actually the same as I imagine most robots' code is: do things with the buttons, then do things with the joysticks (or vice versa). The optimization comes from the `checkJoystickButtons()` function; it only runs code if the buttons have changed. Here's how that function works:

```
#define JOY_BTN joystick.joy1_Buttons //from teleoputils.h

short btn = JOY_BTN;
void checkJoystickButtons() {
    if(btn == JOY_BTN) return;
    for(short i = 11; i >= 0; i--) {
        if((btn>>i) ^ (JOY_BTN>>i)) {
            invokeButton(i, ((btn & (1 << i)) == 0));
            btn ^= 1<<i;
        }
```

```
        }
    }
```

The first line is the most important. `if(btn == JOY_BTN) return`; i.e. if the button state has not changed, do nothing. This is important, as checking the state of each button is (comparatively) expensive. The rest of this is just a pile of binary math, which results in the function `invokeButton()` being called with the arguments `int button, bool pressed` to indicate which button has changed to which state.

If you're really interested, here's what's going on in a bit more detail (I'll assume you're familiar with XOR):

In essence, the `if` statement is using the XOR operator to check if the previous state (`btn`) is different than the current state (`JOY_BTN`). The statement `btn>>i` shifts the button value right by the button number; in essence, it makes the ith button the first digit of the binary `btn`. It does the same thing on `JOY_BTN`. If the first digits differ, the XOR operator will make the first digit of the output 1. The if statement will check this digit for true/false value. And, if this value is 1 (i.e. differing values), then it calls `invokeButton`. The next line simply sets that value to 0 in `btn` so it isn't called again.

The second set of optimizations actually occurred within the JoystickDriver itself. It turns out that (unsurprisingly) the current JoystickDriver is actually relatively inefficient. *(A side note: We've optimized our JoystickDriver.c for use with one controller only - you probably don't want to use our driver if you want two controllers)* Our philosophy with this driver has been simple: **if you keep removing things, and it still works, then good. You're improving it.** So, I'm going to point out a couple things which can be safely trimmed, but I challenge you to see how much you can trim without breaking it. I guarantee it will be at least twice as fast when you're done with it. We got ours down to 126 lines… :]

I guess the main thing here is the `displayDiagnostics` task, which, it turns out, actually uses a significant number of cycles. You know that debug info that shows up on your screen with voltages? Turns out, that actually comes from the `JoystickDriver` - and it isn't actually all that useful. You only really need to see it once, and don't need it running constantly in the background. You can simply delete the entire task. As well as the `disableDiagnosticsDisplay` function. And pretty much everything concerning diagnostic output.

I guess my main advice with this file is: most of it isn't needed. Make sure you understand what you're removing, but it's pretty much safe to remove most of it.

Hopefully this helps! If you have any questions, feel free to contact me personally. I'd be happy to help!

The aim was to create an easy-to-follow guide for someone with experience to optimize the teleoperated program. To our enjoyment, they reported significant increases in response time on their controller.

2.3.2 Reddit

To our pleasant surprise the FTC Reddit subforum was started this year and our team has jumped completely on board to help other teams with both programming and mechanical help. We often will have Skype calls with other teams around the country or just send long documents to them. We have also created extensive and comprehensive documents that detail all of the details, including the advantages and disadvantages, of the different drive trains. The following pages have some of our biggest discussions with teams on Reddit:

8

Offering programming assistance to all teams! self.FTC

submitted 5 months ago* (last edited 5 months ago) by **Telthien** FTC 4278 (Software)

If any team would like live assistance with their code in RobotC, Team 4278, de.evolution, is offering to assist.

We are well-versed in all available RobotC capabilities, and will help with any challenge. We received second at the world championship during the Get Over It! challenge as a rookie team, and received two division awards for the Bowled Over challenge. We earned six total awards last year in the Ring It Up challenge.

We can assist with:

- Conceptualization of code
- Autonomous development and testing
- Manual code and control theory/logic
- All HiTechnic and NXT sensors
- Code structure and design
- NXT/RobotC/Samantha debugging and configuration
- Code formatting
- If you think of something else you'd like help with, don't hesitate to ask!

We will help teams develop their own programming skills-not just write code for you. Our goal is to assist teams by teaching them the skills they need to progress on their own.

Note: I have passed my contact information through ROT13. To find my actual contact information, go here: http://www.rot13.com/index.php.

