2010

SCHOOL OF SCIENCE AND TECHNOLOGY ROBOTICS TEAM

ENGINEERING NOTEBOOK

School of Science and Technology
10/23/2010

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1.Introduction

As we progress through our lives, we encounter mishaps and mistakes. All these mishaps have some type of solution. Very bright minds work daily to solve these common, world-wide problems. Who said that only old people had to do all the work? Maybe they are the only ones that have degrees, but all that does not matter if you're determined to do your best at all times! You MUST be courageous; have a positive and optimistic attitude. You must also have hope and you must set goals for yourself. Everyone in our group has created a five-year plan that shows time progressing along with our goals and missions. Decide what you want to accomplish and then work towards accomplishing that goal! One of the very common fields that lures people worldwide is technology. Technology is the use of science to create worldwide products. One excellent way to exercise this is to use physical objects. That's where BEST comes in. The Best Robotics Competition in Kingsville is a fun, enthusiastic, and mentoric event that changes and

Technology, is the use of science to create worldwide products. One excellent way to exercise this, is to use physical objects. That's where BEST comes in. The Best Robotics competition in Kingsville, is a fun, enthusiastic, and mentoric event , that changes and persuades the life of many young people in the South Texas area. Teams prepare notebooks, presentations, and robots that will complete the assigned mission.

persuades the life of many young people in the South Texas area. Teams prepare notebooks, presentations, and robots that will complete the assigned mission. But what makes it challenging and fun is the new mission every year! Now let us go in depth about technology, its uses, and the influencing aspects to us robotics students at SST. Technology is the process by which humans modify nature to meet their needs and wants. Some very common examples of technology are i-pods, computers, and radios. Another one is ROBOTS!!! In modern day society, we take some common types of technology for granted. Technology is like the cells of our bodies. Without it, we wouldn't be able to survive. Our schools use technology to help us learn. It is the fuel that drives our lives. It is a mandatory item in our lives. From the Internet's entertainment, to cellular communications, computers have innovated our society today. It shapes the universe. As a student, I believe technology plays an important role in our lives. We use it to do almost everything. As a BEST robotics contestant, I understand the importance of robots and computer programming. In this competition I will hopefully master all these subjects. We study electrical engineering, chemical engineering, engineering management, and architectural engineering. You use architect skills to build the robot.

2.Research paper

This year's game is a production line, and in this production line we have to make gadgets and gizmos. In the real world, everything is changing and going to more and more automation. This BEST competition was designed to see which of these designs we make work the best so these companies can incorporate some sort of design like ours in their factory. With robots doing the work they don't have to pay people to do the work, they just pay for electricity and the program/computer that controls them. This makes everything easier for us and makes things more efficient, especially speed. Robots can usually increase productivity like in Australia where a company had switched to machines and their productivity had gone up by 43% in less than one month.

Using automation also increases the rate of quality, like how there are always defects, but with the machines less defects happen and more quality items are produced. What I'm saying is: with the machines at least something increases and nothing decreases.

As humans, we are lazy! We have always wanted to create faster and easier ways to do everything! Let's say that it takes one person five hours to build one robot. But that same robot can build an exact copy of its self in five minutes. I don't know about you, but I would choose the robot over that. Everything has also gotten smaller, like cell phones, they use to be huge! They were bigger than your hand, and now there are some that are computers in the palm of your

hand! Same goes for robots! They have gotten smaller as well. Robots have also gotten more unique by using different materials and different software.

In this year's competition, we use Gadgets and Gizmos, another addition is the Factory Data Port. This is what they use in factories to tell the robots which Gadget or Gizmo is defective, but in this years game, it's almost like the robot is a person and the Factory data Port is it's way of clocking-in to work (shifts) but it never has to clock out. This leads the way for the designs of robots that can walk and learn how to live a life. That would be extraordinary!

> Gadget is like a flash drive. The defect rate is higher, and more recalls have to be used to keep are Sigma high; and Gizmos are like cell phones. Most of the time when a cell phone is defective, there is nothing you or the manufacturer can do, so the phone is not recalled. It is simple disposed of.

