Team #67

HOT Robotics

Log & Report

2010 "BREAKAWAY"

January 9th- Team

We started by reading the rules and discussing different design ideas. We then looked at how back spin affected the ball on the carpet0. and investigated/demonstrated whether forward and back spin affected it. We also reviewed which types of hitting/launching mechanisms we could use. The following ideas were considered:

Suction

- We considered using something like the hose on a vacuum cleaner to catch/hold the ball in our posession. John Bottenberg remembered how team 1771 in 2008 used this strategy and it worked well. He tested the strength to find that a vacuum cleaner could, in fact, hold up a soccer ball.

Rollers

- This roller bar will be mounted on front of robot. It will spin the ball to keep it in our posession. We will use a globe motor to constantly spin the bar for the whole match.

Pneumatics

- We thought about how we could use air pressure to hit the ball and launch it with the aid of a wedge to give the ball lift.

Flippers

- Like a pinball machine.

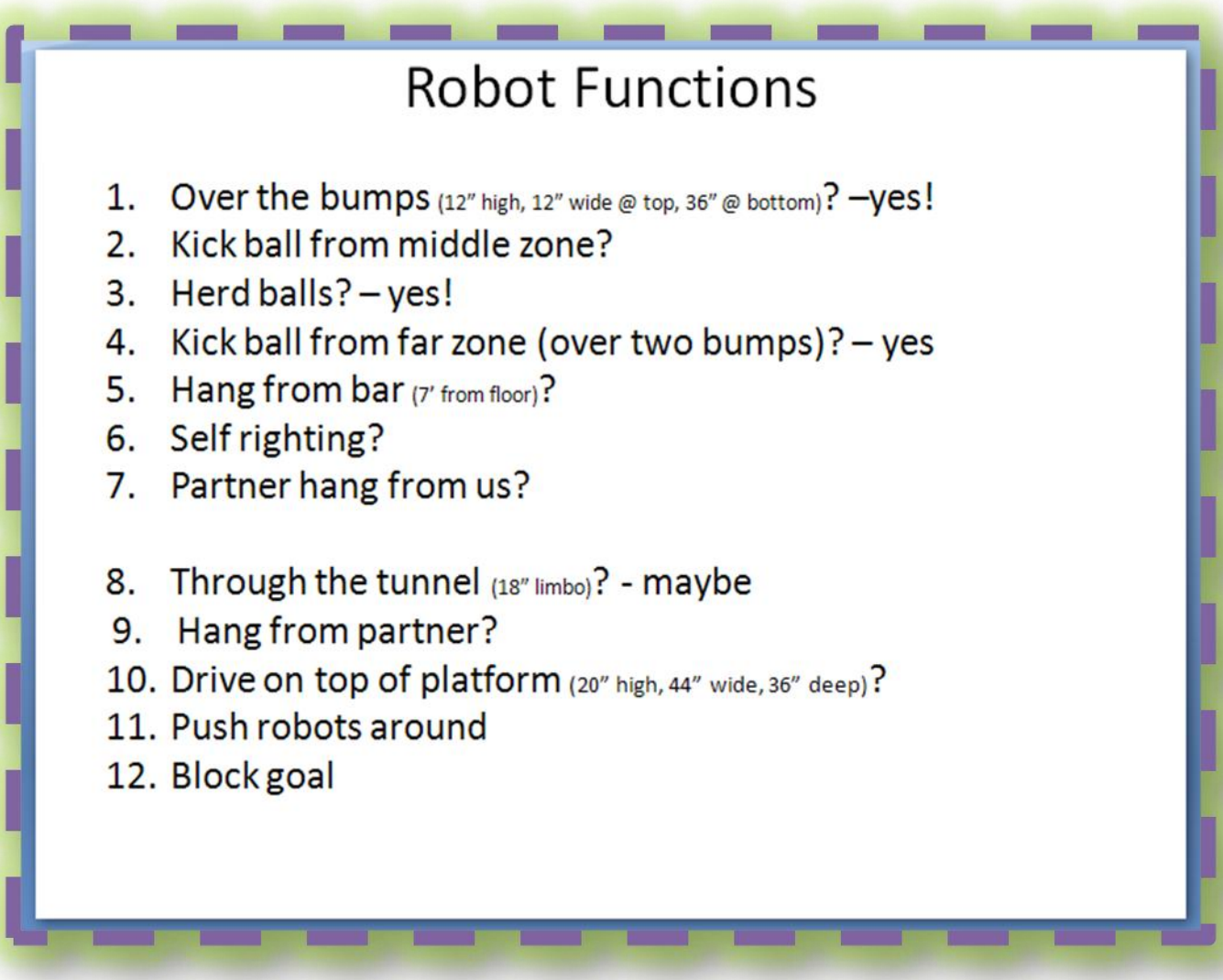
John Bottenberg testing the effects of the suction of a vacuum cleaner on an average

January 11th- Team

Today, we discussed different wheel designs and which designs would get our robot over the bumps. Our goals for functions for our robot were compiled in a PowerPoint and ranked in order of importance. This included: going through the tunnels, hanging from the tower at the end of the match, and kicking from different zones.

January 12th- Team

We decided on an eight wheel robot and we continued to discuss which designs would work best to complete our goals.



January 14th- Team

Today we broke into different groups. Design group met and discussed how we would set up and where. We attempted to download and run Autodesk Inventor.

January 16th- Design, Chairman's, & Programming

The design team struggled to run/download Autodesk Inventor. We obtained new licenses, yet were unable to download or reactivate the program, so we looked into Solid Works, playing around with the program and figuring out how to use it while our mentors tried to find the problem with Autodesk. We eventually determined that GM's firewall prevented us from downloading Autodesk. To be productive we started designing the field in Solid Works.

The Programming Team split up into two sections—Labview and C++ & Java. This serves as a learning experience for the team when, essentially, both programs are going to accomplish the same thing. The C++ team took last year's code and erased the parts that do not apply to this year's game. They spent the rest of the night defining variables. (For example, when they say drive, it will know to use a certain motor.) They also worked with the code for tele-op mode. The Chairman's group decided what they were going to do for the Hall of Fame display in Atlanta and then started to collect materials.

