Engineering Notebook

FTC 7347

December 6, 2014

Matt Iverson
2014-09-16
Brainstorming

This week, I calculated the space we'd need for a scissor lift / conveyor belt mechanism.	The mechanism will fit and reach high enough, but it'll take up a lot of space.

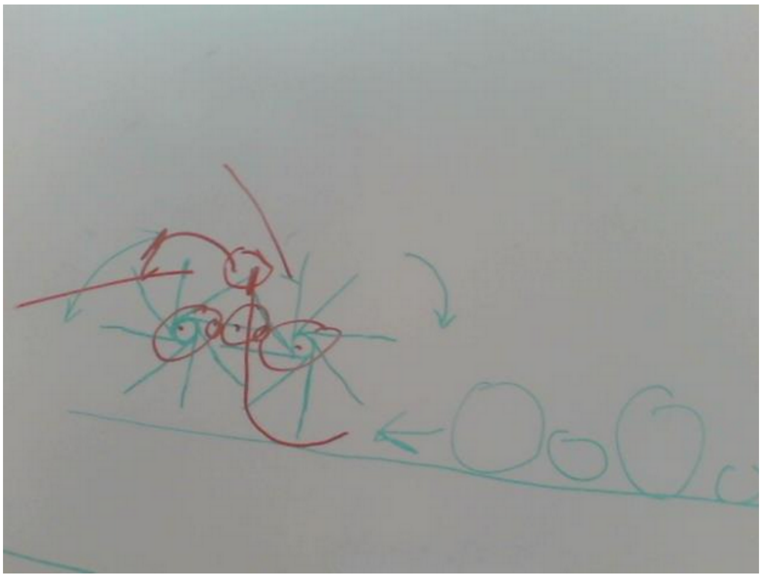
I measured our team's conveyor belt to be 2.5 inches thick. Our robot can be up to 18 inches tall, so we can fit up to 7 layers of the conveyor belt on our robot. We'll need about 2.5 inches on each side of the conveyor belt for tubing to move balls between belt layers, so the belt can be up to 13 inches long. 13 inches at a 45 degree angle is approximately 9.2 inches up and to the side, meaning our scissor lift could reach up to 64 inches (163 cm). This is well above the top of the center goal (120 cm), but I think the system will likely collapse under its own weight at that height.

Nick Vosseteig
2014-09-17
Brainstorming, Designing, and Promoting FTC

This week, the team and I worked together to brainstorm possible ideas for the intake device, the lifter, and the scorer. We also did some calculations and strategic planning.	Reflections (how it went): Overall, it went very well. We successfully came up with a design for the intake device and plan to begin building it next week. We have some possible designs for the lifter and scorer as well, but we are not completely decided and plan to do some tests and calculations to determine what the best method will be.

The main challenge with the brainstorming is trying to lift two different sized balls the maximum of 120 centimeters. It's hard to design an intake device that can pick up both the small and large ball. We also determined that it is most efficient to just pick up all the balls and put them randomly into the tubes instead of trying to get one small, then one large, as this is too challenging and not worth trying to build something to sort the balls and add them to the tube separately. The next problem was not picking up too many balls at once, which we have still not found a definite solution for. We are considering using sensors, but we don't have this incorporated into the design yet.

Here is a picture of the mechanism that we plan to build next week:



The spinners represent brushes, but we are going to build the device with only one brush and test if it will work that way. The one-brush design will only use the front brush and have something to shove the ball up against (represented by the red line in between the two brushes).

Ben Trout
2014-09-19
Brainstorming, Designing, and Promoting FTC

Brainstorming	We started our brainstorming by making three subsystems for scoring blocks: Intake, Lifter, and Scorer. We had a bunch of designs down and ideas flowing. As a team we we're able to list pros and cons of all the designs mentioned and narrowed it down to just a few quality designs.
Designing	Once we had our ideas pinpointed that we thought would be best for accomplishing the challenge we started to design different components of the robot. Me, Nick, and Alex mainly focused on the intake method of picking up balls.
Promoting FTC and FIRST	I went to a lego robotics meeting with my FRC team for recruiting Lego Robotics coaches for the FLL league at liberty that we're starting up. We wanted to promote all three levels of FIRST. We had old lego robots for demo, I brought a ball shooting FTC robot I built and my FRC team brought their worlds robot from last year. We demo'd all the robots and got the kids exited for robotics, hopefully they will move up in the FIRST levels and be on the Liberty FTC team in the future.

Brainstorming

Ways to play the game:

- Tip rolling goal onto ramp. Shuttle balls up and down ramp
- Grab rolling goal and drive around with it putting balls in
- Put balls into center goal

Subsytems:

- Intake
  - scooper

  - rotating brush
  - suction
  - rotating wheels
- Lifter

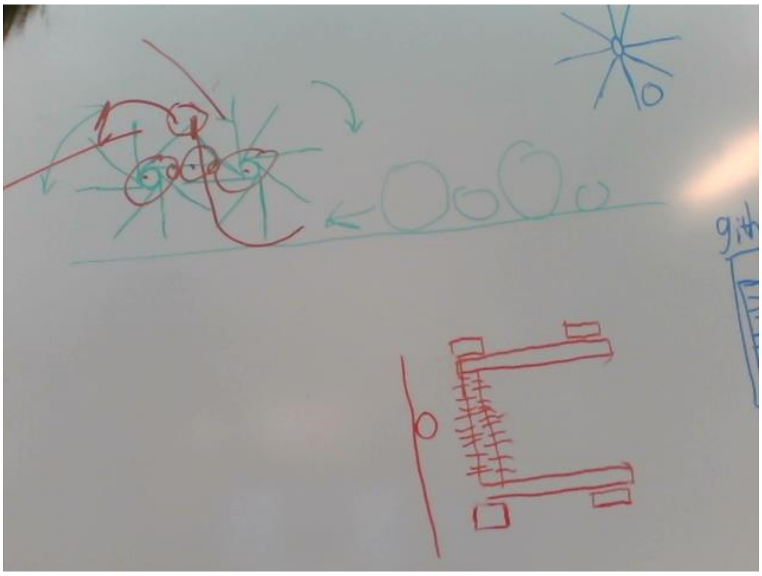
Subsystems:

- Intake
  - scooper
  - rotating brush
  - conveyor belt
  - suction
  - rotating wheels
- Lifter
  - batched
  - continuous feed
- Scorer
  - active dumper
  - passive dumper
- Goal attachment
  - claw
- Drive base

Lifter/Scorer:
Trio of Archimedes Screw
Conveyer belt Tri belt Pulley system
Guided launcher mechanism
Ball sorter
Scissor lift with conveyer belt to bring balls up
Spring Shot with guided tube
Pulley system
surgical tubing sling shot with guided tube

Designing

As a team we finalized on rotating brushes to intake the balls, a surgical tubing sling shot with a guided tube into the goals, and a passive dumper. Our main idea for scoring is using claws to attach to the base of the goal and carry it around with as we launch balls up a tube and deflected into the goal. We have rotating brushes that intake the balls into a slingshot that launches the balls into a guided tube that is extended and retracted by a pulley system. The only part of our brainstorming that we have designed is our intake:



The balls flow under our robot where one rotating brush brushes up a wall bring the balls up into the robot and deflected onto a ramp that leads the balls into the slingshot. The odds of surpassing the five ball limit is low so we aren't going to incorporate a sensor yet. We did a lot of calculations like how many balls we'll pick up per second, size of balls, and if different ideas like a scissor lift will fit in our Robot. I wasn't in charge of calculating, but other team members like David and Matthew were.

Promoting FIRST

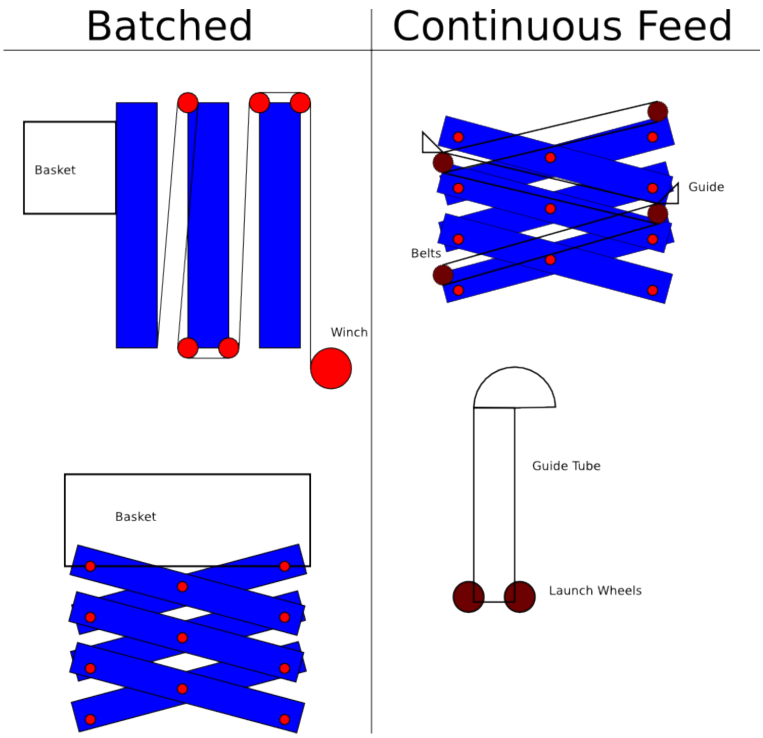
At the meeting put on by my FRC team our main goal was to get Lego Robotics coaches for the starting lego robotics program at Liberty. We want to get young students excited for robotics and mainly Lego robotics. But we don't want these kids robotics to end with FLL. We want to start their robotics program early and keep them going through the levels of FIRST so that when they get to FRC they are used to robotics and accustomed. The FRC team brought that robot and demo'd it and I brought a small FTC robot I made to demo for the kids. We had all three levels of FIRST robots present to get the kids and parents excited for Robotics.