The industrial revolution started in the early 1800's and has progressed greatly from there. We now use robots for many other uses such as helping the disabled. Almost everything you see in your average day was made from some sort of robot, like your car. It goes though a robotic assembly line and is welded, built, programmed, and painted all by robots, big and small. Just to think that what we are making today could be used as something more, something bigger than us. We are the engineers of tomorrow! What we do today affects everything tomorrow, we shape this future before us, and it is what we make to be. Nothing more. Nothing less.

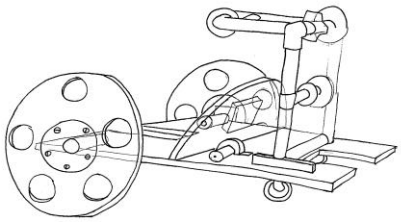
3. Robot Design process

Drawing 3D Robot Design

Making a design for the best 2010 robot was challenging, but with everyone's own image we were able to pull together one design we all agreed to. This robot took our whole 1st week after kick off. Every one of us :Josh, Jordana, Yoseph, Jasson, and myself, Cody.

FINAL DRAWING ROBOT DESIGN

Choosing Robotics platform & Plywood usage



2nd week. We started cutting and measuring the base and wheels; with teachers and parents help we were able to measure and cut them by the 3rd week.

The first thing we cut where the wheels we cut them in the 2nd week on Saturday. Almost a week later we all measured the platform then cut we had to modify.It though it took an extra 27 minutes though.

4.”BEST” Rules & Mission Understandings

4.1 Robot Building Rules

When we got back from Kick Off day, we immediately discussed the rules for building the robot. According to the professor, the robot MUST be built using only the supplies given to us to use from BEST. In this picture to the right I , Joshua Kuhl, am explaining to Cody Mora and Yoseph Mohamed the rules of building the robot. I remember when we were determining the length of the base, we all disagreed on how long the base could be. So, I refered back to the Rules and Guidelines packet downloaded form BESTinc.com. There, it read “must fit in square box 24’ x 24’ x 24’…”. We then modified the design in order for our robot to meet these standards.

4.2 Mission

This year’s mission (A.K.A Total Recall) is a production-line based game. We have a total of two production lines, one fully-automated (Gizmo), the other semi-automated (Gadget). The Gadget production line is semi-automated, and is made for large scale production. In this production line we must use the F.D.P (Factory Data Port) to determine which is the defective color. At first, our team did not understand this at all. Me, Mr.Rasulzada, and Camron watched

the video from Kickoff that we got from the professor about this year's game and figured out how it worked from there. The F.D.P works by using either a open (non-functional) circuit or a closed (working) circuit. Now, it was our job to program the microcontroller to read this and understand which is defective. The Gadget goes through some rigorous testing in order for it to be able to be packaged and shipped. It starts at the O.E.M (Original Equipment Manufacture) from there it is sent through the G.S.T (Gadget Scanning Tube) that detects which are defective. Once we saw that it had to go through the G.S.T, I wondered, "After we sort those balls, how do we get more?" I watched the video some more and found out that you can tell your spotter to send more balls down the tube.

The Gizmo production line is completely automated and will be performed by our robot only. First, our robot must take the packages and place them in the Packaging Center. We wanted to see how hard it really is to put one of the packages on the package holder, so I went home and found a old cone I used for soccer a few year, back that was EXACTLY like the ones BEST is using! The very next day I brought them so we could try this out. After that, we will find the defect from the F.D.P and scan the gizmos. After we, scan them we can put the non-defective ones on the mobile recall trailer.

4.3 Game Rules

One of the most important rules is everyone must to stay in their designated area. The spotter cannot leave his/her place until the round is over; same goes for the controller and the robot. If the robot purposely leaves the playing field at anytime in the game, the robot will be stopped and a Temporary Factory Shutdown will be called. Everyone must stop and that team(s) will be disqualified. Also, the Recall Trailer must be COMPLETELY in the Recalled center or it will count against our Sigma. Better Sigma, bigger score multiplier. Bigger score multiplier, higher score. Higher score, closer to winning.

