

Robots. What are these metal machines anyway? According to the dictionary, a robot is:

A machine capable of carrying out a complex series of actions automatically.

That explains a bit of what a robot is, but where do we see them?

Maybe from the news and science community

Curiosity - NASA's robot doing research on Mars

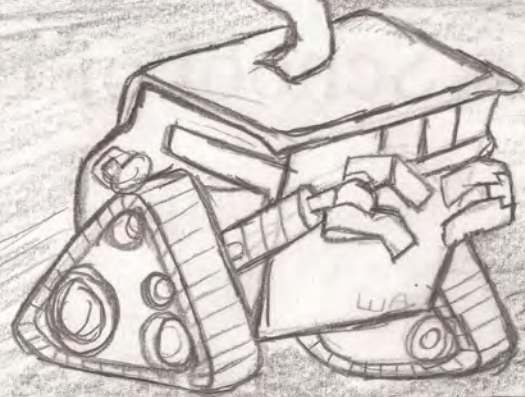
Or maybe in TV shows and movies...




R2D2 from the famous movie Star Wars.




Disney's box making robot WALL-E.



A pencil-drawn illustration of a young woman with dark hair in a ponytail and glasses, sitting at a desk. She is looking down at her hands, which are holding a small object, possibly a tool or a part of a robot. She is wearing a light-colored shirt and pants.

You know, even though this girl only looks to be in high school, she does robotics too! Don't believe me? Well, there is an awesome program called FIRST. FIRST means this: For Inspiration and Recognition of Science and Technology.

In FIRST, there are many level of robotics. There are levels for different age groups but this girl is in FRC

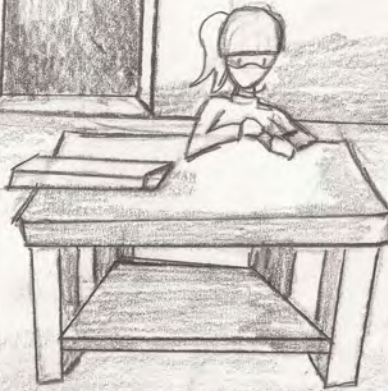
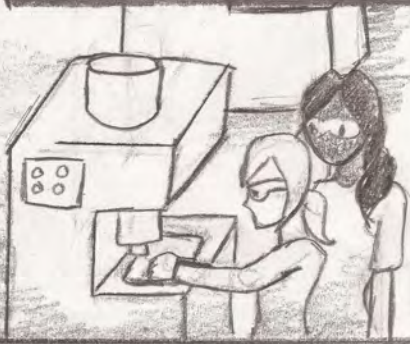
A pencil-drawn illustration of the same young woman from the previous image, now standing at a desk. She is looking down at her hands, which are working on a small object on the desk. She is wearing the same light-colored shirt and pants. To her right is a large, dark rectangular object, possibly a robot or a piece of equipment, with two circular buttons or lights on its side.

FRC (FIRST Robotics Competition) is a robotics competition for ages 14-18, high school in the USA. It is a huge competition that over 2,000 teams participate in all over the world!

The team we are talking about here is Team 3504, the Girls of Steel. Located in Pittsburgh, Pennsylvania USA, this all girls team is making an impact!

Over 40 girls get together for six weeks, building a robot for this competition.

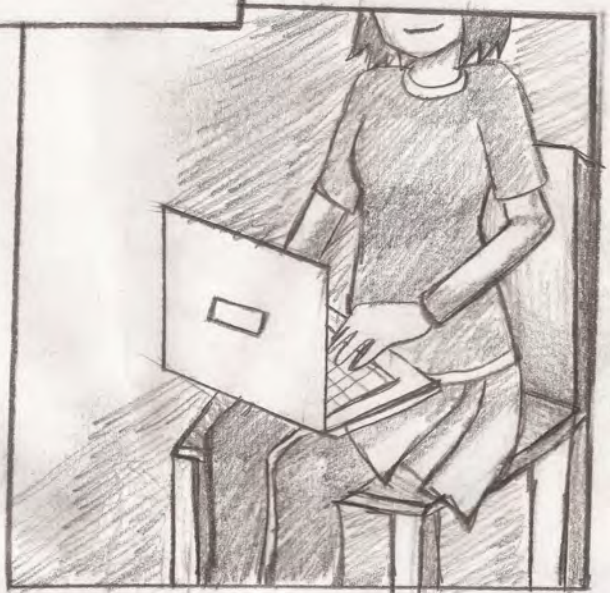
Some make the robot's actual body with metal, plastic and power tools...