Alex Iverson
2014-09-22
Strategizing and Brainstorming

I worked on Identifying ways to play the game.	I think we were fairly thorough. I do not anticipate seeing any major strategy elements at the tournaments we have not anticipated. I do, however, expect to encounter a combination or variation that we have not considered.
I helped brainstorm types of players we could build.	I would have liked to have come up with more possibilities, but I can not think of anything to add. However, it is taking a long time to analyze the ideas we have because some of the team members need to be trained how to do so; Having too many more ideas may take too much time.

The first thing we did was try to identify what interactions with the field elements were involved in playing the game. Then we looked at how these interactions could be combined into strategies.

The first major challenge was to organize the brainstorming. Because I have more experience with designing for the FIRST competitions, I led the effort. I had difficulty conveying the distinctions between subsystems and mechanisms for the purposes of strategizing. Subsystems are categories for how the robots can interact with the field and gameplay elements, for example, a batched scorer versus a continuous feed scorer, or a rolling goal pusher versus a rolling goal grappler. They are relevant to strategy because those distinctions affect what the robots are able to do on the field. A mechanism is an implementation of a subsystem, and is largely irrelevant to strategy, because how a robot plays is much more dependent on what it can do rather than how it does it, for example, whether the robot uses a scissor lift or a forklift style pulley system to lift the balls is not important because as they are both batched scoring systems they are subject to very similar performance and limitations.



We tried to estimate the performance of various subsystems to determine the effectiveness of the strategies. A batched lifter and scorer system is limited because it needs to be in a down position while collecting balls and a raised position while scoring, so its scoring rate is reduced by its travel time. A continuous feed lifter and scorer system, on the other hand is limited by needing to have a goal on hand and its requirement to handle balls in single file (this is a simplifying approximation that we assume will be proven wrong at some point.). We computed the average density of the balls based on the assumption that they would be uniformly scattered across the field area. That density allowed us to estimate the rate at which an intake of a given width would encounter balls. These calculations allowed us to estimate the scoring potentials and limiting factors of each potential design, so that we can make an informed decision about what type of robot we want to build.

Matt Iverson
2014-09-23
Brainstorming

Made decisions about which prototype to use.	we've come up with pros and cons, but haven't made a whole lot of progress yet

We have 2 different designs for both types of scorer we came up with, batched and continuous. Alex made a document containing sketches for all the designs, and Ben made a list of pros and cons. I think that the best way to score the balls is with a continuous scorer, but that requires a lot of power and needs to quickly sort the 2 different sizes of balls.

Ben Trout
2014-09-24
Brainstorming, Calculating

Brainstorming	We established our intake last week so we went over our lifter/scorers and went over what path we want to pursue using pros and cons of all the ideas the team had.
Calculating	We started by doing a bunch of calculations to see if it is even possible to launch a ball to the correct height. Alex is in charge of the calculations but Filip and I helped him with measurements. See Alex's notebook for calculation

Brainstorming

As a team we went through all the pros and cons of our four lifter/scorers: **Batched:**

Pros: possible, easy, reliable, simpler Cons: unreliable

Continuous Feed: Pros: faster than batched Cons: unreliable

Scissor lift with conveyor belts: Cons: complex mechanically, take up a lot of room, require a lot of power to run, slower than a shot, Gear system to reverse direction of belts: difficult to build

Pros: continuous feed, multiple balls traversing mechanism at once, possible with the parts that we have at hand, store balls along conveyor belt and score balls in end game.

repeating sling shot: Cons: requires large rates of fire, needs to be super reliable, needs to be able to handle a failed shot, wearing out the surgical tubing (loses elasticity over time)

Pros: Faster feed, lower transit times (to not get penalized for carrying more than 5 balls), reliable, easy to build, shoots straight up, more consistent than spring shot, faster reset time than spring shot

Spring shot: Back up plan if slingshot fails

Belt variant: Cons: very slow (but not as slow as scissor lift) balls could fall off easily, hard to build, unreliable

Pros: see pros of scissor lift

Guide tube with pulley system: hard to build a telescoping tube, manufacture the plastic tubing very precisely. and integrate pulley system.

Best Idea: Sling shot

We are going to split our group into two teams: One to prototype the intake system and one to prototype the sling shot. We are going to design them first and get a bill of materials.

We split of into two groups for the two prototypes: Intake: Mat, David, Alex Slingshot: Ben, Filip, Nick

Math

Me, Nick, and Filip helped Alex calculate whether or not we can actually launch the balls 120cm with the surgical tubing we have. See Alex's enginering notebook for all math calculations.

Filip Lewulis
2014-09-24
Research and Calculations

Intake calculations	Matthew and David looked over the ideal geometry for the intake device to the slingshot.
Launch calculations	Alex, Ben and I calculated the power output of the Tetrix DC motors, 10.98W and the mass of the balls, 28.9g and 11.68g to compute the theoretical maximum rate of fire.

We will focus on rewriting this in a LaTeX file. We organized the team into the FTC7347 Github organization. For the launch calculations, Alex introduced us to LATEX format. Today I watched the PTC Robotalk Introduction for an introduction to CREO.

Nick Vosseteig
2014-09-24
Github and sick

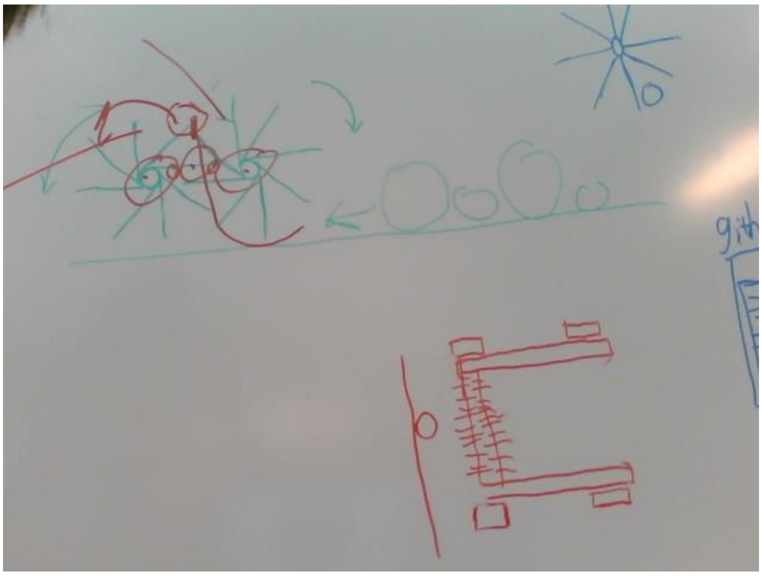
Github	Unfortunately I was home sick for most of the classtime this weeks and was unable to get much done because of this. However, I did manage to set up a github account and familiarize myself with the website. The other teammates did this as well.

I wasn't able to do much this week since I was sick for so much of the week, but our team managed to set up github accounts for our team and each individual team member. This will allow us to organize our engineering notebooks and we can work on the same things at the same time more easily.

David Rohrbaugh
2014-09-26
The Intake Mechanism and Git

This week I worked on the intake mechanism, as well as setting up Git on my laptop. I started to calculate the required deflection of the blades of the intake mechanism requires.	The blades will have to deflect a lot, but I do not know how much yet. Finding a suitable material will prove a challenge.

These are two drawings of a proposed intake mechanism.



Alex Iverson
2014-09-29
Designing Mechanisms

Analyzed pros and cons of various mechanisms	Although fairly straight forward, this discussion was also hampered by miscommunications regarding Mechanisms and Subsystems
Began computing requirements for mechanism	This is much slower progress than it should be. Most team members' lack of prior math and physics training means that each calculation has to be accompanied with lessons and explanation

We have decided that the mechanisms we want to attempt to build first are a rotating brush intake and a slingshot based lifter. We have divided up into two teams. I am drifting between them, helping explain what we need to do to design them and figure out what parts we need to order before we go out and buy them. My brother is working on the intake; he needs very little guidance. The lifter team, however, has not yet completed a physics class; given how slowly the design and calculations are progressing right now, I will probably have to switch from showing them how to do the calculations to showing them by doing the calculations. I am confident that once we have designs and materials, the other team members will be much more productive.

Motor load current draw = 0.91A
Motor voltage = 12V
Motor power = 0.91A · 12V = 10.92W
Mass of large ball = 28.9g = 0.0289kg
Density of polycarbonate = $1.22\frac{\text{g}}{\text{cm}^3}$
Thickness of plastic = 0.125in = 0.3175cm
Diameter of large ball = 2.8in = 7.112cm
Δheight = 120cm = 1.2m

$$\Delta U = mg\Delta h = 0.34\text{J}$$

$$t = \frac{\Delta U}{P} = 0.031\text{s}$$

$$f = \frac{1}{t} = 32\text{Hz}$$

What we are doing now would ideally qualify as prototyping, however, it is being executed far too slowly and ponderously to be call it such. The scarcity of materials for our team means that we can't just put together a wood and cardboard mockup to sanity check the ideas. The rest of the team would much rather tinker, and I want to agree, but we do not have all the components required for our ideas on hand, and if we just start buying things without a reasonable idea of what we need then we are likely to run out of money before being able to finish our robot.

our team name has not been decided yet.

Matt Iverson
9/30/14
Naming Team And Administrative Tasks

What you did this week:	Reflections:
This week, we tried to come up with a good team name, and failed.	Hopefully, the current team name isn't final, because I doubt anyone will find it funny. That said, I don't understand it, so maybe it is hilarious in a way I can't appreciate.

The only idea we've had for a name so far is "$(\lambda x.xx)(\lambda x.xx)$", which doesn't make sense to me, but my brother assures me it's a good name. I've never done this before, so I have no idea what a reasonable team name suggestion is. The other thing we did today was discuss the team organization and elect a captain and assistant captain. My brother is the captain, and Ben is the assistant captain. My brother is splitting the team into a few different groups at the start to design the basic parts of the robot.