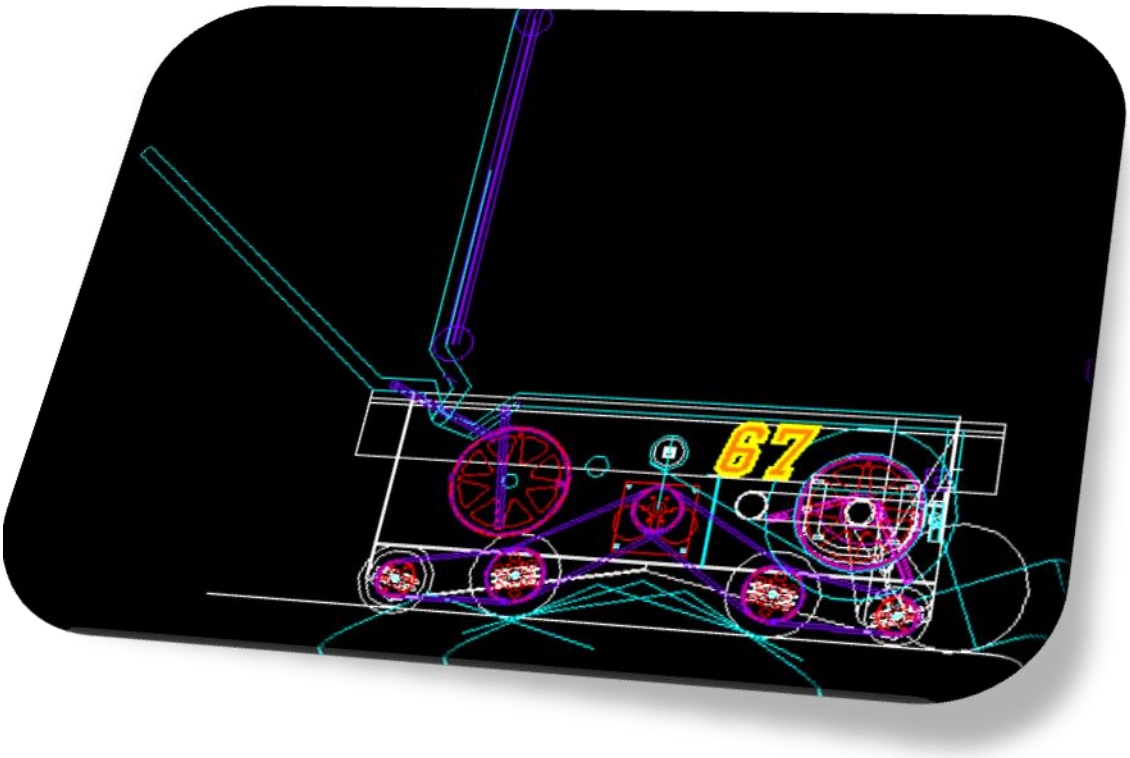
January 19th- Design & Programming

Our mentors tried to contact Autodesk but there was no response. They also tried to talk with GM to get Autodesk working, while we continued designing the field parts in Solid Works.

The C++ group started working on finer points of kicker (load/release).

January 21st- Design & Programming

The design team has finished 2-D concepts of our robot design:



We also continued with the field and finished most of the parts. We still had problems with Inventor.

The C++ group continued working with the kicker.

January 23rd- Design, Chairman's, & Programming

The design team finished all of the parts and worked towards completing the assemblies. We also began building the robot in Solid Works.

The Programming team began planning the autonomous mode.

The Chairman's group designed the freshman expo tri-fold and the Lakeland High School window display.

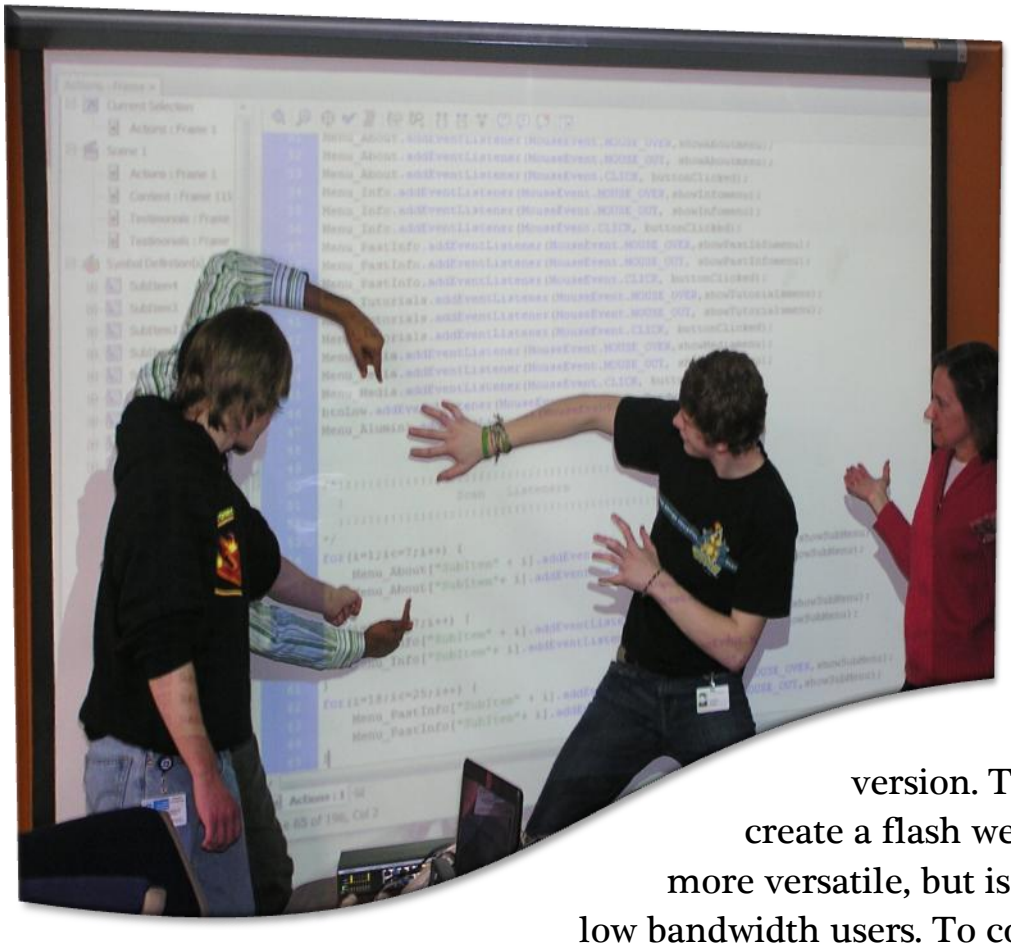
January 26th- Design & Programming

The design team started the final assemblies and finished most of them. We also tried contacting Autodesk by faxing our request for the Autodesk Inventor software.