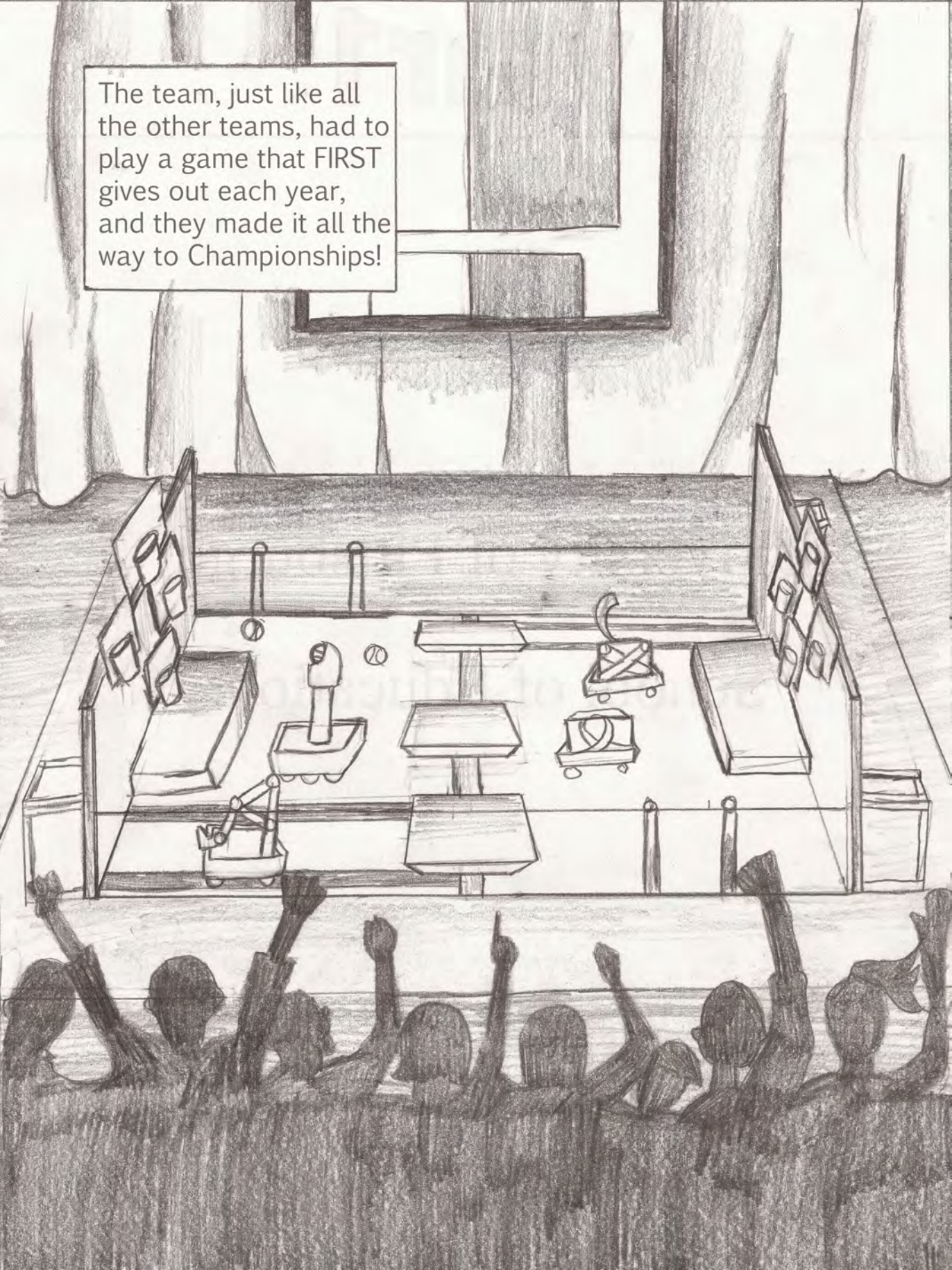
Others use wires, motors and other electronics to give the robot working parts.



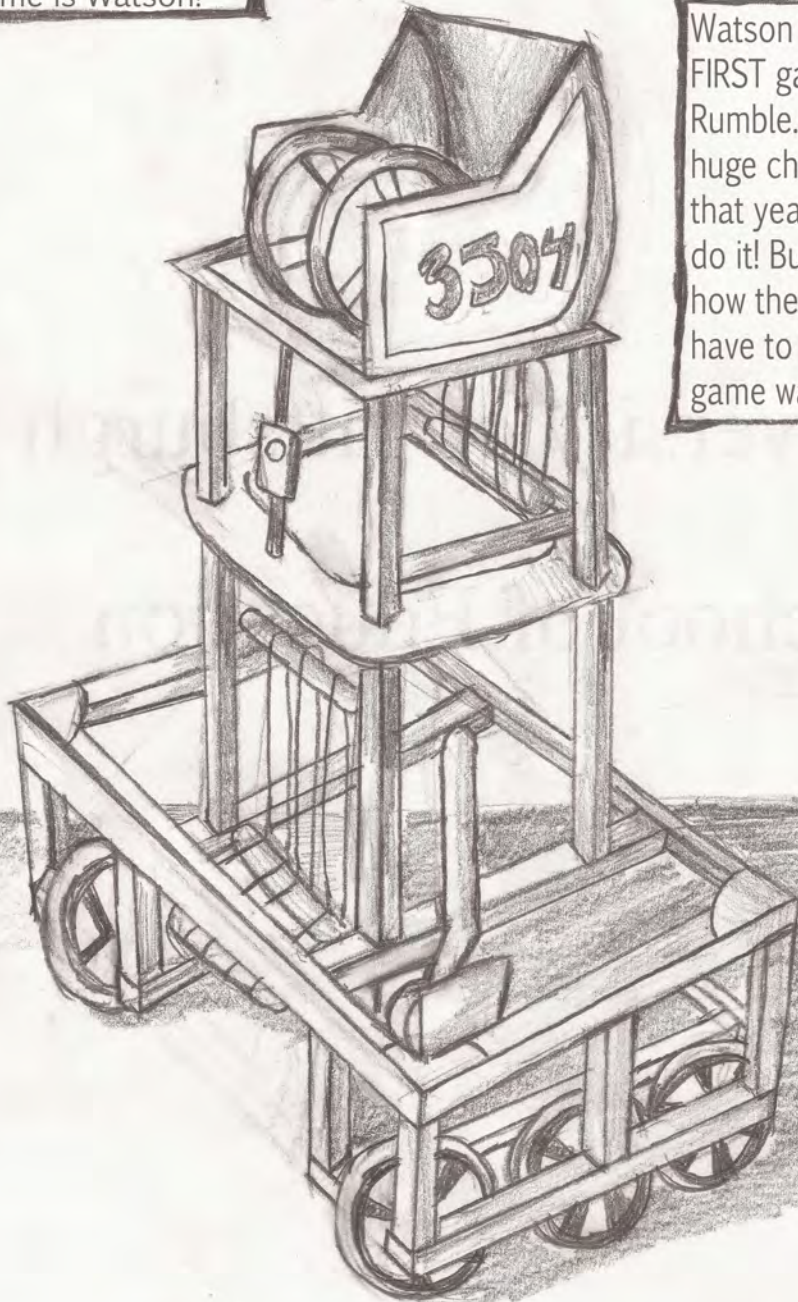
And the last group of girls type the robot's instructions kind of like creating their brain.



The team, just like all the other teams, had to play a game that FIRST gives out each year, and they made it all the way to Championships!