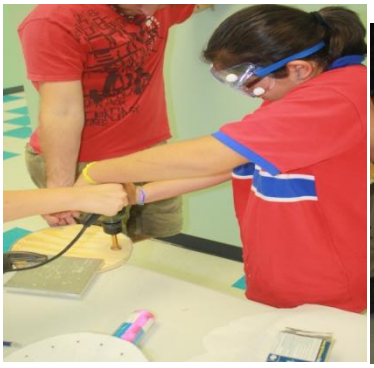
5. Safety

5.1 General Safety

Safety is important no matter what you do, especially in robotics when you're always dealing with mechanical tools. Safety is expected in robotics to prevent serious or minor injuries. It is important that once the hazards are identified that measures of control for worker safety are put into place and followed. To be out of harm's way it is important to always follow the safety rules listed below:

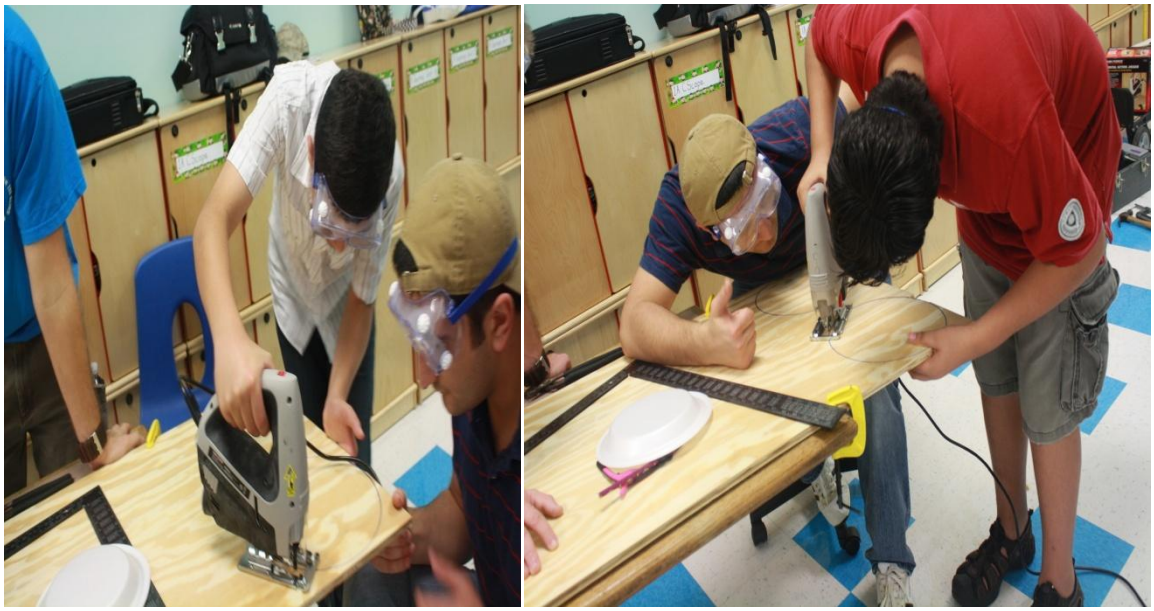
Robotics team safety outline

General Rules-wear eye protection when operating, assisting any power operated machine or tool. Students should wear goggles at all times when working with the robot or machines. All tools should be in proper working condition, before using dangerous tools, such as power drills, sanders, jig saws, or any other dangerous mechanical tools. Please keep your hair up in a ponytail while working near or with the robot. No horseplay near the robot for safety. These rules are made for your safety! An example of how not to wear your goggles is shown on the left hand side.

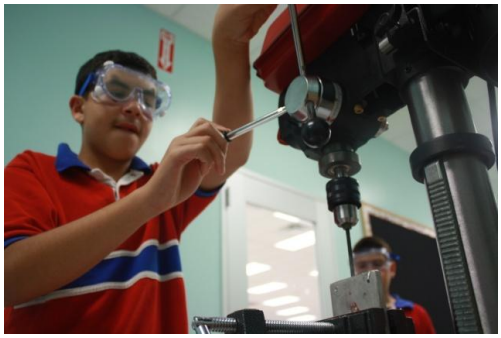

Working Area- the working area is very important when working on projects. You need to make sure that everything is safe that everything is safe to work in before you start working. After using tools put they back to prevent any hazardous things from happening. Make sure to have no food, or drinks by the working area. Always clean up after your mess like picking up trash. Always remember to unplug electrical tools to prevent anyone from tripping over wires. Our

working area is in a little hallway. We as a team strive to keep our working area clean and a safe environment to work in. We always clean our area so that everything is safe to work in.