The Programming team (both C++ & Labview) began to write the autonomous mode.

January 28th- Design, Build, Programming, & Web Design Update

The Web design team has been hard at work. They decided to use Dreamweaver. The old version did not meet all the criteria of the website design award. They also wanted additional features to the website. They decided to take two paths. One was to update the Dreamweaver version. The second was to create a flash website. Flash is more versatile, but is not feasible for low bandwidth users. To compensate the website will have the option to switch between the two. With the Dreamweaver site they are using a combination of JavaScript and html, whereas flash uses action script 3.0. Programs such as Photoshop also had to be used.



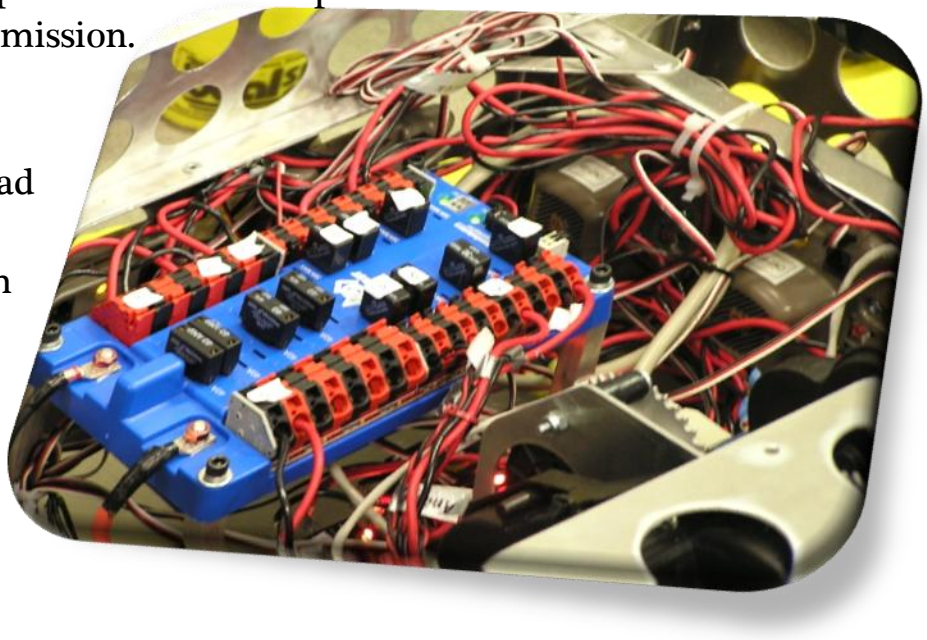
The build team tested our kicker and looked at the

distance it could shoot. We discovered we could kick the ball all the way across the field into the opposite color zone. The key to this was a garage door spring. The following is the calculations used in determining the torsional spring constant:

First Robotics Soccer Ball Kicking Mechanism										
Radius of Kicking Arm										
0.2413	m									
Deflection of Kicking Arm										
100.0	deg									
Kicking Arm Mass										
1.00	kg							Torque Required to		
Energy of Kicking Mechanism								Preload Kick Mechanism		
40.3	J	40.3	Nm	**357**	in-lbs			46.2		
Coefficient of Restitution				Velocity of Arm After Kick						
0.95	#				m/s					
Mass of Soccer Ball				Velocity of Arm Before Kick						
0.45	kg			9.0	m/s					
				Torsional Spring Constant						
Desired Distance				26.5	Nm/rad					
10.7	m			0.462	Nm/deg					
Trajectory Angle										
23.0	deg									
Initial Velocity										
12.1	m/s									

The design team decided to give up on Inventor and use Solid Works to design the robot for our team. We knew it was against the rules for the Autodesk Design Award, but decided that it was worth doing because the lack of Autodesk cooperation and communication left us no choice. We built the robot in 3-D and plan to submit it anyways knowing we will be disqualified or lose lots of points.

We then decided to not only submit it to Autodesk for the Design award, but also to post it on Chief Delphi to see what other people thought of our submission.