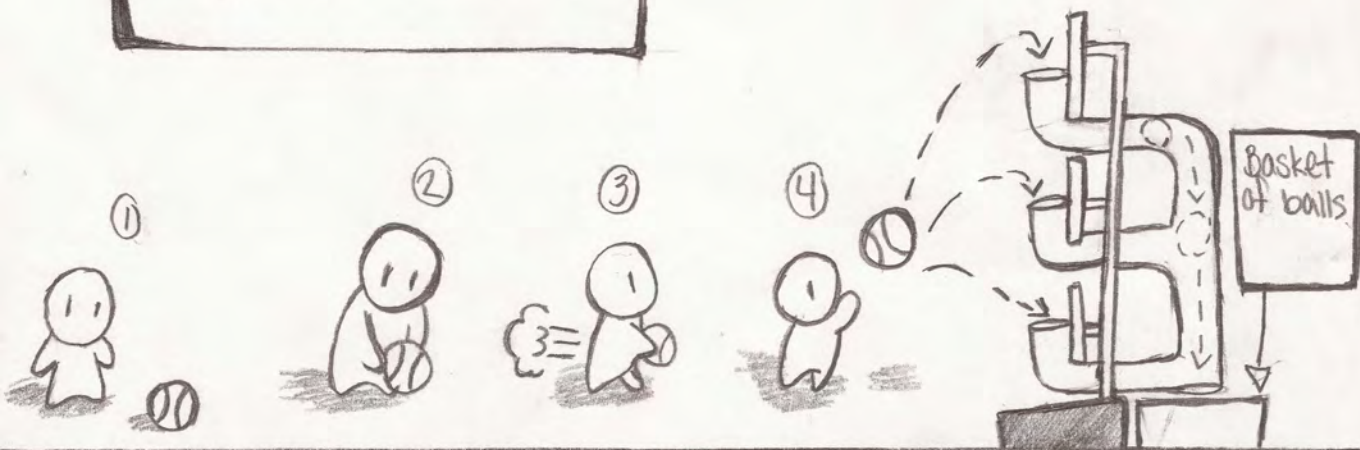
Here is the robot that they made! It's named after the famous IBM robot that competed in Jeopardy and Sherlock Holme's awesome sidekick. That's right, his name is Watson!



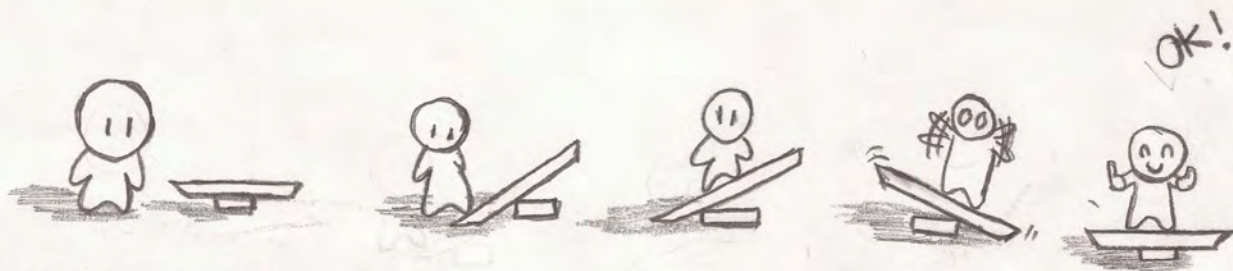
Watson is made to play a FIRST game called Rebound Rumble. This game was a huge challenge for the teams that year, but this robot can do it! But in order to tell you how the robot works, we have to know what the game was.

The first part of this game is something that is close to a game that is played in the USA. The game was basketball. The robot had to pick up a soft basketball, move to the basket and shoot the ball into the high, medium or low basket.

POINTS!



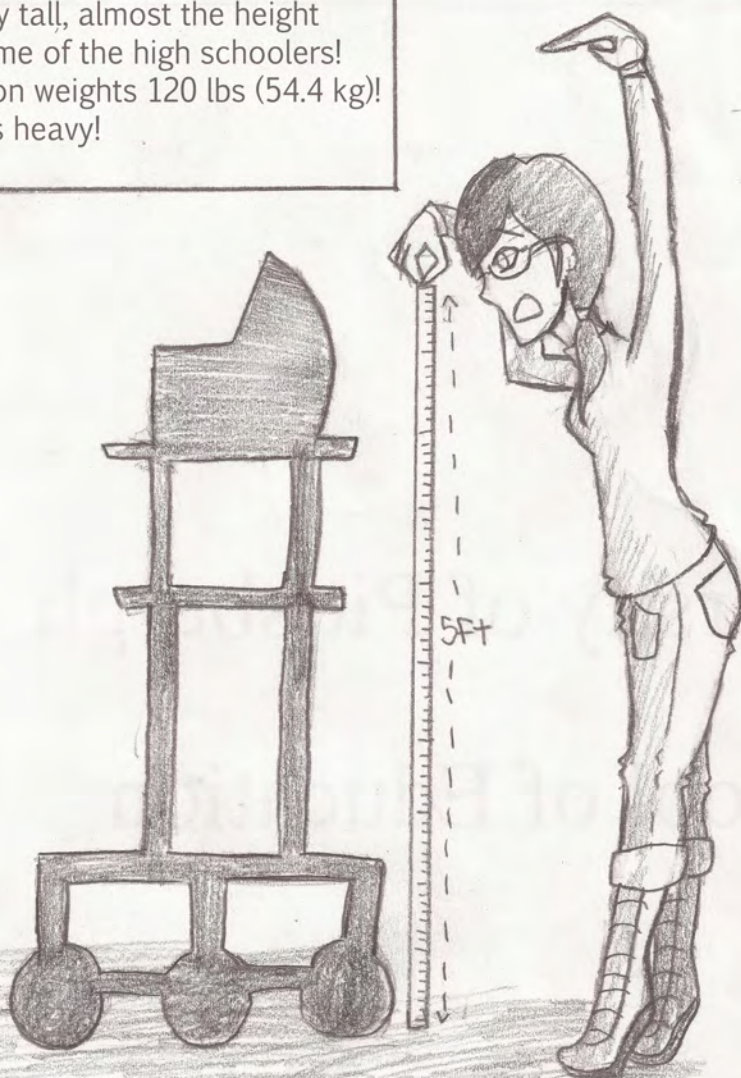
The second part of this challenge was called the end game. In the last 30 seconds of the game, robots had to balance on bridges. When in its normal state, it is balanced, the robots have to push the bridge down, get on and balance. It wasn't easy, the bridges rocked easily back and forth.