5.3 Electrical Mechanical Safety-

is sure to turn off or unplug all mechanical and electrical tools when you're not using them anymore. Be sure to never leave the robot batteries on overnight turn them off when you're not using them anymore. Also be sure to not leave sharp object just lying around anywhere. Be sure to be careful when messing with electrical wires to not shock, and be careful when trying to plug in tools, to make sure that they're off before plugging in.

6. Microcontroller, Motor, and Servo set-up process

6.1 Microcontroller

We used the Vex microcontroller with duel ARM Cortex CPUs that we were given on Kickoff day. At Kickoff, I discovered that these Vex Microcontrollers use WiFi instead of a standard radio frequencies. Here in this picture is me (left) and Cody (right) learning how to install the motors into the microcontroller. Another addition to this year's game is that we can develop our own program. We have decided to use Easy C to program the microcontroller because it was recommended to use by Professor Muller at Kickoff day, and had a more user-friendly interface. Programming this Cortex microcontroller was very easy. All I did was use the given USB cable(one end in the computer, one in the microcontroller) clicked "Write to Cortex" and it was done!

6.2 Choosing Motors for Wheels and Arm

When we got back from Kickoff day, I looked at the detailed drawings of the motors and decided to use the large motors for the wheels because they had a lower RPM rate,but a lot more traction. If we would have used the smaller motors for the wheels we would have to use more energy to get less speed. We also decided to use the smaller motors for moving the arm, because they can move the arm back and forth faster (higher RPM's).

6.3 Using Servos

For the hand part of the arm, we decided to use the servos given to us. We decided to use these because they can turn 360 degrees and can go back on command. We have designed this hand to be used like a wrist as well as a claw on a lobster. This wrist-like arm will be able to turn any which way to pick up or drop objects. We also used a servo to turn a wooden block that housed the 4 prongs that will be used to read the F.D.P.

6.4 Joystick

The new controller & old controller

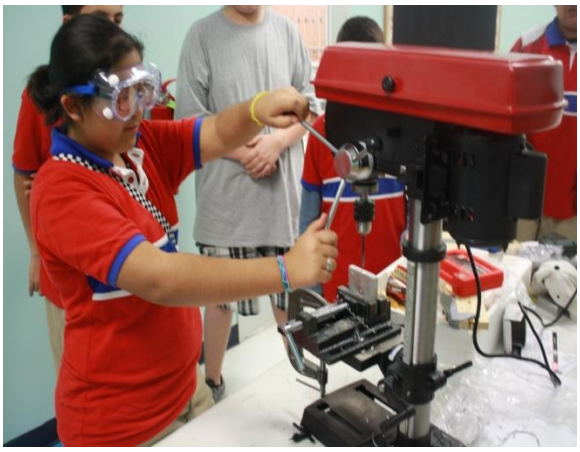
Compared to last year's Best Robotics competition the controls are compliantly different, it's almost as if you here entering in a new competition. Last year the controller was typical standard big antenna wireless controller. Now we have a wireless PS3 type controller that's customizable by hooking it up to a computer. The steering

controls were replaced by analog controls. The arm controls were replaced by back buttons. And there were many extra buttons we could and can use but didn't. Last year's controllers were back forth up and down. This year you can have full three sixty movements and arm control ant the same time. In my opinion is that its going to run much smoother with ought the constant pausing to get the right angel and just go at it.

This new controller will help with many things including also with complaints some people last year complained the sticks tops were to pointy. It will also help with telling you when the battery is going to die or tuning the robot of and on.