Filip Lewulis
2014-10-01
Designing

Designing	We considered the lifting mechanisms from looking at last year's FTC competition, but our calculations for intake appear to remain viable. Alex has written the LaTeX for the maximum rate of fire while introducing us to the syntax. I am following the PTC Robotalk tutorial for using CREO. Ben is researching the materials we can use in accordance with the rules for the robot's components. The launch mechanism is being designed by Matt, David, and Nick. And in accord, our team name is **Children of the Matrix**, which is nice, I guess.

We're all working independently, but next week we plan to reconcile our efforts and begin actual construction of the robot.

Ben Trout
2014-10-03
LaTeXformating for engineering notebook, Promoting FIRST

LaTeX	We started our engineering notebook on google docs, but it didn't take us long to realize that it was very confusing and not organized at all. We switched to LaTeXusing Git as our source control system. TexWorks is the editor that we use.
Promting FIRST	We got six tasks as a group to promote our team to the community and get others to hear about our team. Another main purpose for these six tasks was for obtaining sponsors and others who would want to support our team.

LaTeX

Do to difficulties with google docs we, as a team, made the decision to switch to LaTeX. At first I was hesitant as it seemed really hard and inefficient. But after we all learned how to code it, push, and pull the engineering notebook I came to the conclusion that it will be more organized, easy to read, and better to format math.

Promoting FIRST

We have six tasks, one task per person on our team. The six tasks are as follows. Matt is in charge of an essay to get a 3D printer. Filip is in charge of designing on creo a piece we could print using the 3D printer. David is in charge or developing a simple code to move a servo motor to show other people or potential sponsors. Alex is in charge of making a brochure about our team and FIRST to obtain sponsors or to show other people interested in our team or program. Nick is in charge of designing our logo for our team. And finally I am in charge of making a team website to not only promote our team to the greater community, but also promote FIRST. I have a page with example engineering notebooks, a page describing our team, and a page describing our community outreach through out the year. There isn't a whole lot done yet with the website other than the fact that it is created. The website is a build in progress that will be updated throughout the year as we obtain information and do other things.

Here is a link to our website: https://sites.google.com/a/libertycommon.org/children-of-the-matrix/

Nick Vosseteig
2014-10-03
Set up, helping other teams, and finding materials.

Set up	One thing we did this week was set up Miktex and Github, and moved over the other engineering notebooks that we had written beforehand into the new system. We now have everything set up and engineering notebooks in the future will be easier to format/create.
helping other teams	Since there are two other, less experienced teams at our school, this week I also helped them set up the programs that they needed to test out some of the things they had built for their robot. Most were unfamiliar with RobotC, so I helped them to write basic programs.
finding materials	We decided to buy some surgical tubing this week so that we can start building a prototype of the launcher next week.

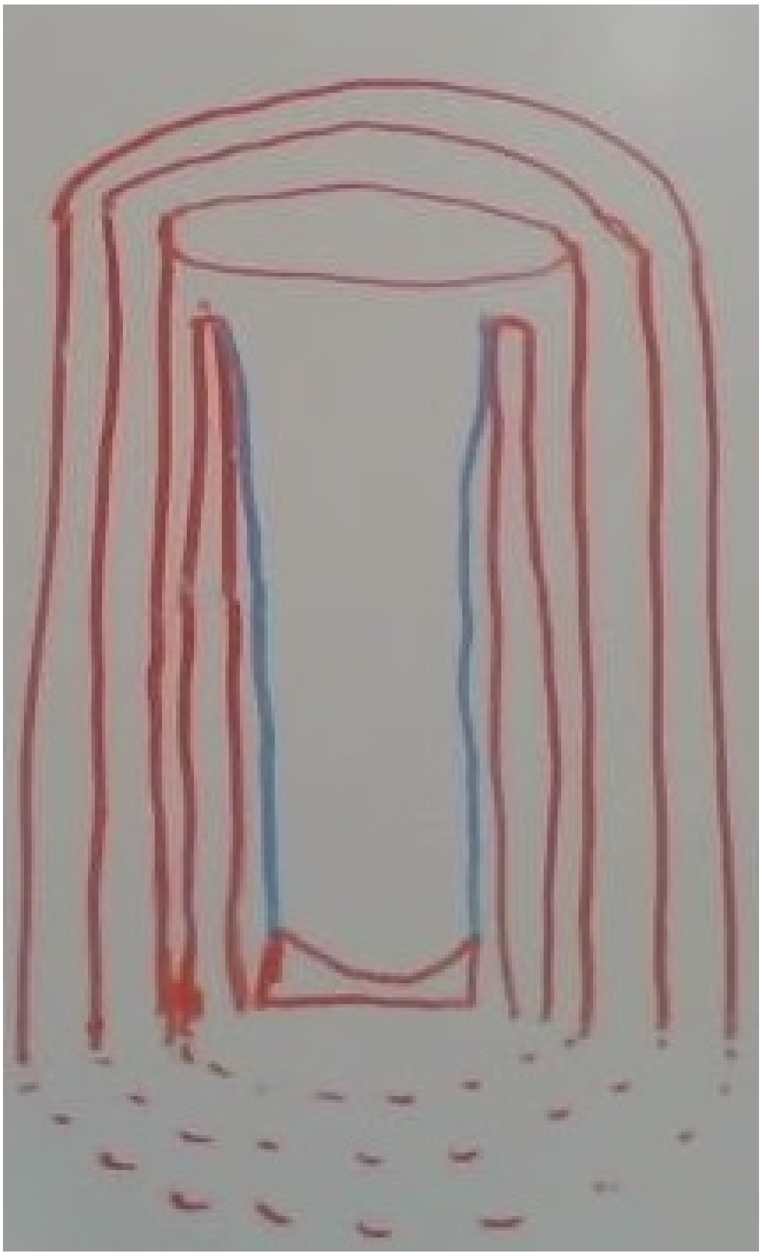
Miktex and Github

This week the main thing we worked on was setting up Miktex and Github so that we can format our engineering notebooks in a more consistent and better formatted.

Helping other teams

The other thing I did this week was help the other teams program their prototypes for certain parts. This was hard because none of them had any experience with programming previously. I managed to help them write some code that allows them to control the motors on their robot with the logitech controllers.

The last thing we did was come up with a basic design for the launcher and tube mechanism that we plan to build with the surgical tubing we are going to buy.



Alex Iverson
2014-10-06
Git, LaTeX, Engineering Notebook, and Calculations

Setting up Git	I walked the team through the process of creating github accounts, installing git, and configuring it. This was not very smooth, and I still have work to do making sure everyone is able to use these tools well. Ideally we would have done this in the preseason.
Setting up LaTeX	I walked the team through installing MiKTeX. This went relatively smoothly, but there is still a ways to go before everyone is able to use LaTeXand the editing environment well.
Converting the Engineering Notebook.	I created the basic file structure for the Engineering Notebook and began converting the entries into LaTeX.
Calculations for the slingshot scorer	I ran calculations for the theoretical maximum rate of fire that could be achieved based on the motors' power output. The results suggest that the design is plausible, but it is sufficiently close that I will refrain from judgement until we have a demonstrable prototype.

The Git Bash and MiKTeX are now installed on our team's computers. We will be writing our Engineering Notebook in LaTeXbecause it is a better system to write technical documents in than the Google Doc we started with. Git's distributed source control allows us to collaborate more effectively and reduces conflicts from concurrent editing. It will also allow us to maintain source control even when we don't have internet access like at a tournament.

Here are the calculations for the slingshot:
Motor load current draw = 0.91A
Motor voltage = 12V
Motor power = $0.91\text{A} \cdot 12\text{V} = 10.92\text{W}$
Mass of large ball = 28.9g = 0.0289kg
Density of polycarbonate = $1.22\frac{\text{g}}{\text{cm}^3}$
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Δheight = 120cm = 1.2m

$$\Delta U = mg\Delta h = 0.34\text{J}$$

$$t = \frac{\Delta U}{P} = 0.031\text{s}$$

$$f = \frac{1}{t} = 32\text{Hz}$$

$$K = \frac{1}{2}mv^2 = 0.34\text{J}$$

$$v = \sqrt{\frac{2K}{m}} = 4.9\frac{\text{m}}{\text{s}}$$

$$m_{\text{plastic}} = (1.5 \cdot 7.112\text{cm})^2 \cdot 0.3175\text{cm} \cdot 1.22\frac{\text{g}}{\text{cm}^3} = 44\text{g}$$

$$K_{\text{plastic}} = \frac{1}{2}m_{\text{plastic}}v^2 = 0.529\text{J}$$

$$K_{\text{total}} = 0.34\text{J} + 0.529\text{J} = 0.869\text{J}$$

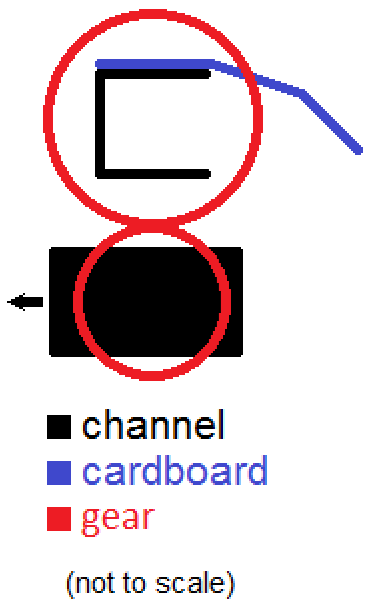
$$t = \frac{K_{\text{total}}}{P} = 0.079\text{s}$$

$$f = \frac{1}{t} = 12.5\text{Hz}$$

David Rohrbaugh
2014-11-07
The Intake Mechanism, Samantha Module, and Electronics

This week, I worked on setting up the router and the flash drives for use with the driver station computer. The router used last year had to be reset and reconfigured. The flash drives also had to be made again. I have not been able to test my work because we are reconfiguring our robot's electronics to incorporate power poles.	All seems to be working properly as far as the Samantha Module is concerned. The robot's electronic parts with power poles incorporated are coming together.