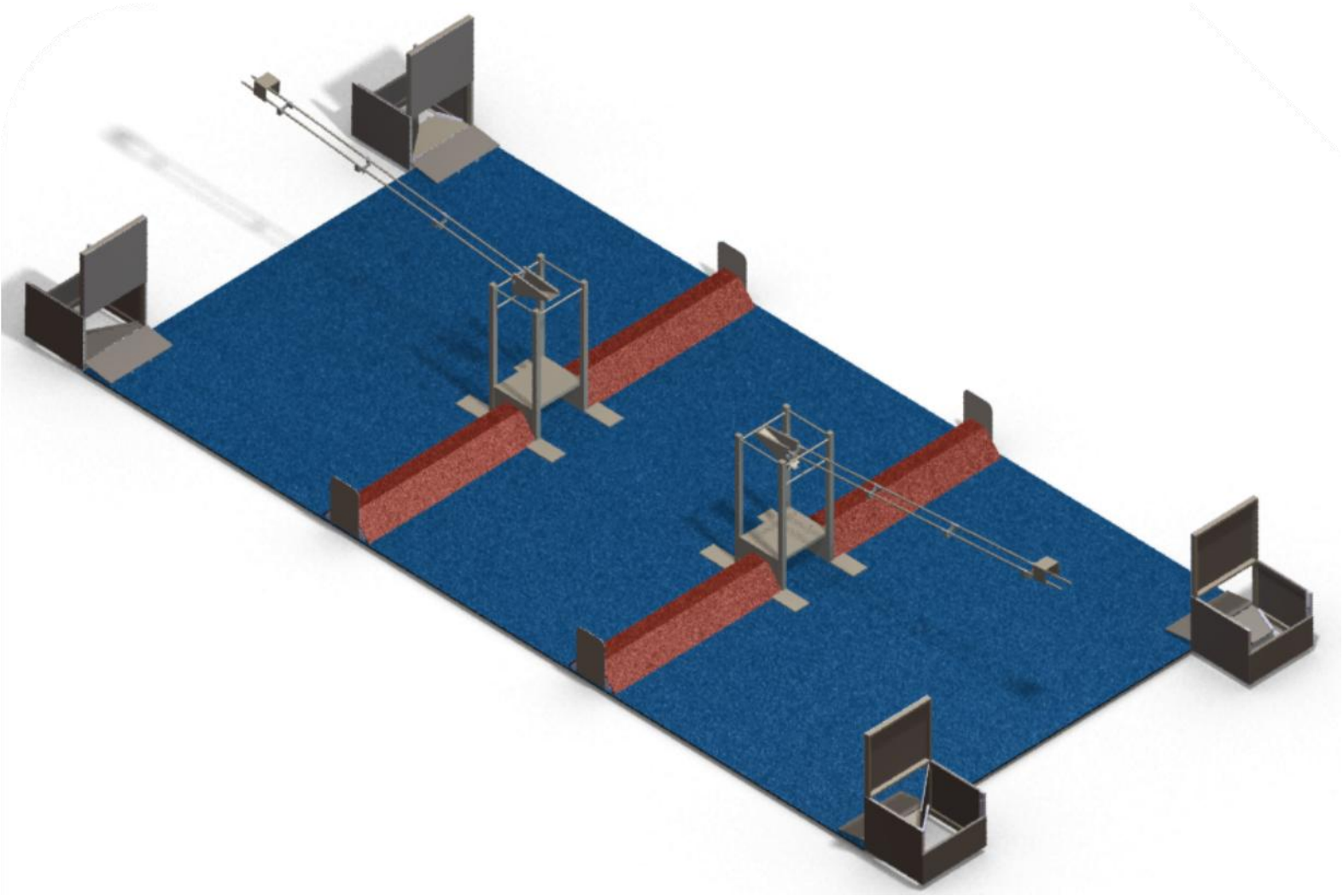


Brooke and Kenny discovered that the Programming team has had to familiarize themselves with a new program which has taken longer than expected. They have now begun to revise the code for autonomous mode. This helps to simplify it.

January 30th- Design, Chairman's, & Build

Today, the design team finished the final field assembly. The build team attached the kicker to the robot's chassis and tested it on the newly-assembled field.

The chairman's group took a vote on the nominee for Woodie Flowers and began writing the essay. They also took pictures of the nominee.



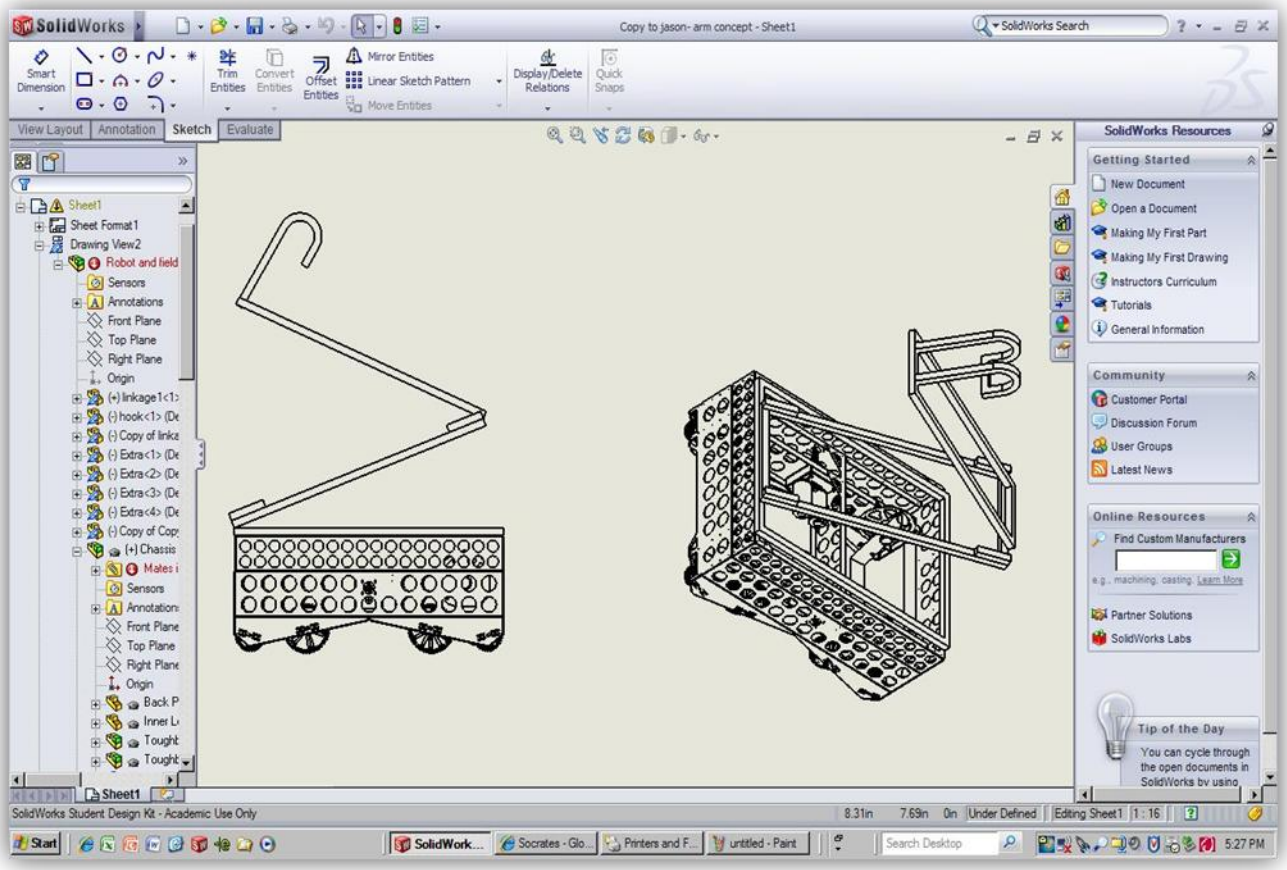
February 2nd- Build, Electrical, Design, Website, & Programming

The Build team is assembling the now expanded frame.

The electrical team is laying out the positions of all of the electronics inside the frame.

The flash version of the website now has a scroll over menu bar and scroll bars were added to both. Tutorial pages were also added. The text format was changed to make it more visually appealing. They spent the first two weeks creating the menu bar code. Since then, they have been recreating the web pages.

Evan Cramer and David Armstrong became familiar with the playing field and new competition balls and how they react to the many elements of the playing field.



The design team began working on an arm concept.