6.5 Assembling Robot

Remember, this is a robot, some assembly is required… well, that's an understatement. More like ALL assembly required! If we didn't assemble the robot, how could we compete!? We started building the robot at about the second week. The first thing we did was measure and cut the wheels, after that was done, we moved on to



cutting the base. I measured the base according to the design given to me by Cody. We all took turns cutting the base with a JigSaw until we were finished. Next, we had to devise some way of locking the motor to the wheel. I thought long and hard about until Cody said “How ‘bout to cut metal peace and to make a hole ?” That was it! We cut the metal and made two holes in each. One vertically, one horizontally. Using the drill-press, we all took turns cutting all four of the holes. One hole was straight down the top of the metal until the bit broke through the previously drilled hole in the middle. We then drilled a larger hole in the side of the piece all the way though. In the large hole, we placed a nut sideways and threaded a screw though the nut (it was a long screw)until it was pressed against the motors. But then we needed some way to hold the motors!!! Jordana used a dremel-like tool to cut 2 squares with one big hole in the middle. I had to trim the hole a bit because it wasn’t perfect, but once it fit, we drilled eight holes in it all together. Four in the middle around to bigger hole to screw into the motor and four on the corners to hold the motor to the wood. We had to modify the screws for the motor to about ¼ inch so it wouldn’t be damaged. Later on we had to add another piece of wood under the other side of the motor’s due to unstability.

7. Sportsmanship & Team work and Spirit

We can show good sports man ship by not booing the other teams. By the importance of evaluations

By being far, being honest, and not cheating. Show how one another work. If another team wins we

conglate them on their win and say things like ‘’good job”, ‘’nice work’’,’’and ‘’glad that you won’’.

We can also show sports man ship by being kind to one another. And that’s how we can show good sports man ship.

8. Software and Programming

8.1 easyC

EasyC is a drag-and-drop block-like program that was designed to be easy (hints the name easyC) to operate. This is one of the reasons we decided to use easyC. EasyC was also the easiest to install. I was assigned to program this Cortex microcontroller. We had many problems with the updating and installing of the program. After Demo Day, this problem was resolved.

8.2 RobotC

RobotC is a straight text editor for many forms of C code. If you know C, then this is way easier than using easyC. We didn’t use RobotC mainly because we will learn C programming in high school.

8.3 Matlab/Stimulink

The one reason we didn’t use MatLab was because it was really complicated to use, hard to install, and it took forever to get. We also didn’t get much information on MatLab besides what the Professor said about it having a live simulation.

9.Robot Testing

We had been testing the robot as we built it, but to see if it really worked, we decided to use Maven as a crossing guard. This worked out perfectly, so we incorporated this in our commercial video. Then we had to build the hand. That is when we ran into problems. The servo stopped working and started smoking. We had to order two more servos to replace the ones we broke. We thought the Cortex had broken but it was fine. Just the servo was shorting it and making motor ports 1-5 stop working completely. The next day we got the new servos and setup the hand and arm. Our idea worked perfectly and let the hand rotate, giving us a huge advantage.

10.Coach's Observation

BEST Robotics competition is the best way to motivate students in math, science , technology and especially engineering . I have never seen such a great event to cover such a wide variety of educational fields. During our short 6 weeks period my students have learned tons of things. They have worked with electrical device and components to make their robot run. They have learned mechanical engineering skills from cutting wood and pieces of metal to connecting wheels. They learned the graphic design process by sketching a robot model in design programs such as OutoCAD and SketchUP. They learned how to make an engineering design process by preparing an "Engineering Notebook". They learned math science and geometry fractions by measuring robot components. They have learned computer engineering by using software programs to run their robot. They learned how to solve problems by reading instructions.

Finally, they learned HOW TO ACT AS A REAL ENGINEER by participating in Best Robotics competition.

I forgot my tiredness when I saw my students' enthusiasm in Robotics. After 42 days the students built a robot with their own hands. That was a biggest award that they have gotten! Finally, I believe these students are ready to go NOT only to Robotics competition, but also to go the college. What a promising future!

I met with my Best Robotics students almost every day after school. As well as Robotics, they had school responsibilities. The students have all A's in their class. If they have lower grades, they can't join the robotics team . As a result, they really worked hard

academically and at the Robotics job. Right after school (at 3 pm.) they stayed in library to do their homework until Robotics practice started (5pm.) Usually practice was from 5-7 pm and sometimes until midnight students stayed with me to get their done.

Rahman Rasulzada

SST –CC Coach /teacher