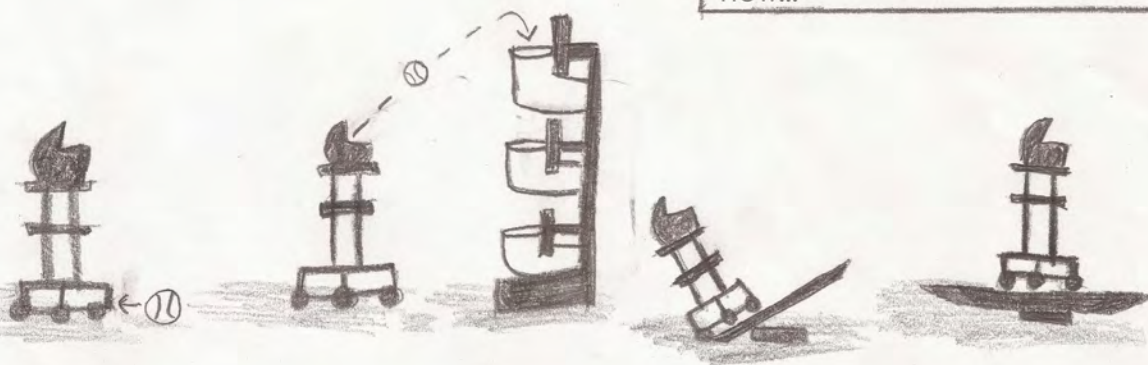
One robot balanced was good, two were better, but three robots were the best!



Watson does it all! The robot is very tall, almost the height of some of the high schoolers! Watson weights 120 lbs (54.4 kg)! That's heavy!



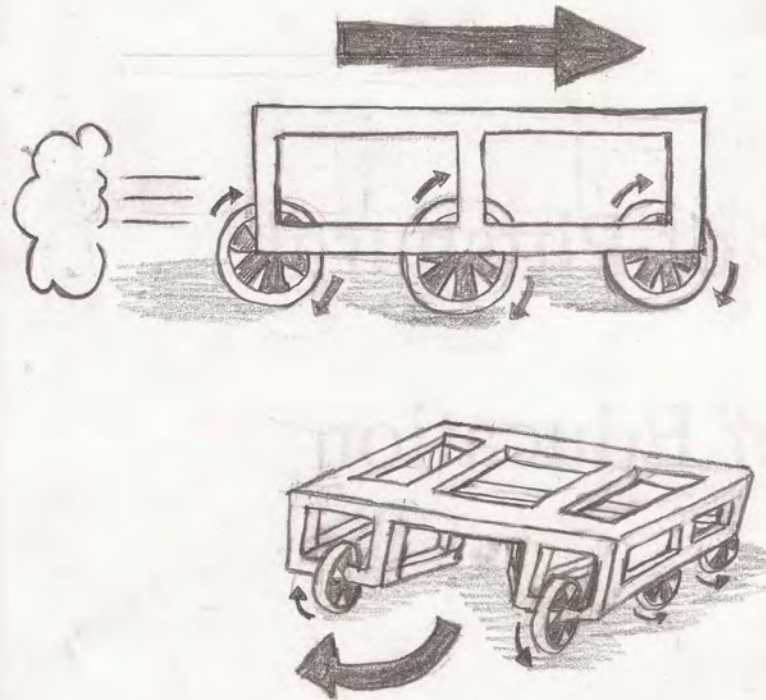
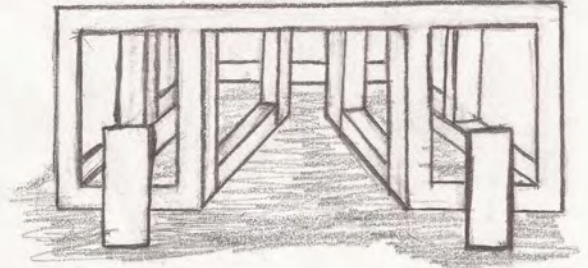
Watson is awesome, able to shoot basketballs, pick them up and balance on the bridge! I'll explain how...



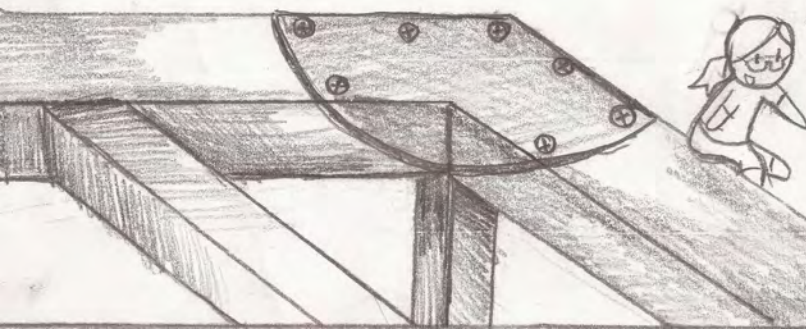
The chassis (pronounced cha-see) is the base of Watson. It is the base because more things are built on top of this part. It is what allows him to run around the field to play the game. It is made of strong metal called aluminum. The chassis has six wheels, allowing the robot to turn and have good movement.



The Chassis



To move forward, all of Watson's wheels turn forward. To go backwards, the wheels turn backwards. To turn, one half of the wheels turns backwards while the other half turns forwards. The robot spins in place just like humans do.