To get in contact with me, you can add my Skype (nygubea.rfgina, through ROT13). I request that, if you contact me by Skype, you put that you put your team number and your name in the contact request - contact requests without team numbers and names will be ignored, for obvious reasons.

Thank you, and good luck! --Noah, 4278 de.evolution co-programmer

5 comments share

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[–] **idoescompooters** 1 point 4 months ago

Are there any specific websites, videos, etc. that you would suggest for learning RobotC? I've found a lot RobotC learning resources, but I was wondering if there were any that you think really stick out and would help people beginning with RobotC and be able to program with it. By the way, I have previous programming experience.

permalink

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e.g. *mozrila FTC 3415*

[–] Telthien FTC 4278 (Software) [S] 1 point 4 months ago

Actually, for new programmers, the standard RobotC introduction videos and documents are rather useful. Let me know if those help, or if you need a pointer to where they're located (they can be somewhat difficult to find).

They're primarily useful in that they provide tasks. However, the actual code instruction is good when supplemented by a knowledgeable team member/mentor.

permalink parent

[–] idoescompooters 1 point 4 months ago

Are these the training videos? Could you possibly link me to these. In the past, I've discovered training videos and a huge amount of webinar videos that I may give a try.

permalink parent

[–] Telthien FTC 4278 (Software) [S] 1 point 4 months ago

http://www.robotc.net/teachingmindstorms/

You don't actually *need* to build the robot they have there, but it may be helpful. The introduction can be done conceptually.

permalink parent

[–] idoescompooters 1 point 4 months ago

Yeah, that's what I was talking about.

permalink parent

e.g. *Anton338 FTC 3415 (Alum)*

Important Links

US FIRST
Offical FTC Forum
FTC Blog
10% off Tetrix Parts
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created by FTC Team 3415 -- The Lancers a community for 2 years

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TurnRobotOn Volunteer
robertf224 FTC 3415 (Alum)

π

What Gear Ratio Are You Using For Hanging // Weight?

5

self.FTC

submitted 2 months ago* (last edited 2 months ago) by Arctic_Wind FTC 6112 Wolfbyte

Hey guys,

What gear ratio are you guys using for your hanging system, and how much does your robot weigh?

Is there an easy way to solve what ratio you should use mathematically? Or is it more of a "safe bet" sort of thing?

Our robot is about 35 pounds, but we're looking into also supporting another robot to hang. How does 9:1 gear ratio sound?

Thanks! FTC 6112 Wolfbyte Alaska

P.S. If you're wondering what some others are doing too, I posted this topic on the FTC Forum as well.

FTC Forum Thread: What Gear Ratio Are You Using For Hanging // Weight?

7 comments

sorted by: best

[–] Oriek 6376 2 points 2 months ago

We're using a rack and pinion system with a... well I don't know the gear ratio but it's the small textrix gear to the medium one. Works super well.

permalink

[–] Dastyruck 4278 2 points 2 months ago

We are using an arm to hang, so a large part of deciding our gear ratio was using torque calculations to figure out how much torque we would need in order to raise our robot. I'll spare you the complexities of calculating this but I can say that our arm is geared 7.6:1 and the arm hooks onto the bar about 17 inches from the rotational axis. We weigh about 30 pounds and use two tetrix motors to lift ourselves.

9:1 with two tetrix motors should be more than enough to lift a 35 pound robot, depending on your method of hanging from the bar. If you are using an arm, the further away your "hook" is from the rotational axis, the more torque required, thus the higher the reduction you will need.

If you post more specifics, I would be happy to help you figure out an optimal solution.

permalink

[–] Arctic_Wind FTC 6112 Wolfbyte [S] 1 point 2 months ago

The current plan is to use a "grappling hook," with the length of the line being 28 inches (though this could be moved to the second level, so could be 16 inches). We were thinking about using the tetrix worm gears, which have options of 4:1, 10:1, 20:1. We ideally would like to use 1 motor here; using 2 would be rather costly.

The idea is to have an arm which would have a fulcrum length of about 5-6 inches. It would

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e.g. *mozrila FTC 3415*

portrude a "second bar" for another robot to hang on. Ideally again 1 motor used here, and we're looking into worm gears again for this.