2010 ROBOT CONTROLS:

Driver GP

- x-axis (right stick)- RC drive
- y-axis (left stick) - RC drive
- Button 6 (hold) - Aiming
- Button 5 & 7 - Lift

Kicker GP

- Button 1 - Zone 1 Arm
- Button 2 - Zone 2 Arm
- Button 3 - Zone 3 Arm
- Button 4 - Camera-Based Arm
- Button 6 - Kick

*** All buttons can be changed to suit driver preferences ***

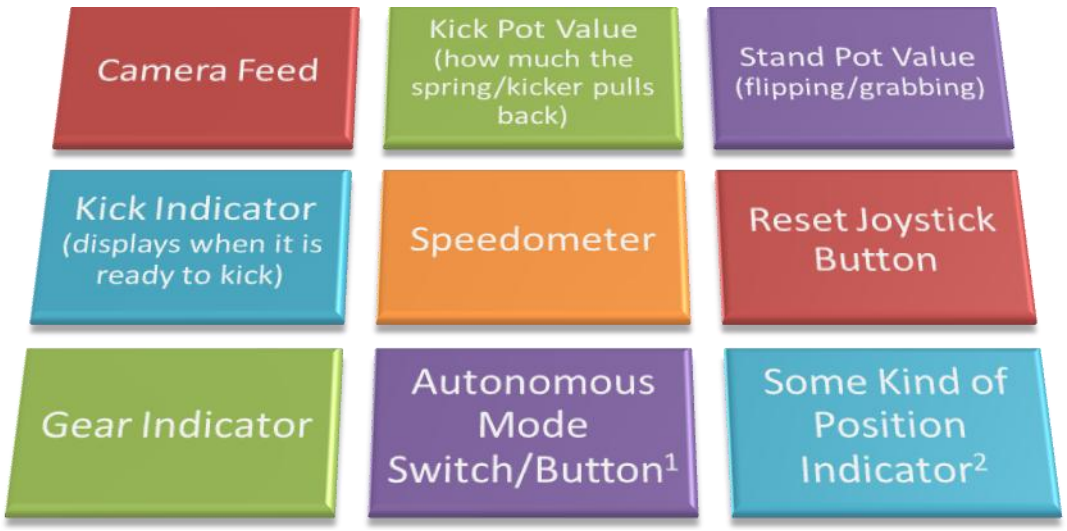
** Two lift buttons so you cannot inadvertently activate lift

February 4th – Programming

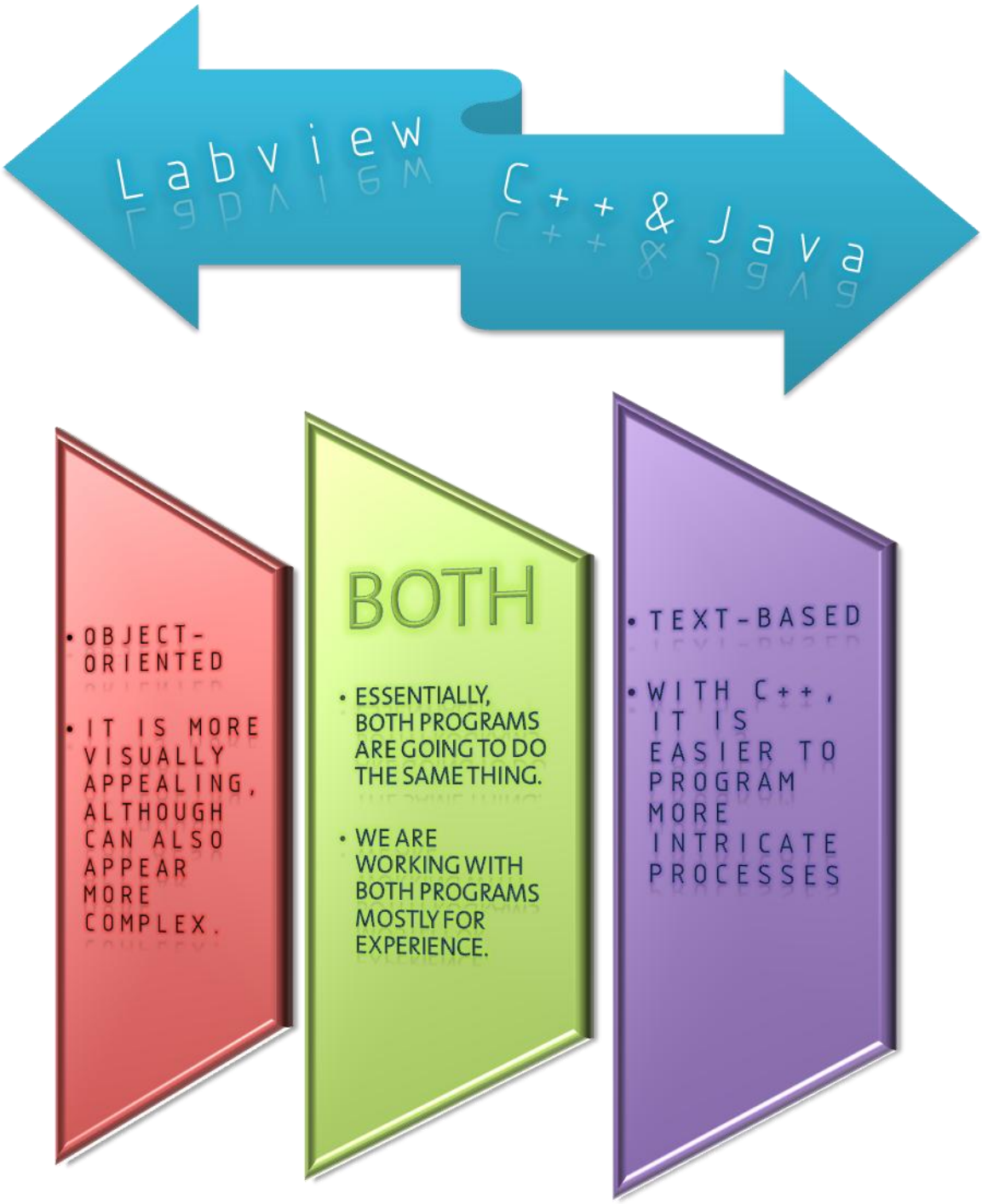
Kenny and Brooke interviewed/observed the programming team. They first started by copying the main program to all of the computers and applying the program to the 2009 robot.

They then proceeded to discuss the dashboard.

POTENTIAL DASHBOARD FEATURES



1. The programming team hopes this will be extremely valuable to switch between Autonomous programs depending on which zone we start in.
2. One possibility is a "Shot Zone Position Indicator". This will display which zone (1, 2, or 3) the robot is in. Another possibility is a "Distance Pot" which will display the current distance from the goal (in feet). The Programming team hopes to make this color coded so that it will display the current zone as well.