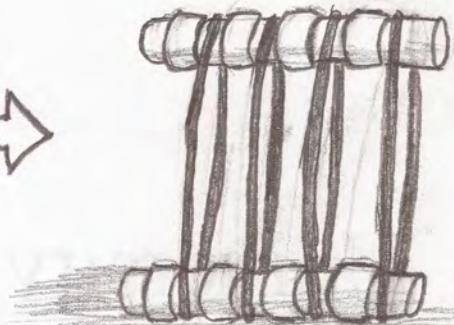
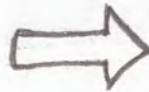
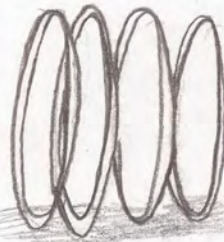
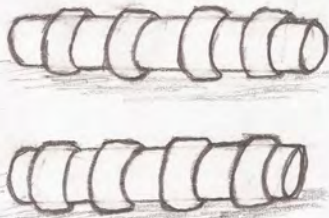


Talk about strong! This chassis supports more than 100 pounds! (45.3 kg) How's that for strength?

The next challenge for Watson is getting the basketballs off the floor. It seemed simpler than it actually was. There are many different ways to pick a ball off the ground, but this is the one Watson uses.

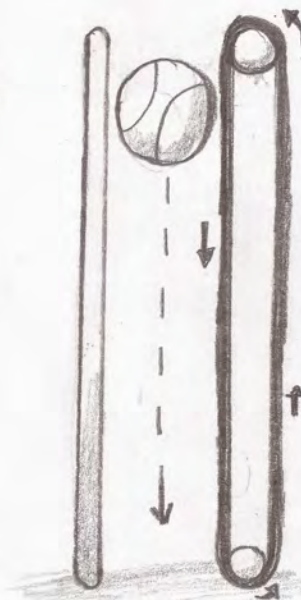
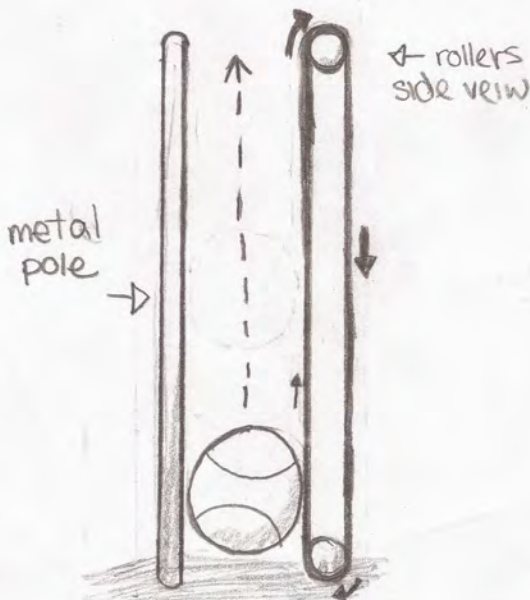


rollers



The collectors are made of a PVC (plastic) tube with rings glued at intervals. There are four rubber tubes that are made into a band. This is assembled together to make a collecting system.

How these collectors work is very interesting. There are 2 metal poles for the ball to slide up while the bands move. When the bands move, the ball goes either up or down. This is how the ball travels through our robot.



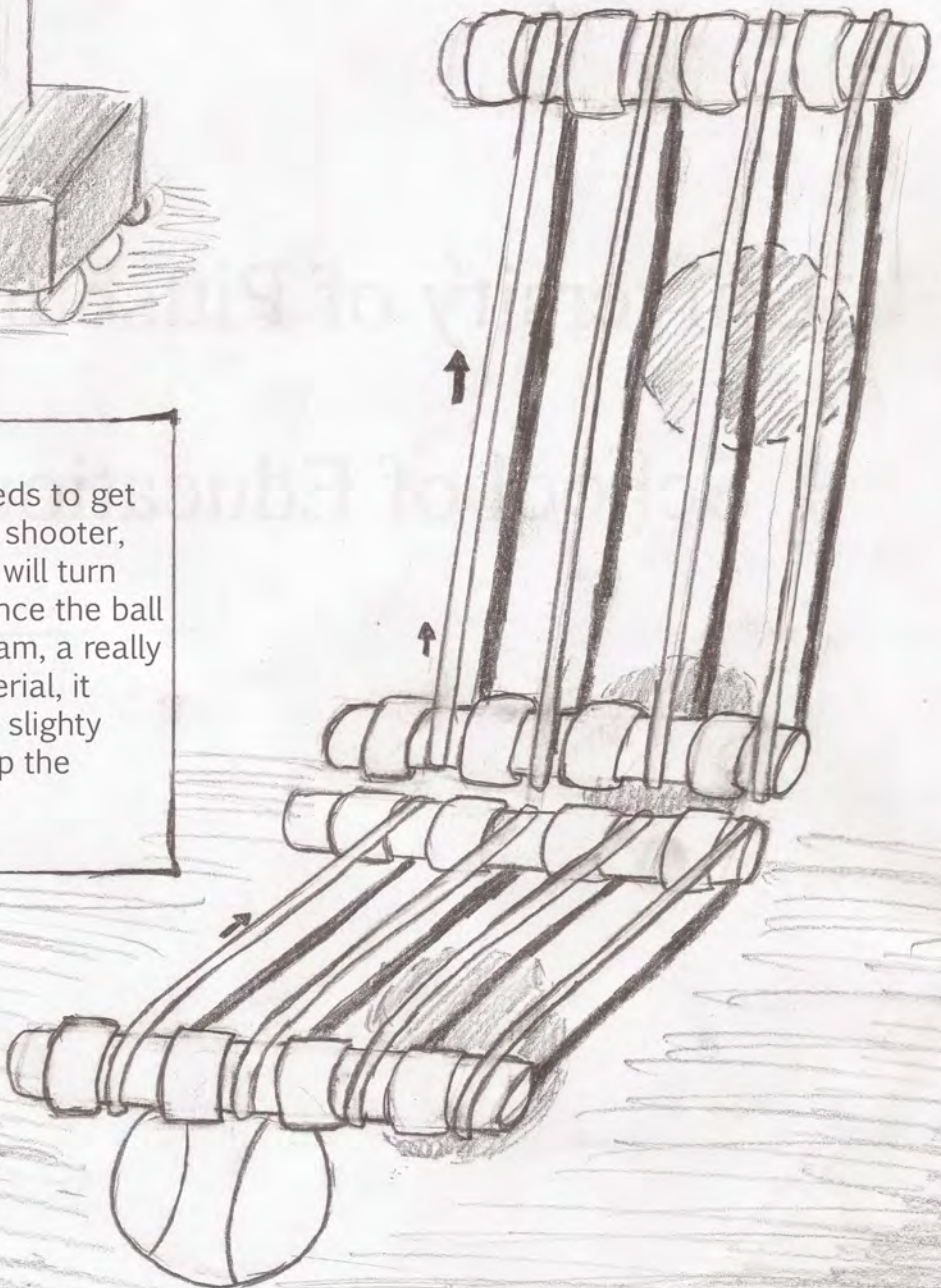
Talk about cool!
I never would
have guessed that
bands could do
that!