This is a diagram of our current prototype for the intake mechanism. A Tetrix channel is attached to a DC motor so it rotates as shown. It is now geared up. The solid black portion is part of the robot's frame. The robot is facing to the right, with most of it to the left of this representation.



David Rohrbaugh
2014-10-10
Tasks Related to the 3D Printer and Joystick Control

This week I worked on getting a servo motor working with a joystick. Even though I had the correct code, RobotC was not set up the right way, so it did not work. Nick's computer was set up correctly, so when the code ran on his computer it worked.	I was finished with the task of getting the joystick and servo working by the end of class Thursday. I missed class on Friday, but my teammates continued their work on their tasks. Nick has a lot more code which can be used as a template for doing basic tasks.

Nick Vosseteig
2014-10-10
brainstorming, helping other teams, and testing.

Brainstorming	We brainstormed methods to repeatedly fire our slingshot and came up with two possible solutions of a winch with a clutch, and a wheel attached to the ball-holder.
helping other teams	I continued helping the other teams since they are less experienced with programming. David set up the hardware to test simple programs by using the joystick. This week I also set up a few sample programs that people can reference or test out with the hardware to see how the code works.
testing	We tested out the surgical tubing by using a makeshift launcher with 2 chairs and a cup attached to the tube in order to test launching the balls. We determined that it does not need to be pulled down very far to launch the balls as high as we need to, but it takes a substantial amount of force to pull down. If we use less tension, it needs to be pulled down further, but takes less force to do it, but having a much shorter, higher tension launcher could increase reliability and make the mechanism easier to work with.

Helping other teams

Helping the other teams with programming is something that I've been working on alot and this week I came up with some short sample code to show them:

```
#include "JoystickDriver.c"

task main()
{
  while(true)
  {
    getJoystickSettings(joystick);
```

```
    if(joy1Btn(1)){
      servo[servo1] = 255;
    }
    if(joy1Btn(2)){
      servo[servo1] = 0;
    }
  }
}
```

It's very simple code, but it helps them to understand how to set up their code and allows them to understand this simple code on how to use a servo motor with the joystick controller.

Testing

We tested out the surgical tubing, but the problem is whether we should use a lot of tension or a little tension. There are pros and cons to both sides: Having less tension means that the tubing needs to be pulled further down, but it would be less hard on the motor doing it, having more tension puts more pressure on the motor, but allows for a more reliable, and more compact slingshot.

Alex Iverson
2014-10-13
Git and Documentation

I continued helping the team learn to use the Git source control system.	Most of the team is getting the hang of the source control system fairly well, but there is still plenty of room to improve.

Most of the team is starting to get to the level where they can use git and LaTeXon their own, but Nick still requires help resolving merge conflicts, and Ben has trouble remembering the commands.

I made a diagram depicting the functioning of distributed version control on the board and discussed how commiting, branching, and merging work.

Matt Iverson
10/14/2014
Building intake prototype

David and I are getting back to work on the intake prototype, now that our special tasks from last week are done.	We've finalized what we want to build, and have just started building it.

David and I decided that we want to build an intake that uses rotating bristles to pick up balls. The bristles need to be long enough to reach a small ball in the corner, sturdy enough to pull it in, and strong enough to force a large ball out of the corner. So far, we've only built the shaft that the bristles will attach to.

Filip Lewulis
CREO Modeling

Modeling	Our team worked in Parametric to design the ball container. Will helped us greatly.
Robotalk	PTC Webinar Notes:

Our productivity is still slowed by lack of materials.

David Rohrbaugh
2014-10-16
Code for Controlling Robot Remotely

This week I worked on setting up a basic robot, specifically, incorporating the gamepad and electronics. We now have basic code for a servo and a DC motor.	We have the basic framework in place, but it will have to be fine-tuned.

David Rohrbaugh
2014-10-17
Code for Moving Servo with Joystick

Today, I worked with the rookie team on making a servo work with the joystick. We were not able to get it to work, but this year being my first year coding in RobotC and uncertainty over whether the computer was set up right didn't help.	I and the person I was working with both learned a lot more about using RobotC with joysticks and servos despite failing to move the servo with the joystick.

Nick Vosseteig
2014-10-17
helping other teams, testing, logo design.

Helping other teams	This week I helped other teams by creating some more sample code. I also built a simple model showing how wiring works. It has a servo controller and a dc controller so that I can show the sample programs with it.
testing	We continued testing the surgical tubing as well as began building a prototype for the intake device.
logo design	I made a logo for our team this week.

Helping other teams

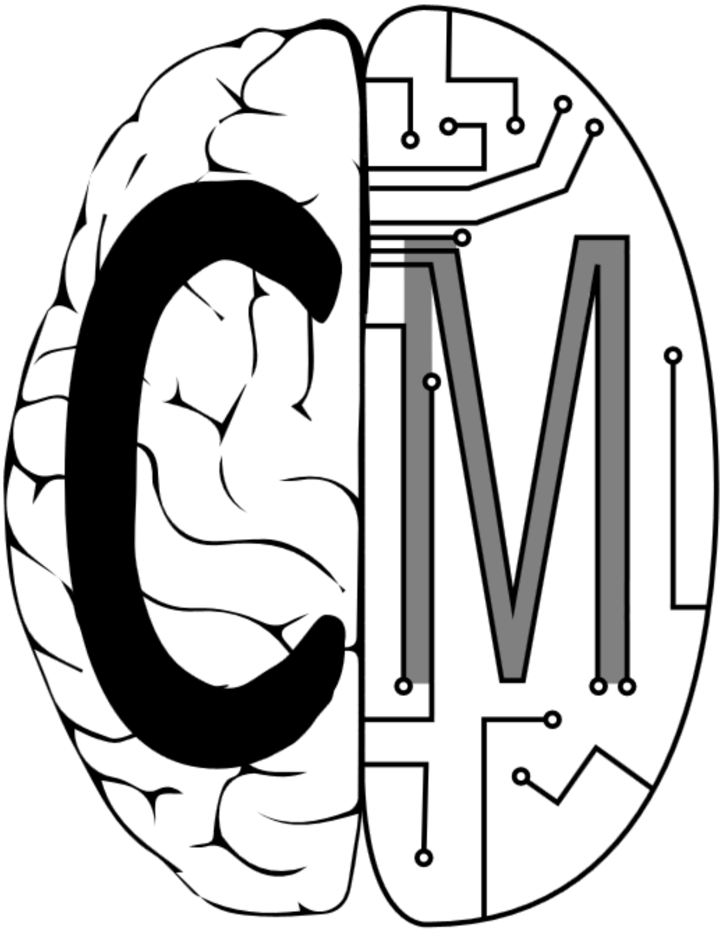
This week I created another sample program that uses the logitech controller to control the motors.

```
#include "JoystickDriver.c"

task main()
{
  while(true)
  {
    //each stick controls a motor
    getJoystickSettings(joystick);

    if(joystick.joy1_y1 < 20 && joystick.joy1_y1>-20)
    {
      motor[dc1] = 0;
    }
    else
    {
      motor[dc1] = joystick.joy1_y1;
    }
  }
}
```

The code shows people how to move the motors using the joystick, demonstrates using a deadzone for the joystick, and shows them how to use dc motors.

Logo Design

I created a logo for our team - Children of the Matrix. The logo has a brain, with one half being organic and the other half looking like part of a computer. Children of the Matrix means people who can connect to the internet with thier minds, so I found the brain with two sections fitting. I also added in the two prominent letters from our name into the brain: C on the organic side of the brain and M on the technological side. Here is a picture of the logo:



Ben Trout
2014-10-17
Cut pieces for Field, Design and prototype slingshot

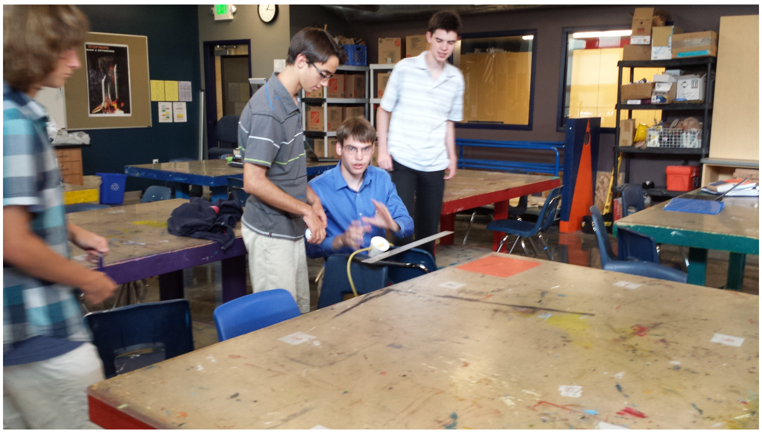
Cut pieces for field	The FRC team I am apart of allowed us to use their wood shop so we could cut the pieces for our field. The first Sunday it was just me and I outlined all the pieces on the two plywood sheets and got started on cutting some of the pieces. I spent a total of three hours the first Sunday with the help of the FRC coaches guiding me, and helping me with the cuts. The second Sunday David and Filip joined me to help cut the rest of the parts. We outlined the rest of the parts on the remaining plywood we had and with the help and guidence of the FRC coach got all our pieces cut. I brought all the pieces to Liberty and now all we have to do is assemble the field elements.
Design and prototype slingshot	We started to design the slingshot and have a good idea of what it will look like. With the help of Filip and Alex we designed a piece to hold the ball on Creo. My FRC team will help me print the ball holder with the 3D printer they own. Our method of launching the ball is to have a bar connected to our ball holder, and the other end connected to a wheel. The wheel is connected to a motor. As the wheel spins the printed piece will move up and down. As the piece is pulled down the surgical tubing will get pulled down and as the wheel goes around the ball holder will fling up with the surgical tubing flinging the ball into the air.