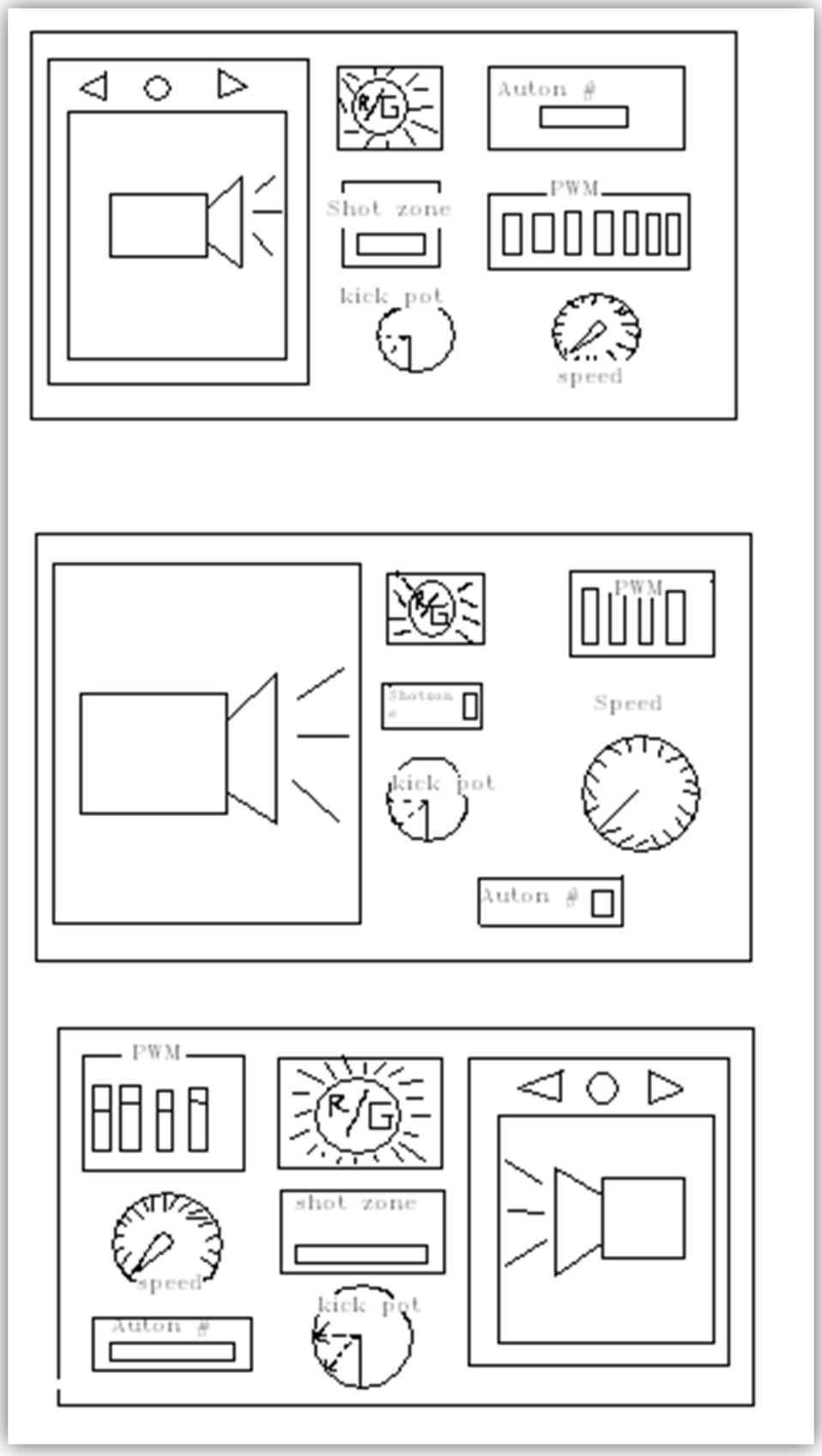


February 6th- Design

We weighed the robot: 58 lb. We also figured out how to bend sheet metal in Solid Works. Evan designed a battery holder. Kenny made a robot controller. We also started designing Peer Awards.

February 9th- Design & Programming

The design team interviewed the programming team and looked at their ideas for a dashboard set up. On the left is a representation of 3 potential dashboard layouts.



A small group of programmers also began writing a formula relating angle-of-kicker to distance-kicked (See next page for graphical data). They also successfully tested all of this year's code on last year's robot.

February 11th- Design, Build, & Programming

The design team continued

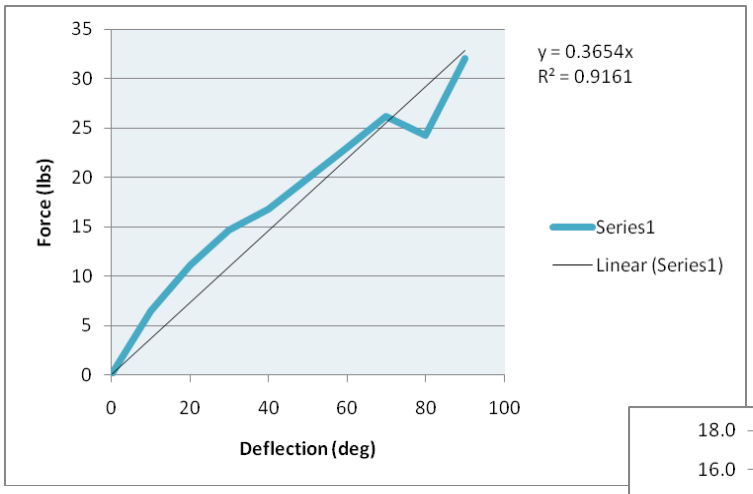
interviewing other teams. The build team attempted to finish the wiring for the drive and kicker. They also attached a piece of metal to mount the wires to the battery and robot.

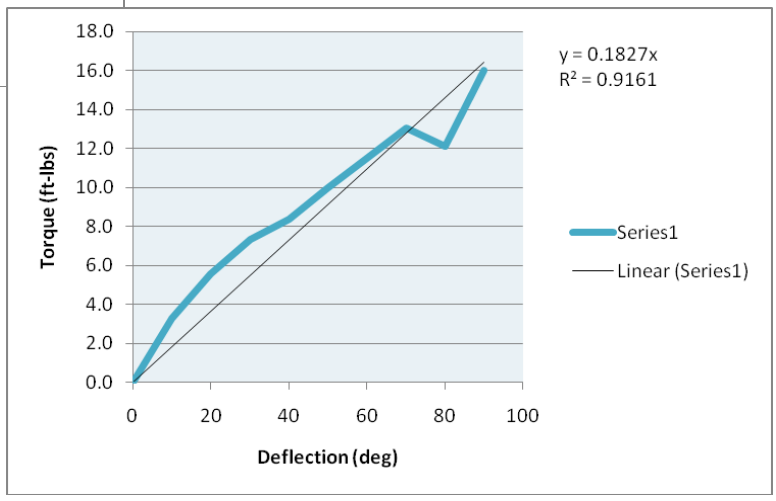
February 13th- Design, Chairman's & Programming

We are continuing to work on the log. We are also downloading RC car simulators so that we can find out how easy it is to learn how to pick up the skills for driving from different control options. We are using a simulator to test each driver. The students who choose to will be responsible to take place in the try-out process today.