Now that you know how the conveyor works, let me explain how the ball gets off the ground. There are three sets of conveyors in the robot, but we will focus on the bottom two. One faces the ground while the other one stands upright. The one on the ground doesn't have the metal rods like the one standing upright. The ball gets caught and then rolls into the robot.

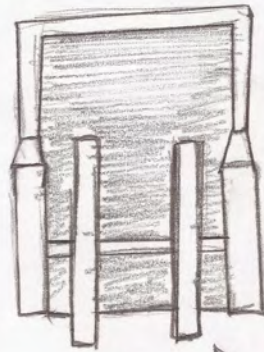


When the ball needs to get all the way to the shooter, all the conveyors will turn the same way. Since the ball is made out of foam, a really soft, squishy material, it allows itself to be slightly squished to get up the conveyor belt.



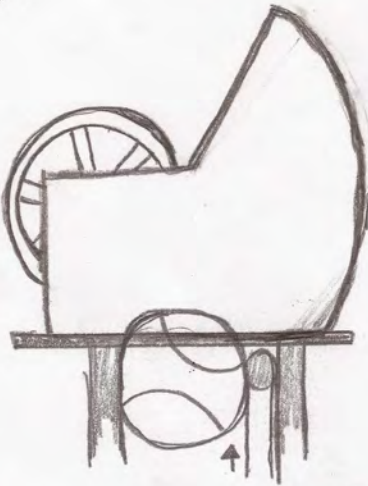
The Shooter

The shooter is what launches the ball into the basket from the collectors. The sides are made of thick metal and there are two, smooth wheels that spin very fast.