If the arm were supporting another robot, would the line also take some of the stress? Would we need to gear for about 70 some pounds on our line? As for each individually, would the 10:1 worm gears work? We appreciate any help you can give!

permalink parent

[–] **Dastyruck** 4278 1 point 2 months ago

From what it sounds like, you would like to first hang yourselves using a grappling hook method using a worm gear and then a second arm would then be used to grab and then lift another robot off of the ground.

If this is the case, your line would indeed need to be able to handle the force of two robots statically. The worm gear used for the first stage would also need to not back drive under the stress of two robots. Though, neither stage would need to pull with the force required to lift two robots.

Starting with the first stage, the grappling hook, the amount of force the "winch" system will have to pull with is going to be the weight of your robot, in this case 35 lbs. The torque that a tetrix motor can produce at stall current is 325 Oz - in. The force that the winch system pulls is F = T / (r * sin(A)). In this case, the angle of lever arm will always be 90 degrees, which simplifies the expression to F = T / r where F is the force, T is the torque, and r is the radius of the axle that your winch cable is wrapped around. Since our torque is given in Oz-in, we want to use ounces for the force and inches for the radius. Converting our robot weight of 35 pounds into ounces gives us a force required of 560 ounces. If we used no added gearing, our formula would be 560 oz = 325 Oz-in / r. Which solves to r = .58 inches. If you move up to the 10:1 worm gear, the effective torque would be multiplied by 10. Which would make the formula 560 oz = 3250 oz-in / r. Which solves to r = 5.8 inches. So, if you choose an axle for your winch smaller than this, you will be able to lift yourself. I would stay on the side of caution and use something smaller than this, such as a 1.5" radius axle. The larger the axle, the faster you will go up.

For the next part, you have already said that your lever arm will be 5-6 inches. Staying on the side of caution, we should say that it is at 6 inches in radius. The force required to lift is again 560 ounces if the robot is of similar weight. Though, this time, the formula does not simplify out as the angle of the lever arm will change as the arm is rotated upwards to lift the robot off of the ground. Thus, F = T / (r * sin(A)). Solving this equation for torque, we get T = r*sin(A)*F. As the arm moves towards 90 degrees, or parallel to the ground, the torque required increases to its maximum. So, if we set the angle equal to 90 again, we are left with T = r*F. Since our radius is 6 inches and our force is 560 ounces, we find that we need a maximum torque of 3360 Oz-in. With the 10:1 worm gear ratio, we only get 3250 Oz-in of torque when the motors stall. So, increasing this to the 20:1 would be the best way to go if you wanted to use one of the worm gear options.

I am unsure of how much force is required to make the worm gears back drive or if they can even hold up to that amount of force on them. For a line that would most likely be able to hold up to 70 pounds of tension, I recommend a modern bow string material. We used this last year for our forklift cables. It has the benefit of being very strong while also being very thin, if you need it to hold more, braiding it is very easy to do and will give quite a bit more strength.

If you have any questions or want me to clarify anything, don't hesitate to ask.

permalink parent

[–] **Arctic_Wind** FTC 6112 Wolfbyte [S] 1 point 2 months ago

Geez thanks for all the help on that! Shoutout to Team 4278.

As for our secondary lever arm, it is the last thing we are really looking into but we could also shorten the length of it to perhaps 3 or 4 inches.

The first ideal situation would be to hopefully use our grappling hook to hook, then move away from the hanging bar -- give another robot space to get hold of the bar -- and then come back and have both robots lift on their own simultaneously (brushing up against each other would prevent swinging). Sort of a concept that I've seen work on Youtube, not particularly sure whether it's consistent.

Thanks also for the tip on the bow string!

permalink parent

[–] limellipsis FTC 5421 1 point 2 months ago

One word of warning about a grappling hook: you can't make your robot throw it. It's illegal for the robot to launch pieces of itself (as the GDC ruled here). A team got called out on it at our qualifier, and had to take their assembly off- don't let that be you!

permalink parent

[–] tmbrudy 1 point 1 month ago

I use JVNs mechanism calculator for this kind of stuff: http://www.chiefdelphi.com/media/papers/2755?langid=2

It doesn't have the tetrix motors listed in the list but you can get the new and old motor spec sheets here: http://cheer4ftc.blogspot.com/p/motors.html

permalink

π

2

Hanging with worm gears

self.FTC

submitted 1 month ago by rohyourb0at 5205 SyBorgs

Hey guys. My team was wondering how we should utilize our (10:1) worm gear set for hanging. We want to use our six bar to hang but were contemplating whether to replace the driving gear(s) with the worm gear or not. Thanks & Merry Christmas!