Field Cutting

The Field assembly went great. I had some adults who know a lot about wood works help me. The planning and cutting went perfect. We didn't mess up on any pieces and now have all the pieces cut. Now that's all left to do is assemble the field which is up to the other teams with me as there guide.

Designing and Prototyping slingshot

The plan for the sling shot has a lot of potential. We got our surgical tubing and tested different lengths and tightness to see what will launch the ball the required distance. We found though that our testing wasn't very usefull, and wouldn't be until we got our actual ball holder. The holders we were using had the surgical tubing attatched in a different method rather than it would. The actual holder would also be a different mass than our current holder we threw together. We desided to stop our testing on the surgical tubing and launching the balls and instead focus on designing the ball holder on Creo. Next week we'll start designing the holder on creo.



Our team testing the sling shot

The original makeshift ball holder that we made out of TETRIX parts

Alex Iverson
2014-10-20
Code Listings and Git

I worked with David to set up code listings.	We are using the listings package and have created a custom style for RobotC which formats and colors the code like the RobotC development environment does. It is also set up to be automatically available to any of our entries.
I continued to help Ben and Nick use git.	Nick is getting better at merging, but is still not able to handle the full process independently. I had to re-teach Ben how to save a file and quit in vi, which is used by the git bash for windows to write commit messages.
I helped Nick put together the basic robot frame for the test chassis.	Now that we have begun with hands on assembly, productivity is much better.

Matt Iverson
10/21/2014
Finishing Prototype

I finished the prototype for our intake mechanism.	The prototype works, but it's going to have to go a long way to be implemented on the competition robot.

I showed the previous prototype to the rest of the team, and we decided that having the cardboard bent would be more effective at picking up balls. I then cut out a section of cardboard that fits the entire shaft of the intake, and folded it similarly to the original. This is the result:

David Rohrbaugh
2014-10-22
Code for Moving Servo with Joystick

This week I worked on building the field with Ben and Filip. We cut out most the plywood pieces at a friend's shop, and finished cutting out the pieces at our on-site shop.	The only thing that remains to be done is screw all the pieces together.

Nick Vosseteig
2014-10-24
building, wiring, programming

building	This week I built a frame for the robot and added the wheels, using holonomic wheels in the front of the robot to allow it to turn more easily. Matt and David worked on building a prototype for the intake device, but did not complete it.
wiring	I also did all the necessary wiring for the frame so now the 4 dc motors necessary to drive are wired.
programming	I wrote a simple program that allows us to control/test the robot with the logitech controller.

Programming

This program allows us to drive the robot frame.

```
#include "JoystickDriver.c"

task main()
{
  while(true)
  {
    getJoystickSettings(joystick);

    if(joystick.joy1_y1<20 && joystick.joy1_y1>-20){
      motor[left] = 0;
      motor[left2] = 0;
      }else{
      motor[left] = -joystick.joy1_y1/2;
      motor[left2] = joystick.joy1_y1/2;
    }
    if(joystick.joy1_y2<20 && joystick.joy1_y2>-20){
      motor[right] = 0;
      motor[right2] = 0;
      }else{
      motor[right] = joystick.joy1_y2/2;
      motor[right2] = joystick.joy1_y2/2;
    }
  }
}
```

We did not get a chance to test the code out yet, so we will have to do it next week.

Building and wiring

I built and wired the frame of the robot which has 4 dc motors, one for each wheel. The front wheels are 4 holonomic wheels set 2 on each side for stability and better ability to turn. The building and wiring went pretty well since I had done it before and knew what to do. The wires are still a mess, and I need to clean them up in the future.

Ben Trout
2014-10-24
CAD Designing, Field Assembly

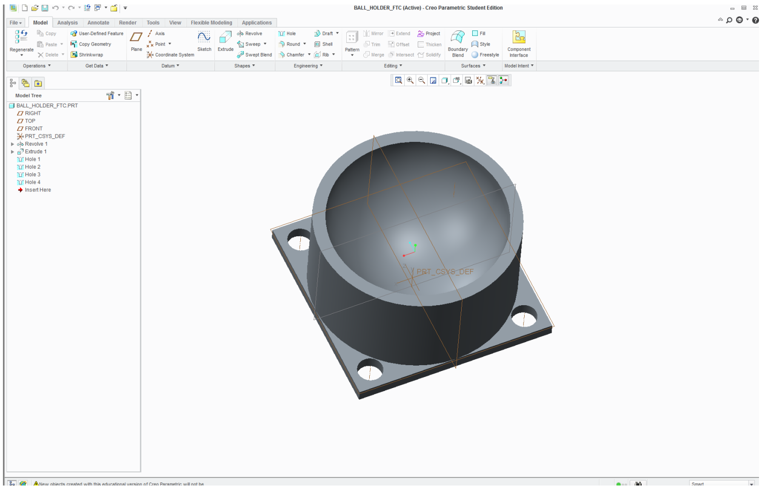
CAD Designing	Our current plan for launching the balls into the tubes is a slingshot. But we need a ball holder that will hold the balls and release them into the tub. The best way to do this is to make a piece on CREO that can perfectly fit a ball and has four holes that can attach to the surgical tubing. Me and Filip will were in charge of building this piece on CREO.
Field Assembly	Now that I have all the pieces cut and ready to be assembled some members from other teams were willing to put it together. Rob, Eric, and JJ are going to put the pieces together. I got them started and went out to make sure their on the right path and putting all the pieces together correctly. I plan on helping them less and less.

CAD Designing

I was in charge of designing the ball holder for our slingshot and building it on Creo. It was pretty hard as I'm new to Creo and it will take me a while to get used to. Will Werst, a member on my FRC team, helped me make the piece on Creo. He's a great teacher who knows a lot about Creo. With his guidance I was able to build the part using the revolve tool. Now all we have to do is take this piece that I CAD'd up and bring it to FRC. They have a 3D printer that can print our piece for us. CADing up pieces can be incredibly useful. If we need to make a slight change to the design because the ball wouldn't fit in the cup we can easily just make the changes in CREO and spit out the piece again on the 3D printer. Now that I know the basics of CREO, me and Filip plan on designing our entire robot on CREO and this is what we'll be working on next week.

Field Assembly

It was a rough start for the build team but they've got it all figured out now. It took them a couple days to figure out how to put it together, but they have all the holes for one ramp predrilled and will start putting it together next week. I'll let them off on their on and we should have a built field here soon.



CAD image of ball holder

Alex Iverson
2014-10-27
Testing Prototypes

I am continuing to help some team members use git.	Although Nick is fairly competent at git by now, he doesn't know how to read the error messages. Ben still doesn't know how to use git.
We tested the prototype chassis drive base.	The prototype chassis drives just fine now. Now we just need to add other prototype components to it.

Matt Iverson
2014-10-28
Fixing Intake Prototype

What you did this week:	Reflections:
Corrected intake prototype	I had to make the sweeper slightly smaller

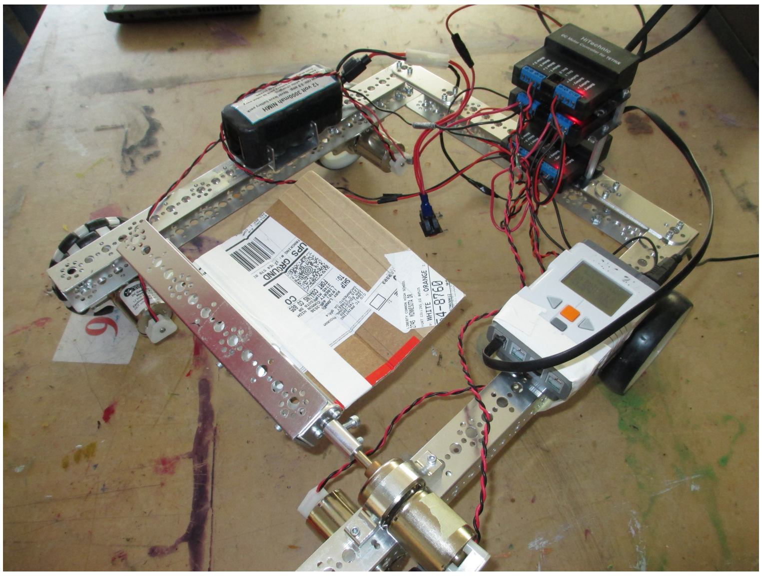
Unfortunately, David and I assumed that we would have 13” to work with, which turned out to not be the case. Since the front wheels are mounted such that there is no extra space for the sweeper, it will instead have to be mounted between the wheels. I reduced the width of the cardboard from 12.5” to 7”.

Ben Trout
2014-10-31
Building Intake, CAD

Building Intake	Me and Nick with the help of some other team members were in charge of starting the robot. While I worked on CREO last week Nick finished the base of the robot. Our basic idea is that This week as building really started to get under way Nick asked if I could help. Me and Nick finished putting on all the wheels and while I attached the intake Nick wired all the wheels and intake motor. we used a cardboard piece that we slit into a curve. We then attached another motor to the very front of our robot and screwed a TETRIX bar to it. Finally, we tapped our cardboard piece on the the bar. By the end of the week we were able to get a driving robot with a rotating intake that can capture balls as it drives around.
CAD	Me and Filip are still working on CREO to have a virtual robot. Will came down to help us again. He set us up a folder in Windchill and made us our own personal workspaces in Windchill. We can now work on the same robot from different computers and log into our workspaces from any computer. Filip can start a piece and check that piece into Windchill and then I can checkout that piece and start editing the same piece Filip was working on earlier. Me and Filip downloaded all the TETRIX pieces and using the assembly tool in CREO we will start assembling the robot. As we go we can also CAD up different pieces like the ball holder and use the 3D printer to print that piece.

Building Intake

The intake went well for just being a prototype. Our basic idea is reliable and we will probably stick with it. The only problem so far is we need a support on the other side since we're only using one motor. We also want to put it as far forward on our robot as to not interfere with any of our mechanisms such as the ball launcher. The only problem we had on the actual mechanism is the cardboard over time didn't have as much of a curve as it lost its rigidity. We'll definitely be using a 3D piece on our final robot.