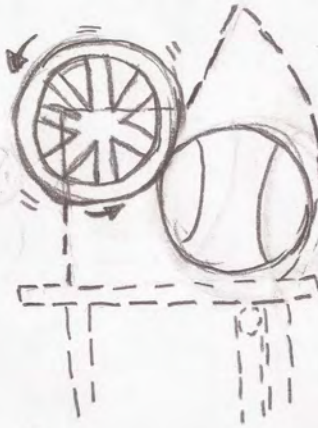


Front View

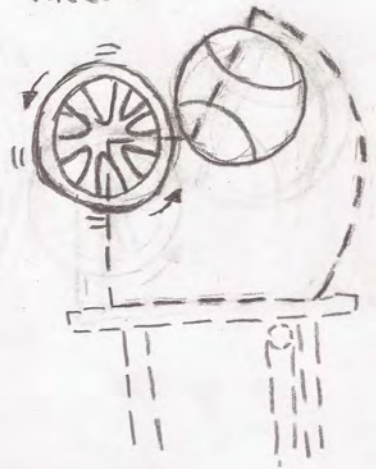
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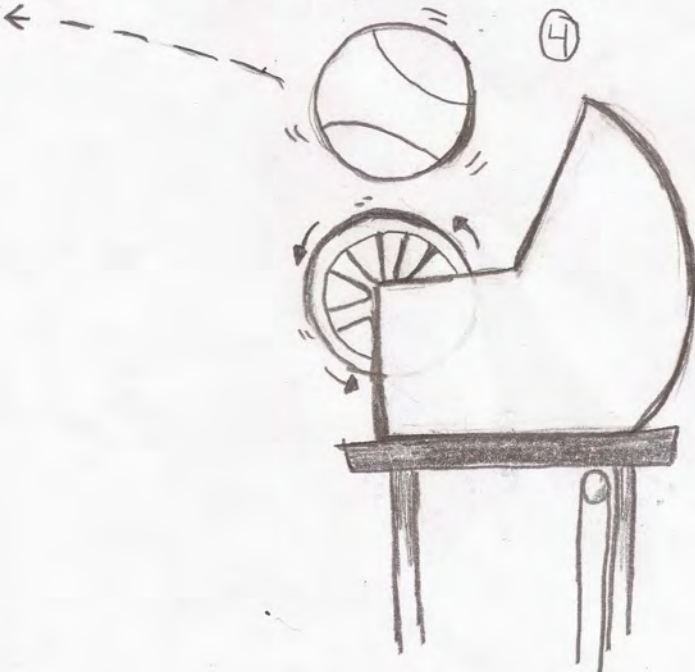
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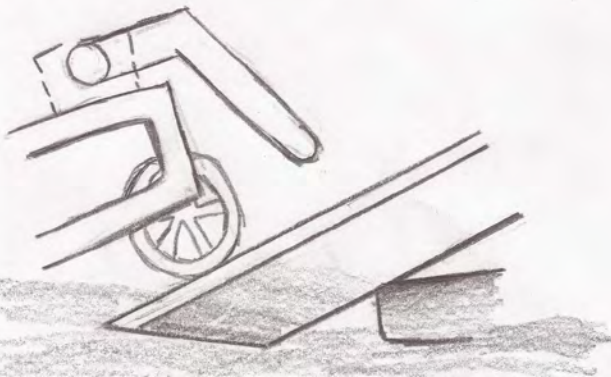
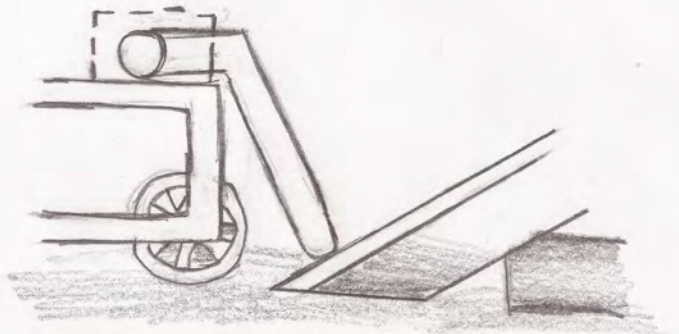
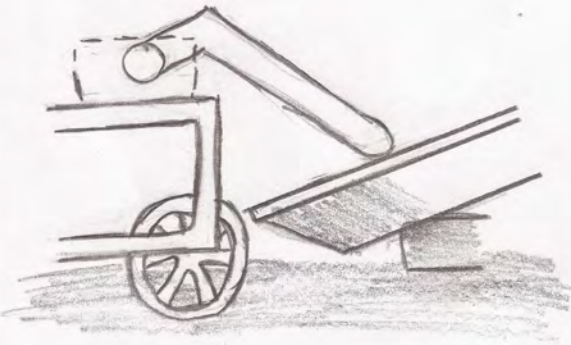
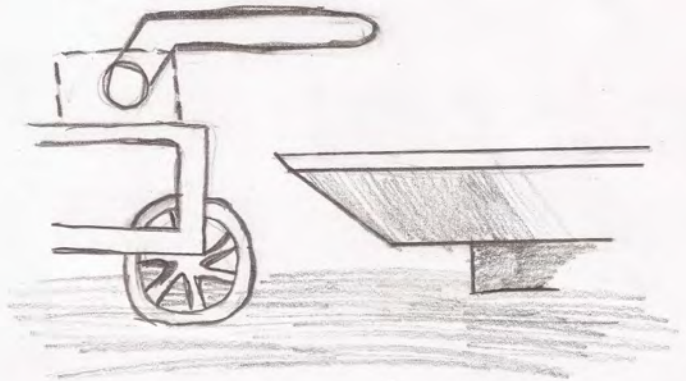
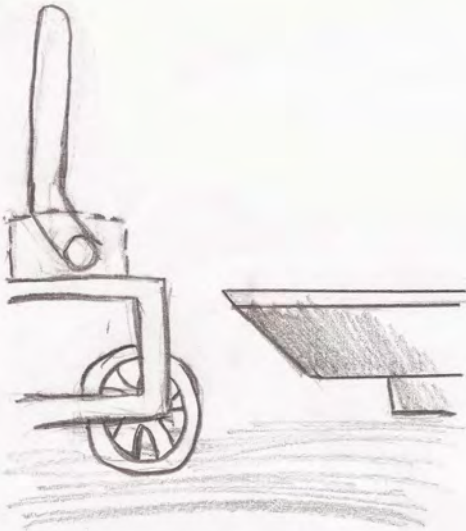


The wheel spins forward. This lets the ball spin against the curved back. It then launches the ball into the air. It flies high into the air and into the top basket! Totally awesome!

The collectors underneath the shooter allow the ball to reach the wheel in the shooter.

To get on the bridge, the robots had to be able to lower the bridge. The metal 'arm' is very strong. This was very simple to use and effective!

Bridge Arm

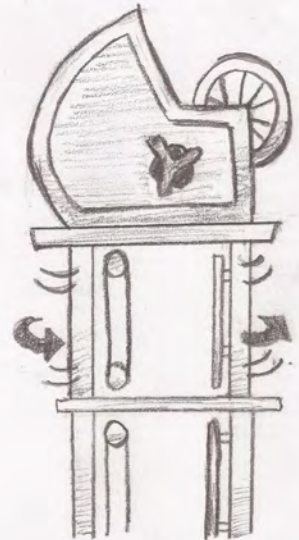
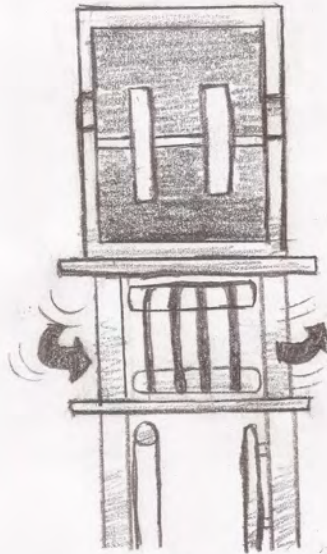
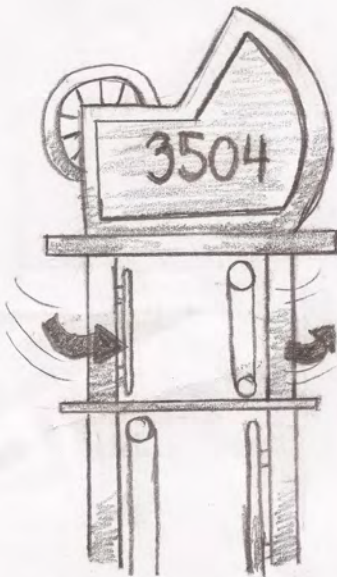


The bridge arm lowers, pushing down the bridge. This lets the robot drive up the bridge and balance!

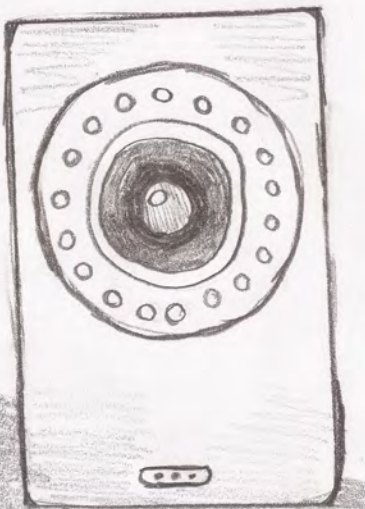
Watson has one very special feature on him. He has a small ring in the middle of the huge column of conveyors. This small ring allows the top to spin, even when the chassis is not moving! Isn't that amazing?