5 comments

sorted by: best

[–] Dastyruck 4278 2 points 1 month ago

More details would be needed to fully determine whether or not you could hang with your 6 bar linkage. But, if your robot is fairly light, and your 6 bar isn't too long, hanging with it shouldn't be a problem with only one motor. The worm gear might make it so your arm wouldn't move when it wasn't powered, which you want if you plan on hanging with it.

I would make sure that with the gearing that you choose, that your robot could actually lift itself. I have seen quite a few teams attempt to hang and are unable to due to the lack of torque in their current gearing. If you give more details on your robot, I would be happy to help you figure out adequate gearing for your system.

permalink

[–] rohyourb0at 5205 SyBorgs [S] 1 point 1 month ago

Thanks for the quick reply, we're using two motors to power our six bar linkage so that's what I was having trouble with figuring out

permalink parent

[–] rohyourb0at 5205 SyBorgs [S] 1 point 1 month ago

I'm unable to send pictures right now because I'm in Florida for vacation lol

permalink parent

[–] Dastyruck 4278 1 point 1 month ago

No problem, the easiest way to link two motors into one worm gear box is to add an additional gear onto the motor that is the input to the worm box and put a second gear of equal size onto the second motor and have both of these gears mesh. Both motors will be linked in a 1:1 ratio and you will get the torque from both motors into one worm box.

permalink parent

[–] _TrafalgarLaw 1 point 1 month ago

Something you might want to watch out for is the warping of metal. If you put too much stress onto a single point of an axle (which is easily possible with a high gear ratio) your axle will warp, rendering it useless if you ever want to remove it or replace it.

I don't know how you set up your robot, but hanging should definitely be possible, you just need to be careful with how you distribute your force.

permalink

FTC

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this post was submitted on 24 Dec 2013

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e.g. *Anton338 FTC 3415 (Alum)*

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/r/Robotics

created by FTC Team 3415 -- The Lancers a community for 2 years

Message The Moderators

COMPETITION JUDGES

rainydayplaylist
thebootsiest
mozrila [MOD[FTC 3415
Anton338 FTC 3415 (Alum|Mentor)
stanleychg FTC 3415
TurnRobotOn Volunteer
robertf224 FTC 3415 (Alum)

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Additionally, the code assistance post was also mirrored on the Chief Delphi FRC forums. We have contacted six teams through these mediums.

2.3.3 FTC Team NESI (6033)

One of the many responses we received for our online posts has been copied here. In short: a team was in need of holonomic drive assistance, and we responded with details about how the algorithm might best be implemented. We did so with the intent to provide a conceptual structure, while still leaving an educational problem for the team to understand and develop. In this way, we are not simply giving them the solution; we are instead helping them understand the tools they need to implement a solution, furthering their understanding and education.

> “I saw your offer to help teams with programming. We are a new FTC all girls team and could use some help with programming our robot. We originally had tank drive and were able to modify the code to work. However, we thought omni direction would be be better for us and built a [chassis] with omni directional wheels mounted at 45 degrees in each corner with a motor on each. There is an encoder on each. I know there has to be some conversion to establish drive vectors, but having some challenges with that. If you had some sample RobotC code that would be great. The girls are very sharp and could make it work, we just need a little help. Ideally we want to use one joystick to go forward, back, left, right. Then the other joystick to rotate left or rotate right.
> Anything you can do to provide sample code would be VERY much appreciated! Thanks!
> *Coach Jerry, Team NESI (6033)*”

Our approach to helping teams in this situation is not to outright give the solution, but help provide a conceptual framework for thinking about approaching a solution. That way, teams still gain the educational experience of solving problems themselves, but aren’t working in the dark when they attempt to solve the problem.