Drivers must race through a 2-lap track with realistic robot view and controls. They will obtain NO experience whatsoever with the controls before the first time trial, and none between trials.

The following was retrieved from the programming team.

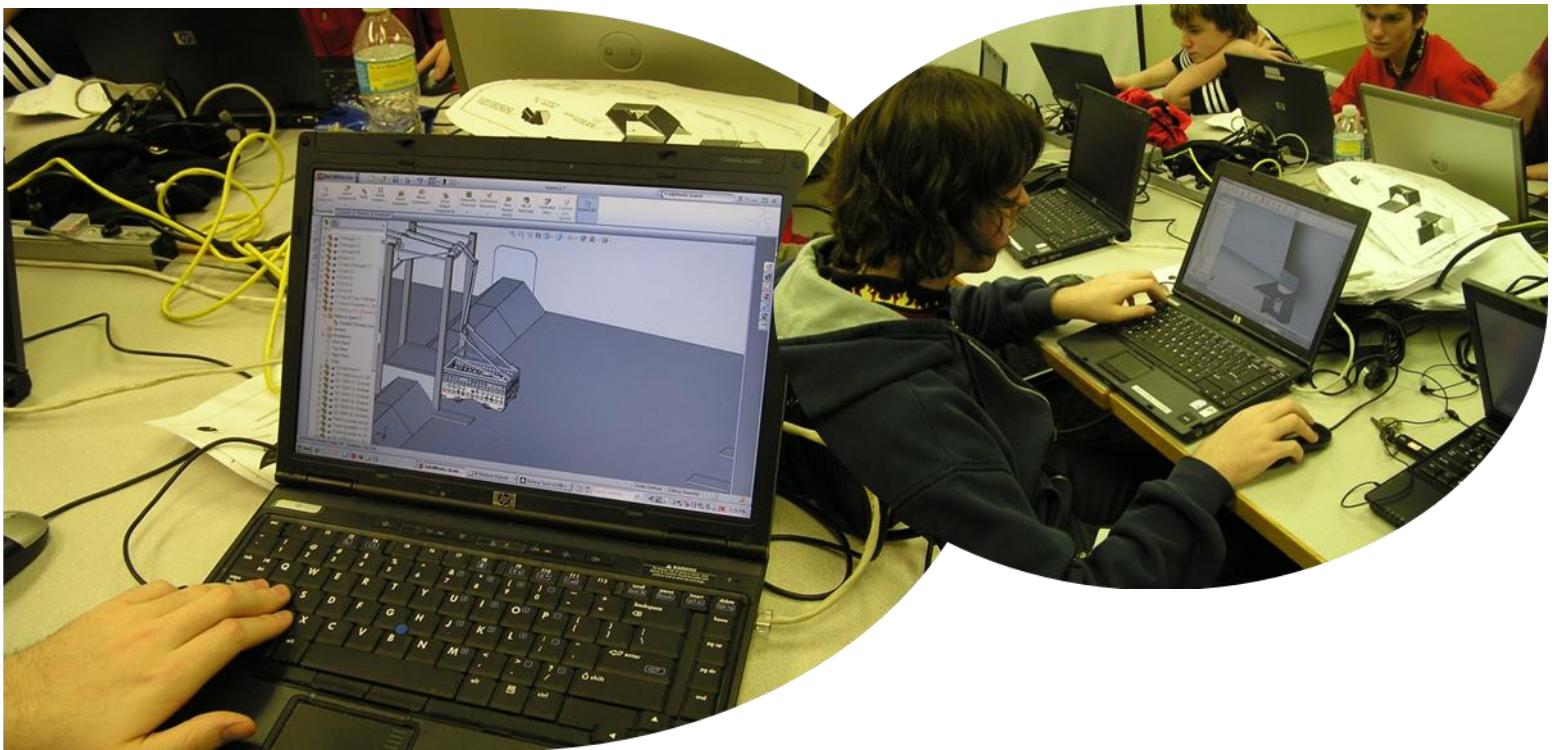




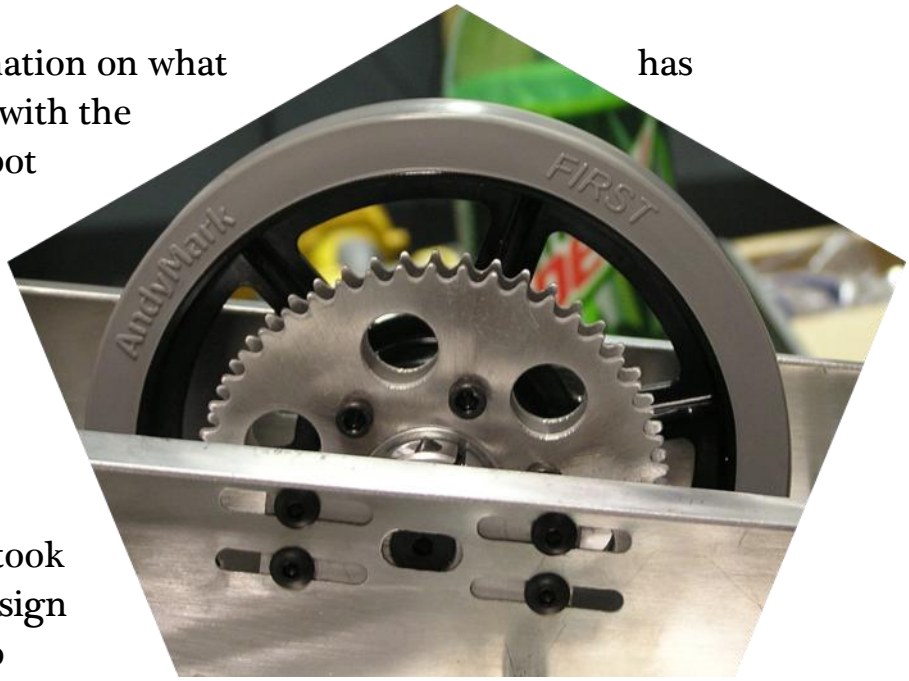
The Chairman's group started working on buttons and edited Woodie Flowers. They are in the process of submitting the essay.