The Turret

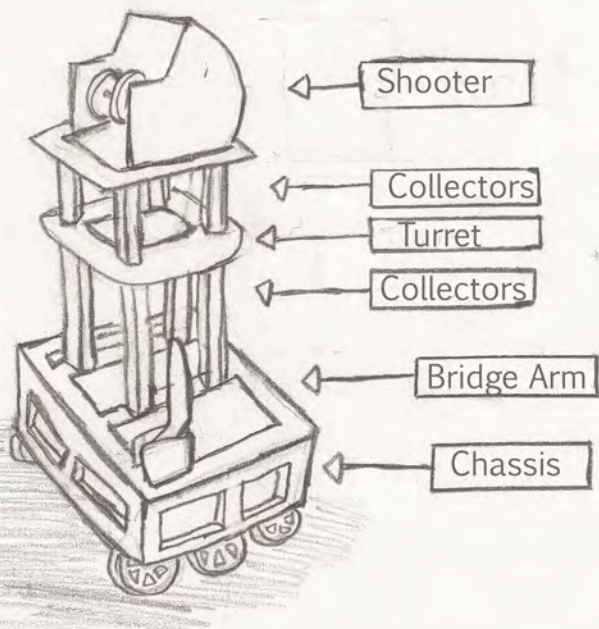
Top View →



The turret allowed Watson to score no matter where he was on the field. The shooter would constantly face the goals as it ran around the field.

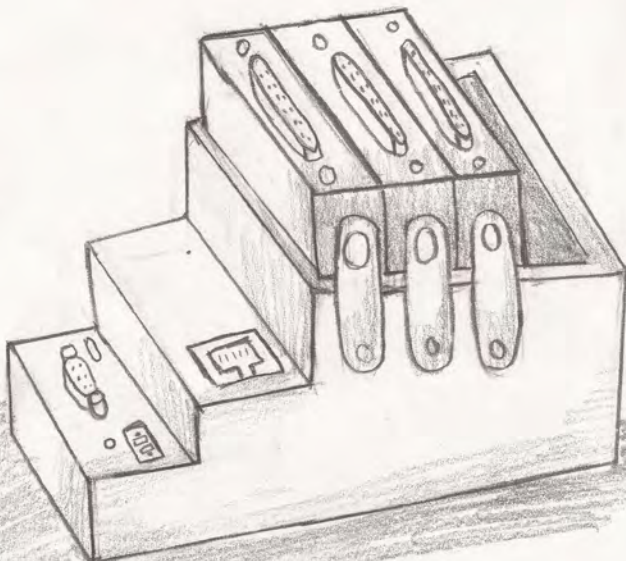
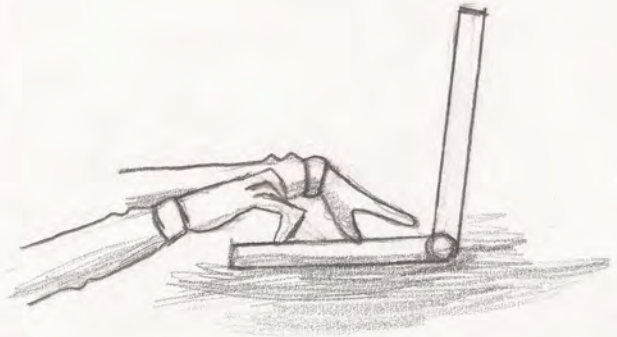


This is a special camera that is on the front of Watson. This can 'see' the goals and make sure that the shooter is constantly facing it. The camera works with the turret to make sure that the basketball is shot in the right direction.



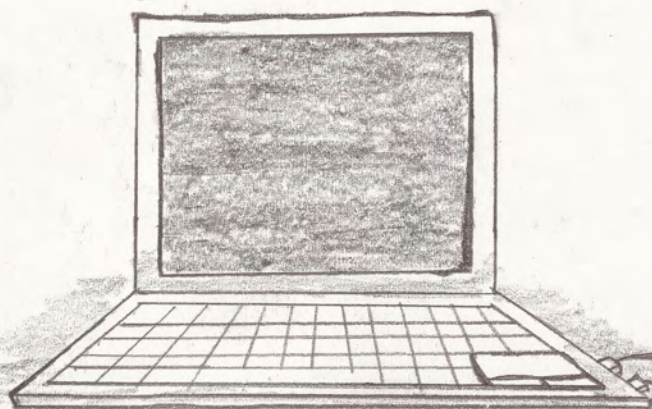
Watson needs all of these parts to work, but there are more parts than just this. The parts I just explained are called mechanical parts, or the 'bones' of the robot. There is more to Watson than metal and wheels, and they are two very important parts of the robot that cannot be overlooked.

Programming is a huge part of robotics. People 'write' or create something called code to make the robot function. Programmers create the 'brain' of the robot, creating a list of instructions of what to do.



The other part of robotics is called electronics. This part of the robot gives the program wires and tools to send information across from the computer where the code is stored to the parts that use the code. The electronics give the robot power, movement and energy. It is like the muscles in your body. Just like muscles, it gives the robot the ability to do the things it was made to do.

The robot is controlled by two remotes. These remotes contain the controls to everything in the robot! It's really fun to drive, it is a remote controls machine!



CONTROLLER 1



CONTROLLER 2

Drives chassis around.
Raises and lowers bridge arm.
Balances robot on bridges.

Controls shooter.
Controls turret.
Turns rollers on and off.
Controls camera.

And that is how Watson works! I hope you learned something and enjoyed it! Check out the Girls of Steel at: girlsofsteelrobotics.com. See more videos about robotics on YouTube. Think of your own ideas of robots and other technology creations!

Comic made by: Lynn Urbina, a 3504 Girls of Steel member