> I'd be happy to explain conceptually! I'm sure you and I would both agree that, even though I could simply give source code, it's better for the programmers to come up with it themselves to gain a conceptual understanding. Of course, holonomic drive (45 degree omni) is confusing, so feel free to ask questions!
>
> First, the programmers will need to have an understanding of polar coordinates. Nothing too deep, just the basics: that they are expressed with an angle and a radius. The best holonomic drive will follow sines and cosines, so I recommend converting rectangular coordinates to polar coordinates. In this way, the theta of the joystick position becomes the direction the robot is to move in, and the "r" magnitude becomes the speed.
>
> There are two parts to a holonomic drive: rotation and translation. Rotation allows the robot to turn to any bearing, and translation allows the robot to move in any direction at a time. Make sure the wheels are aligned such that, in positive power, both the left and right side motors move forward.
>
> Rotation should be added to translation, since translation is more important and complex. Thus, the goal is to work out a translation algorithm. Remember that your controller should be stored in polar coordinates. It is helpful to plot out on paper which direction you want the motors to move for each angle; for instance, at 45 degrees, you want the front left (FL) and bottom right (BR) at 100% power, and FR/BL at 0% power. You can use these points to build a sine/cosine graph for each wheel.
>
> Once a translation algorithm has been tested and implemented, rotation is the next step. Conceptually, to rotate the robot, all the wheels need to move the same direction. Thus, you can simply add whatever your rotational value is (we use the x axis on the second joystick, but be sure to divide by 128 to get a number from -1 to 1) directly to the output from the sines and cosines.
>
> When you add rotation, you will encounter another problem: sometimes motors will be set to 200% power, while others are at 100%. Yet the robot still needs to turn. The cause of this problem lies in the rotation. If the robot is going at 45 degrees, FL/BR = 100%, FB/BL = 0%. However, if you are rotating at full power, you'll end up with a situation where FL/BR = 200%, FB/BL = 100%. The robot will just drive forward. What you need to do at this point is find the maximum power, and divide all the powers by it. They will stay proportional, and you'll get the expected output.
>
> Please let me know if you have any questions! It's certainly not a simple algorithm to think about. I've tried to give a general conceptual outline of how it works, since we'd probably both agree it's better to write the code oneself. Still, if you would like further help, feel free to ask!

While we have removed most of the discussion from this text, the conversation was left with:

> "Your explanation will be a big help to the programmers! I anticipate they will have some questions for you about how the theory gets put into practice with RobotC. Thanks for pointing out some of the troublesome aspects of how translation and rotation come together. We will be in touch. Thanks!"

2.4 Mentoring of FLL teams

Our team aided the Islamic School of San Diego's FLL Teams during their rookie years by mentoring the young kids on robotics and the engineering design process in general. Our students voluntarily watched over the excited and energetic children, assisted in teaching them key concepts, and created useful PowerPoint presentations that were presented to further educate the FLL teams.

In each meeting, the FLL teams was taught a concept and then given time to build something from LEGOs using their newfound knowledge. Since our de.evolution volunteers were there, the FLL leader could split the team into small groups with a mentor or leader helping each group. Another advantage of having an FTC mentor available was that the volunteer could lead the team while the leader temporarily prepared the next lesson or dealt with other essential tasks. It relieved the leader of FLL and kept everything running smoothly.

The lessons taught the eager and energetic students about what causes earthquakes and the destruction that they inflict. This understanding supported the kids in cooperatively creating ideas for a machine to aid anyone who recently experienced a devastating disaster. The mentors also educated the group about the engineering design process to assist them in efficiently building a better solution when they were ready to begin fabrication of their product.

We found that mentoring FLL teams has not only allowed us to teach the students a lot about robotics, but we gained valuable experiences by doing so.

2.5 Meeting with the SDUHSD Disctrict Office

A while back, we met with the San Diego Union High School District (SDUHSD) district office to present the FIRST Tech Challenge program. It was a significant demonstration, as our ultimate goal was to inspire further funding for robotics in regional high schools.

Our efforts paid off. Recently, Proposition AA, an educational bond bill, was passed in the San Diego area. This included significant funding for the construction of a robotics building at our host high school, Canyon Crest Academy. We have already brought approximately 15 to 20% of the high school population through some form of FIRST's programs, and this will hopefully expand both the educational capacity and general awareness of FIRST among the high school students.

2.6 TEDxYouth@SanDiego

As our team is greatly involved with Canyon Crest Academy as an academic institition we teamed up with the FRC team at our school and began creating promotional videos to show robotics to our school. At TEDxYouth@SanDiego we were invited to put on a robotics and dance choreography. We worked with the FRC team at our school and the dance conservatory to put on a truly magnificent performance. It was the joining of exceptional engineering and amazing talent in terms of the arts.

At TEDxYouth@SanDiego, over 500 students from high school in the San Diego region all came together to be inspired. By being honored to present our robot on the TED stage we were able to reach many students and show them the elogance of robotics. By integrating it with the arts we are really able to show the practical and artistic aspect of robotics.

2.7 Press Releases

To really reach the community of professionals and the general public, we turned towards press releases. By having the media come to us to cover not only our successes as a team, but our ability to inspire and reach out to many other students has given us many new opportunities to go to middle schools and mentor other FTC and FLL teams. The following pages are excerpts of some of the media and press that has covered our team:

CCA De-Evolution robotics team members: (L-R) Kian Sheik, Noah Sutton-Smolin, Tristan Murphy, Alex Quan, Christian Cooper. Not pictured: Mariella Gauvreau, Ryan Lee, and Yousuf Soliman. Noah and Tristan are holding the two trophies for winning the Inspire Award and for Captain of the Winning Alliance.

Double win for CCA's De-Evolution robotics team

Canyon Crest Academy's robotics team, De-Evolution, has now qualified to compete in the Los Angeles regional competition, after the team's double win at the L.A. qualifying tournament held Jan. 25 in Glendale.

De-Evolution has already qualified to compete in the upcoming San Diego regional competition with the team's double win in December at the Escondido qualifying tournament.

Going into the semi-finals at the L.A. tournament, De-Evolution was ranked Number 1 out of 30 teams and maintained its top position, remaining undefeated the entire day.

A double win means the team qualified twice for Regionals, by being named the winner of the coveted Inspire award as well as being the captain of the Winning Alliance.

De-Evolution placed second internationally three years ago, as a rookie team. Four members of that rookie team, now CCA seniors, remain on the team.

De-Evolution has now won the Inspire Award at both qualifying tournaments, which is considered more prestigious than winning on the field. The Inspire Award is described by tournament organizers as a team that is "a top contender for all other judging categories and is a strong competitor on the field."

The Inspire Award winner, organizers say, "is able to communicate their experiences, enthusiasm and knowledge to other teams, sponsors, and the judges, [and] will have demonstrated success in accomplishing the task of creating a working and competitive robot."

De-Evolution received a standing ovation from the other teams when it was announced the team had won the Inspire Award.

"Winning the Inspire Award is an unexpected honor," said Noah Sutton-Smolin, De-Evolution's co-president and programmer. "We never strive for the Inspire Award for its own sake. Historically, our team has been about building the best robot possible. This year, though, the focus of our team has shifted from winning the competition to helping others succeed.

"The teams at the competitions are wonderful, as always. The cooperative spirit of the events is fundamentally perspective-altering, as it grows into more than simply a competition for awards."

De-Evolution is a FIRST Tech Challenge (FTC) team, with eight members this year, and is CCA's after-school FTC robotics team. FTC teams are limited to 10 students in grades 7-12.

Based in Manchester, New Hampshire, FIRST (For Inspiration and Recognition of Science and Technology) is an international robotics competition founded by inventor Dean Kamen in 1989. A non-profit organization, FIRST [www.usfirst.org] was created to inspire and motivate students to excel and pursue careers in engineering, science and technology.

De-Evolution team members are committed to advancing understanding of robotics in middle and high schools and to spreading the message of the excitement, team spirit and intellectual stimulation that FIRST competitions provide. Any local schools wishing to start a robotics program are encouraged to contact De-Evolution to schedule a visit or demonstration.

De-Evolution will now compete at the San Diego regional competition Feb. 15 and at the Los Angeles regional competition Feb. 22. The winning teams at Regionals will advance to the Super-Regionals in northern California in March. The winner there will compete internationally in April.

The public is welcome to attend and cheer on De-Evolution at the San Diego Regionals on Feb. 15 at Madison High School in San Diego.

Canyon Crest Academy's De-Evolution robotics team takes top prizes at tournament

Canyon Crest Academy's robotics team, De-Evolution, was named the winner in the team's first appearance in this season's qualifying matches.

Going into the semi-finals, De-Evolution was ranked Number 1 out of 28 teams from several Southern California counties. The team maintained its top position and remained undefeated at the tournament, held Dec. 14 at Escondido Charter High School.