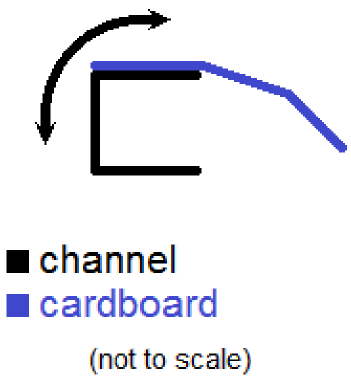


The first prototype of our rotating brush in the front of the robot.

David Rohrbaugh
2014-10-31
Prototyping the Intake Mechanism and Joystick Control

This week I, with several teammates, worked on prototyping the intake mechanism.	Our current intake mechanism is a folded carboard panel. It will most likely be replaced by a more suitable material. This material must be able to deflect enough, however, to collect balls when the robot is up against a wall.

This is a diagram of our current prototype for the intake mechanism. A Tetrix channel is attached to a DC motor so it rotates as shown. The carboard, which will probably be replaced by a more suitable material, makes contact with both sizes of balls, pushing them into our yet-to-be-constructed launching mechanism.



Nick Vosseteig
2014-10-31
building, wiring, programming

building	I continued building the robot and added the spinning prototype on the front.
wiring	I wired the motor for the spinning intake device.
programming	I added to the robot's code to make the 1 and 2 buttons on the controller control the intake device.

Programming

I added this section of code to get the spinner to work:

```
if(joy1Btn(2)){
  motor[intake] = 100;
  }else if(joy1Btn(1)){
  motor[intake] = -100;
  }else{
  motor[intake] = 0;
}
```

This week we tested out the code and got all the motors working. There was one bad motor which we replaced, and then the motors were not assigned correctly in the code. We just went through and tested each one individually to correct it.

Building and wiring

This week we mainly built more on the robot frame and added the prototype intake device on the front:

Ben Trout
2014-11-7
Building Intake, Designing

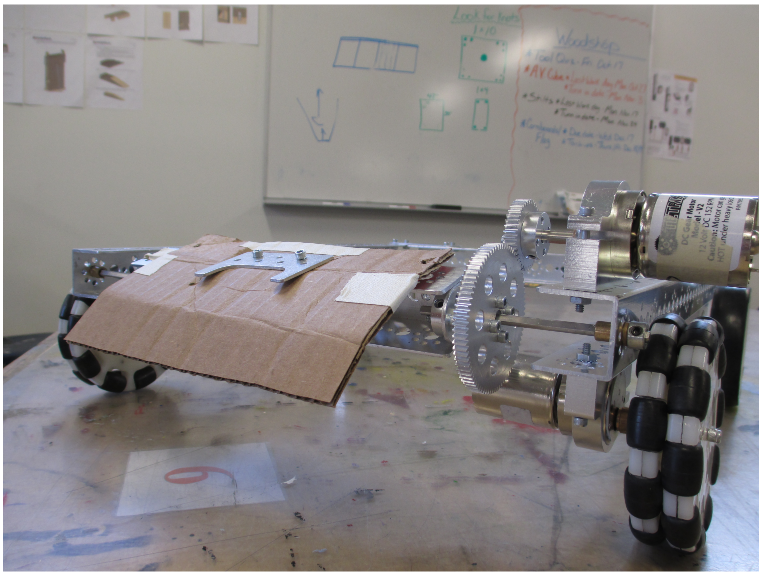
Building Intake	As this week went under way we soon realized we wanted to put the intake farther forward and lower to the ground. We lowered the bar farther to the ground and put it to the last hole to the front. It was an easy solution to move the bar lower to the ground as we just added some gears and slipped the intake onto two bars that go into the two side bars. By doing this we gave ourselves a good couple of inches of extra room for the rest of our mechanisms in our robot.
Designing	As we analyzed our robot and realized what limited space we had we soon came to the conclusion as a team that we needed to change shooter mechanisms. We decided that a slingshot was too risky and would not be adequate. We switched to a ramp that the balls would go up and into the tube. And as these balls went up the ramp a waker would spin around and fling the balls up the ramp into the tube. This is still a beginning idea, but has promise.

Building Intake

Our first intake went very well. There was just one problem with it: the intake took up to much space in our robot and we wanted to greatly reduce this. So what we did first is move the intake to the farthest bar forward; that was an easy change. Our second idea to reduce space was to move the intake farther to the ground so we can cut the cardboard and reduce the amount of space it takes up when it revolves around. To move it farther to the ground we added two gears, one attached to the motor and the other attached to the bar the intake was on. We attached two bars to the sides of our robots and attached the intake to those two bars. The two bars on their own would wobble around and I tried to stabilize the bars, but Alex pointed out that once we attached the intake to the two bars it would make the whole mechanism rigid. Our original intake used a structural bar and we were afraid that it would not allow enough clearance for a big ball to go under. We tried to attach a small bar across the two beams and use that as our main piece for the intake, but it wasn't strong enough. We ended up just going with our original intake and it does give enough space for the big ball to go under. Our intake is officially done. We cut down the cardboard and there's no way we can move it forward or lower anymore. We are pleased with the intake and will move onto the shooter mechanism next week.

Designing

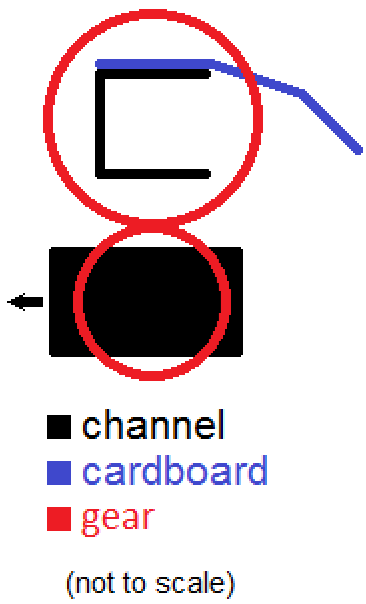
Our main problems with the slingshot is it took up too much space, didn't have a reliable way to reload that didn't take up a ton of space, and didn't have an easy way to get the balls into the holder that was reliable. As we were messing around with our new intake we soon realized that with the motor on very little power and a lot of weight on it could fling a ball pretty far up a ramp. We rolled with this idea and are now going to build a funnel from the intake to a one ball wide curved ramp in the middle of our robot. A bar over the ramp that has a waker attached to it will spin around and hit the balls up the ramp. This idea in theory will be much more reliable and efficient. We don't have to worry about reloading; we can have a constant stream of balls; funneling the balls into the ramp will be easy; and we don't have to worry about surgical tubing that can wear over time. My only concern with this new design is that balls could easily get clogged in the tube if the waker can't hit them high enough or has one misfire and this could lead to a whole lot of trouble. I drew up a design for this and we'll be starting on it next week.



David Rohrbaugh
2014-11-07
The Intake Mechanism, Samantha Module, and Electronics

This week, I worked on setting up the router and the flash drives for use with the driver station computer. The router used last year had to be reset and reconfigured. The flash drives also had to be made again. I have not been able to test my work because we are reconfiguring our robot's electronics to incorporate power poles.	All seems to be working properly as far as the Samantha Module is concerned. The robot's electronic parts with power poles incorporated are coming together.

This is a diagram of our current prototype for the intake mechanism. A Tetrix channel is attached to a DC motor so it rotates as shown. It is now geared up. The solid black portion is part of the robot's frame. The robot is facing to the right, with most of it to the left of this representation.



Matt Iverson
11/11/2014
Improving Intake

What you did this week:	Reflections:
I helped fix the intake.	The intake isn't functional yet, but it's working better than it was earlier.

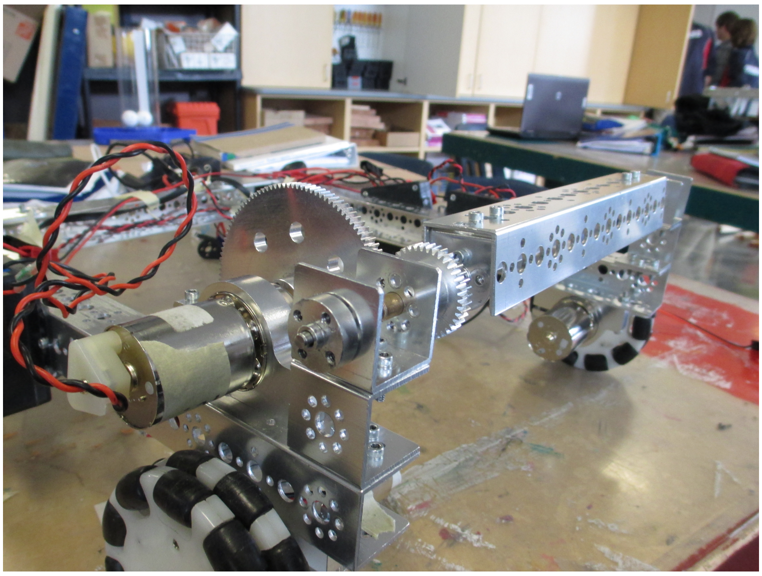
While testing our first attempt at making our robot score while fitting inside an 18" cube, the intake started squeaking and then stopped working entirely. It turned out that the screws attaching the motor to the chasis hadn't been tightened all the way, so the gears were slipping and eventually lost connection. I fixed the screws, and the rest of the team made sure the other parts were going to stay in place and strengthened the intake in other places.

Ben Trout
2014-14-14
Building

Building Launcher	At the beginning of the week we had an intake and that's about it. As the next step, building the launcher, got under way we split into two groups. David and Nick started to wire the whole robot while me, Filip, and Matt started to build the launcher. The idea is simple. We have a bar attached with a gear ratio to a motor. The bar has another cardboard piece to it that hits the balls. Our gear ratio is a 3:1 allowing the cardboard to hit the balls with more force. We put the bar higher up allowing us to have a longer piece of cardboard. We also put the launcher at the front of our robot taking of our original intake.