February 16th- Design, Chairman's, Programming, & Build

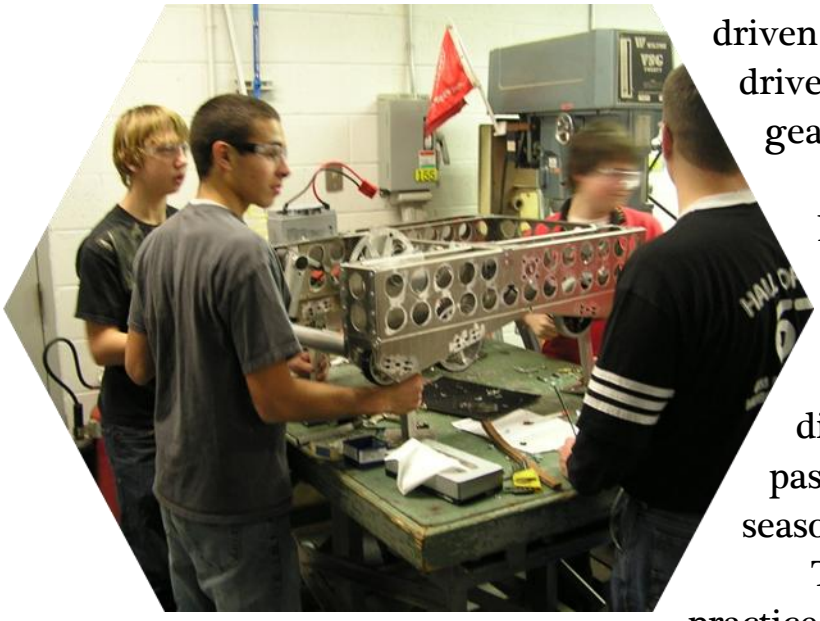
Today, the design team gathered more information from the rest of the teams. We also continued working on peer awards and the 3D robot design. We are organizing where the electrical components will be located and modeling it in 3D. This is going to be very important, especially this year, due to our limited space. The elder members of the team also worked specifically with the newer members in hopes to prepare them for next season.



We also found information on what has happened the last few days with the build time. The practice robot was used to test the kicker and to get the rollers working. It had plenty of torque to pull the kicker. The competition robot is currently being assembled and they are attaching the electronics base. They also took out some holes from the design for the competition robot to change the tension. To make room for the spring they changed rivets to screws to move the roller. They used bigger ones for more stability. The top of the robot is bigger than the bottom to comply with the rules that nothing be outside the robot boundaries.



We also realized that the worm gear broke because there was too much stress on the piece. This is driven by a window motor to drive the shifter in and out of gear. The idler gear also broke.



Chairman's, with the help of other team members, have been working and are continuing to work diligently on the buttons to pass out for the competition season.

The programming team practiced driving over the bumps and making sure that the joystick commands on the gamepad operate

the correct motors in the correct directions. They also corrected problems with the shifter.

February 18th- Build

Today, we decided that we would use low-durometer rubber stripping for our rollers, which grabs onto itself after stretching trying to retract. It is non-adhesive so it is NOT tape, making it legal. Our previous idea was to use adhesive-backed rubber mat.

The programming team worked with the shifter and made several kicks with the robot, but the spring broke.

The spring broke again because we put too much pressure on it and it wasn't functioning properly. Instead of the spring unrolling like it is supposed to, it was bending and it breaking.

February 20th- Design, Build, & Animation Update

Some of the design team, today, worked on drawing the side of our team van into Solid Works for decals.

Evan Cramer is working on a prototype for the arm. We successfully built a prototype arm which extends up to the bar. We have yet to figure out exactly how to lift ourselves up to it.

The field build is working on the bumpers, while the robot build is adding more parts onto the competition robot.

The programming team worked on setting up the dashboard and receiving data from the encoders.

Our spring only lasts about 500 cycles and we are messing with the tempering process to get more cycles so that we don't have to have a lot of springs. We need about 300 cycles per competition and around 2400 over the entire season.

Animation uses tools (like the designers) in Studio SMax to make their animation. They can take pictures offline and turn them into animations like they did with the jets. A full length film is 30 seconds. They also help each other out like a team within a team. The theme for this year is an animation about helping the world. The

animation is two jets flying and one blowing up and breaking part of the other jet. The pilot releases nanobots to repair the plane.

The Superintendent and the President and the Vice President of Huron Valley Schools came along with the Principal of Milford High School to see exactly what we do on the team.

FINAL ROBOT

Frame:

The frame in robot design is important to a good robot. A frame needs to be able to take any impact that the bumpers don't fully absorb. We make our frame from 1/16" aluminum sheet metal that we cut out on a water jet. We have used this technique for many years. We then bend the sheet metal to our desired position. Once everything has been clamped into place, we pop rivet it together. To give our robot more structural strength we designed the panels so that they cross each other at 90 degree angles. We also water jet holes in the frame to cut down on weight. In the spaces left we put the key elements to our robot: the electronics, the drive train, and our unique shifting mechanism (that releases our kicker and controls the arm).

Drive train:

Our Drive train is unique to this year's game. We have an eight wheel drive train. Two CIMs are connected into a single Toughbox, which drives one side of the robot. Additionally, not all eight of our wheels are constantly in contact with the floor. On each side of the robot, the far front and far back wheels are slightly higher than the than the two in the middle. This enables us to have a smoother, tighter turning robot on flat ground, while having great stability when crossing the bumps.

Shifter, Kicker, and Arm:

Our Robot has a shifter which transfers our Fisher Price motors to control our arm and kicker. The shifter is very unique. It was

designed mainly by our mentor Adam Freeman. The shifter utilizes two fisher price motor/gearbox combinations to drive a single shaft. Inside of this shaft is a piece of nylon stock which connects an engager on each end of the shaft. There is also a window motor which engages one of the engagers. We then can drive the window motor to shift the drive to kick or lift the arm. Our kicker is powered by a Garage Spring which we cut and fit into our robot. This took us a while to get right. We finally figured out that the best way to make the spring was to cut it to size with a Dremel, then we would heat the ends with an acetylene torch and bend them. Once they were bent we would oil quench the spring and then bake them in a tempering over for an hour. This resulted in a spring that would retain its strength and handle many hundreds of cycles.