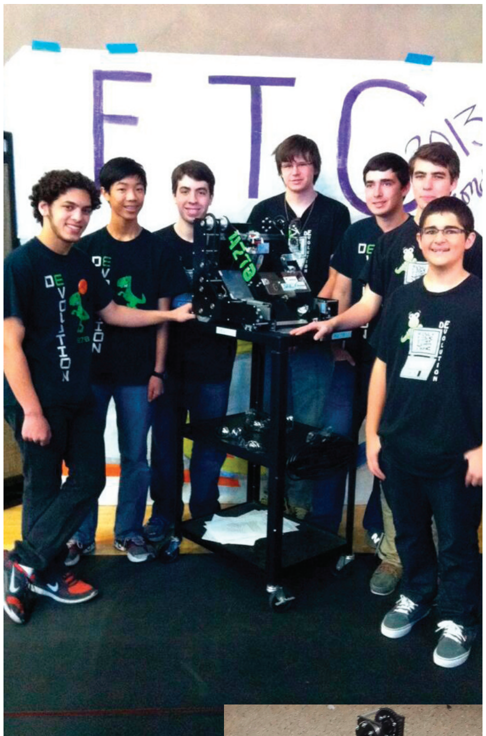
In the finals, the De-Evolution alliance scored the highest points, 256, in any one match of the day.

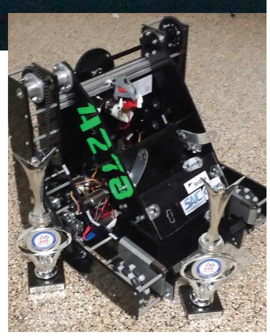
As the Winning Alliance Captain team, De-Evolution now qualifies to advance to the San Diego regional competition to be held Feb. 15 at Madison High School in San Diego. The winning team at Regionals will advance to the Super-Regionals in Northern California in March. The winner there will compete internationally in April.

De-Evolution placed second internationally three years ago, as a rookie team. Four members of that rookie team, now CCA seniors, remain on the team.

De-Evolution was also given the Inspire Award, which is considered more prestigious than winning on the field. The Inspire Award is described by tournament organizers as follows:

"The team that receives this award is chosen by the judges as having best represented a role-model FTC team. This team is a top contender for all other judging categories and is a strong competitor on the field. The Inspire Award Winner is an inspiration to other teams, acting with Gracious Professionalism™ both on and off the playing field. This team is able to communicate their experiences, enthusiasm and knowledge to other teams, sponsors, and the judges. Working as a unit, this team will have demonstrated success in accomplishing the task of creating a working and competitive robot."





(Above) CCA's winning De-Evolution robotics team members (left to right): Yousuf Soliman, Alex Quan, Tristan Murphy, Noah Sutton-Smolin, Ryan Lee, Kian Sheik, Christian Cooper. [not pictured: Mariella Gauvreau]; (Right) The robot with its trophies!

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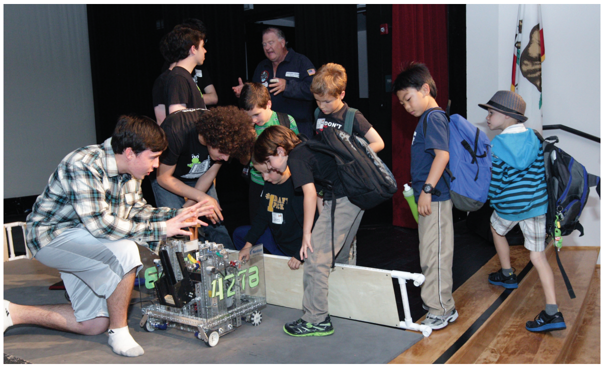
On the Web: December's contest is 'Cutest Kid Photo'

December's On the Web photo contest theme is "Cutest Kid Photo." Submit yours today at DelMarTimes/net/Contests for a chance to win a prize.

Accomplished CCA robotics team visits R. Roger Rowe School



Canyon Crest Academy's robotics team De-Evolution demonstrates its robot's design and prowess to students in 5th through 8th grades at Rancho Santa Fe School on April 5 during Science Discovery Day. The team has achieved success at several regional and local competitions this year.

(Right) CCA Robotics team DeEvolution: Tristan Murphy, Ryan Lee, Nic Stone, Colin Murphy, Noah Sutton-Smolin, Yousuf Soliman; (Left) RSF School students get a close encounter with Robot T-Payne. Photos/Jon Clark