Building Launcher

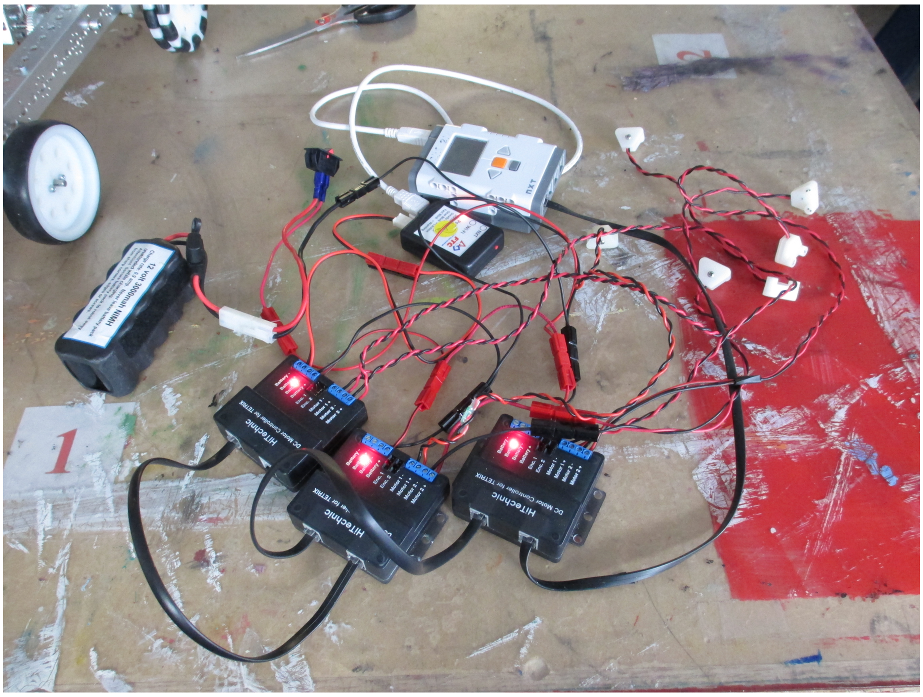
Building the new launcher was easy. It was basically a replica of the intake just had a swapped gear ratio to make it go faster. It didn't take us long though to realize that having an intake and then a launcher that were identical was inefficient. We didn't need an intake if all we had to do is drive around and hit the balls with our launcher. We originally had the launcher behind the intake and as the intake took in the balls the launcher would spin around and hit them up a makeshift ramp we made. We had many problems with this: from the two cardboard pieces hitting each other to the balls getting stuck under the cardboard as it swung around. We took of both the intake and launcher at this point. We put the launcher at the very front of the robot putting it two bars higher than before allowing us to have a larger piece of cardboard. By moving it to the front we have all that space in the back available now for the ramp. By moving the axel up two bars we won't have to worry about the balls getting stuck under the cardboard as it can swing out farther and scoop them in. Next week we'll focus on building the ramp we'll be flinging the balls up.



David Rohrbaugh
2014-11-14
The Samantha Module and Electronics

This week, I worked on the electronics with Nick. We finished implementing power poles into our wiring, and put the wiring back on the robot, but better this time. The Samantha Module seems to not be working, but a real test will have to be run.	The configuration of the electronics was changed, so the power poles are a little bit out of wack. This can be fixed, however.

This is a diagram of our current wiring, but separate from the robot to aid comprehension.



Nick Vosseteig
2014-11-14
building, wiring, programming

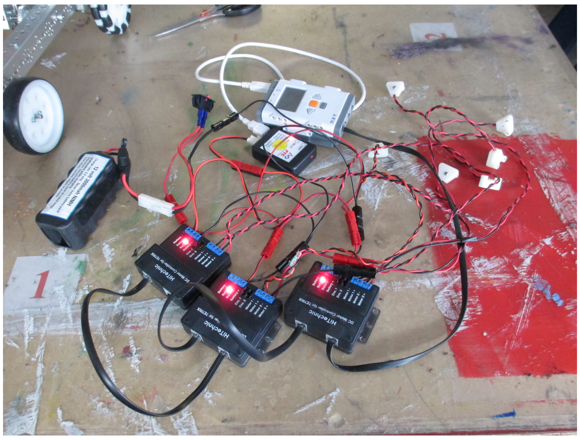
building	We built two spinners, one to intake and one to launch balls up a ramp and built a ramp.
wiring	David and I took the wires off in order to build and installed power poles into our wiring. We then reattached the wiring.
programming	I changed the code to accomodate the new wiring and the new spinner.

building

This week we built an intake device and a spinner. However, upon testing we decided that this setup was not optimal due to problems between the two spinners. We decided to try removing them and making a single, larger spinner that we can use both as an intake, and a launcher.

Wiring

This week David and I worked on the wiring. We added power poles onto the wiring and then reattached it to the robot. Here is what the wiring looked like when it was not attached to the robot:



David Rohrbaugh
2014-18-14
Mentoring my Brother's FLL Team

My younger brother is on an FLL team, coached by my dad, of which I used to be a member. This team was started back in 2009, when I was in 5th grade. My dad and another dad coached it. As of last year, I was the only official orignial team member still on the team. (My brother helped us out the first year, hence "official.") I helped the team to transfer the subroutines from last year for NXT-G 1.1 to NXT-G 2.0, as I worked on many of these programs. *not finished yet*

Here is a picture of me with the team:

Matt Iverson
11/18/2014
Cutting cardboard

What you did this week:	Reflections:
I cut some pieces of cardboard to make the base of the ramp.	The cuts didn't turn out the best, but we did make a very distracting frisbee.

The sides of our ramp are made out of cardboard circular pieces. Drawing a circle is hard enough, but cutting it out of cardboard with scissors is extremely difficult. The pieces weren't quite symmetrical, but they're close.

Ben Trout
2014-11-21
Building

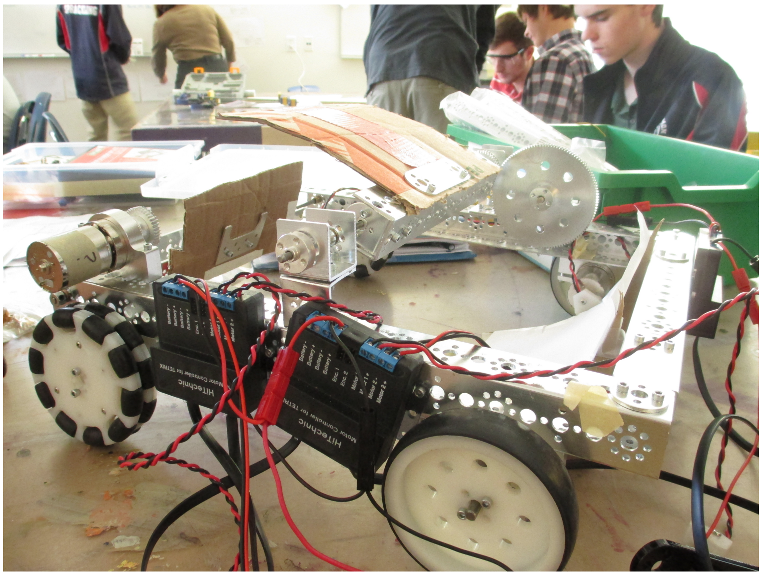
Intake	With the help of Filip I returned to the original idea with the intake at the front and the launcher behind it. We moved the launcher to the middle of the robot, but still with the same gear ratio and height of the ground. We put the intake back on the robot exactly where we had it when we had it there before: right at the front as low as possible (between the bar).
Ramp	Me and Matt were put incharge made a ramp for our robot. We made a circle with radius 6in in a cardboard box and cut it out. We then drew tangent lines to opposit sides of the circle and conected the tangent lines. We cut these lines out making a square with a curve radius 6in going from one corner to the next. This will allow the ramp to have a nice smooth curve that the ball can easily travel up. Me and Matt then put supports on the back and front of these two cureved pieces attatching them together. We finally got a piece of cardstock and taped it along the curved part of our cardboard sidese making a rigid and smooth ramp.
Claw	One of the final pieces to our robot is the claw that will hook onto the rolling goal and drag it around with us as we launch balls into it. I had Matt head this, but helped a long the way. We got two servos that attach to the back of the robot that have a bar conected between them. Attatched to the bar is two claws perfectly spaced to hook into the holes on the rolling goals. The servos will bring the claws up allowing the robot to fit in the 18in by 18in box and then release them down when we are ready to hook into the rolling goal and drag it around with us.

Building Intake

Once Alex finally returned he pointed out the flaws in having the intake and ball launcher being the same thing at the front of the robot. We need these two to be separate because the intake needs to be flexible to pick up balls of the wall while the launcher needs to be rigid to hit the balls up the ramp. We went back to our old plan which was very easy because we saved our original intake. Rebuilding the robot as we had it before was super easy. It was just a time game and Filip helped me put it back together as we had it before, only difference was our intake is the same as we had it when it was in the front of our robot.

Ramp and Claw

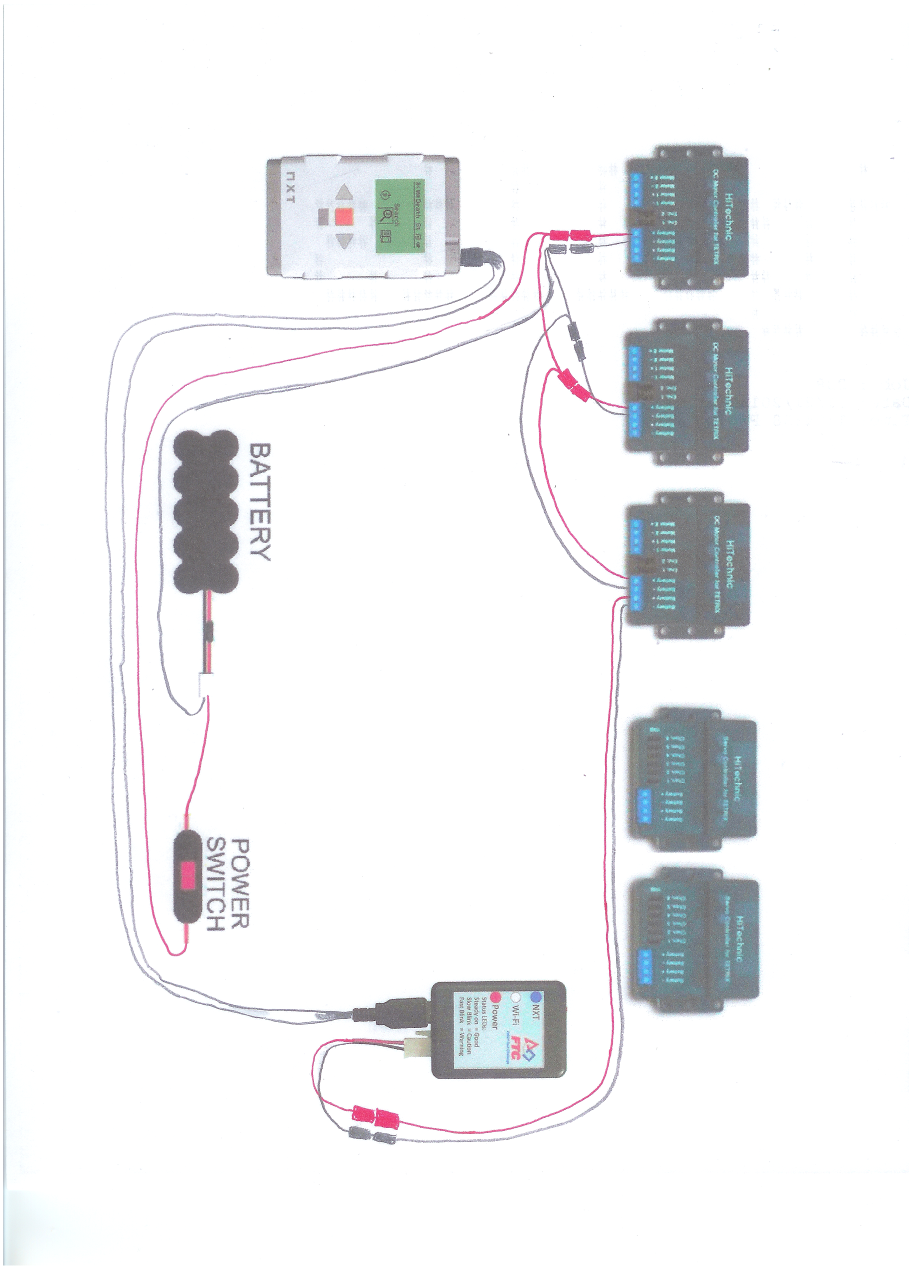
As the intake got done and Nick and Alex started to rewire me and Matt started to work on the ramp and claws. I had Matt do the ramp first time around while I finished the intake, but we only had regular paper at that time and the ramp was slanted as the curves weren't semetrical. As I finished up with the intake I helped Matt and we learned from our old mistakes. We made sure the circle was perfectly round and made sure our tangent lines were perfectly tangent, because if they weren't we'd have an angled ramp to one side like we had last time. We carefully cut out every piece and taped it all together. We then got cardstock instead of paper and used that for the ramp as it is sturdier and will last the impact of a ball going up it. As we finished the ramp we moved onto the claw. It is still in the very begining stages and we have no pictures right now as we're just messing around with the idea, and only have conceptual images in our heads of what it would look like. How I described it above is how it will most likely end up being. Right now it's a lot of messing around with different positions of the servos to make sure they pivot the claws up and down.



David Rohrbaugh
2014-11-21
The Samantha Module and Wiring Diagram

This week, I worked on the Samantha Module. It is still not set up correctly, but we are taking steps to make sure it works.	The configuration of the electronics was changed, so the power poles are a little bit out of wack. This can be fixed, however. The router may need to be reconfigured, as the Samantha Module is still not working.

This is a representation of our current wiring setup.


BATTERY
POWER SWITCH
HiTechnic
HiTechnic
HiTechnic
HiTechnic
HiTechnic
NXT
Wi-Fi
Power
FTC

Nick Vosseteig
2014-11-21
building, wiring, programming

building	We moved back the large spinner and added a new intake device so we can pick up balls from the walls.
wiring	Alex, David, and I worked on the wiring after finding a few problems. David created a wiring diagram.
programming	I updated the program so that it works with the new configuration

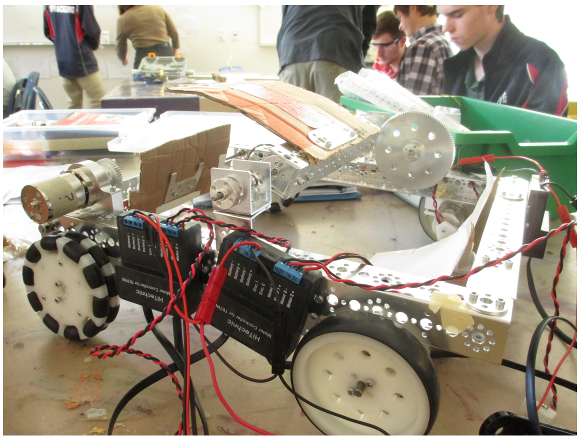
building

After adding the larger spinner, we realized that, while it does work better, it has the disadvantage of not being able to pick up balls that are shoved against the wall. We added a smaller spinner on the front to get the balls off the wall and moved the larger spinner further back on the robot. We also created a prototype ramp out of cardboard that worked much better than the makeshift ramp we were using to test before.

Wiring

We found a few problems with the wiring and got them fixed.

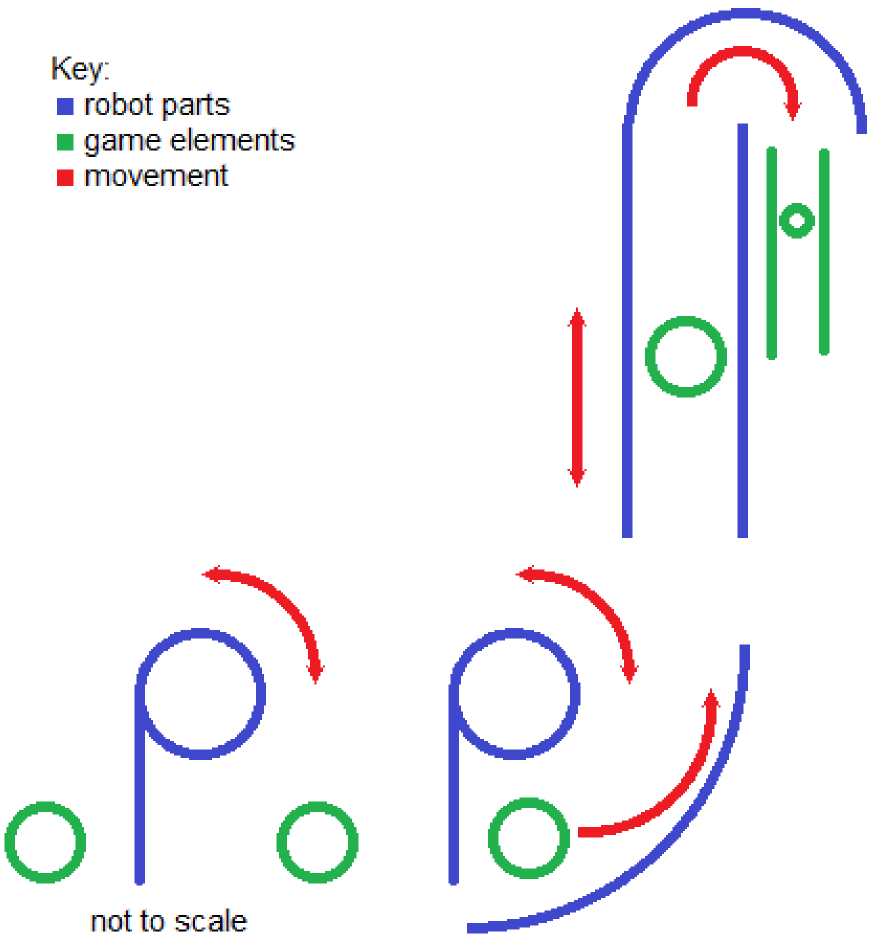
Here is a picture of the new setup with both spinners and the wiring on the sides:



David Rohrbaugh
2014-12-5
Encoders, Wiring, and the Launching Mechanism

I did a little bit of everything this week. I put encoders on the two drive motors, worked with everyone else on the wiring another day, and helped Alex with the new plastic launching mechanism.	The encoders have not been tested yet, as the wiring is still being figured out, but they should work. I believe that the wiring is nearing completion. Our robot is starting to come together, as even with a flimsier cardboard launching mechanism it can fling a ball to the required height. Eventually, this fling will be directed into the goal with another mechanism. We replaced the cardboard with plastic.

This is a graphical representation of our overall plan for getting balls into goals:



The basic idea goes something like this: the first spinner collects balls, the second spinner, launches the balls into the tube, which redirects them into the goal. The redirect tube has yet to be implemented, but we have some materials available that may be suitable, e.g. metal ducts.

Nick Vosseteig
2014-12-5
building, wiring, programming

building	This week we replaced the cardboard with plastic on the launcher and built a part to grab the base of the tubes.
wiring	Alex and I worked on the wiring and soldered the wires to the motors.
programming	Updated the code and changed controller configuration.

building

We built a grabber on the back of the robot to grab onto the base of the tube and drag it with us. We also replaced the main launcher with a plastic counterpart so that it is stronger, hits the ball with more force, and doesnt break very easily.

Wiring

We fixed up the wiring some more and soldered the wires to the motors to make them stay on better and to save space.

Here is a picture of me soldering the wires to the motor: