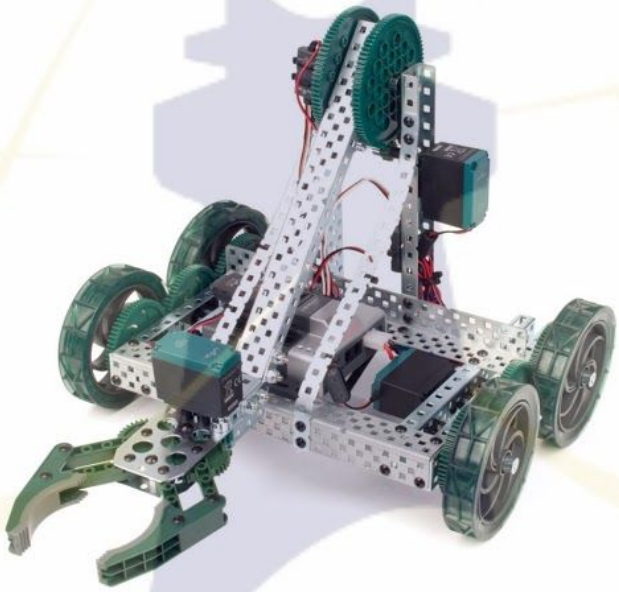
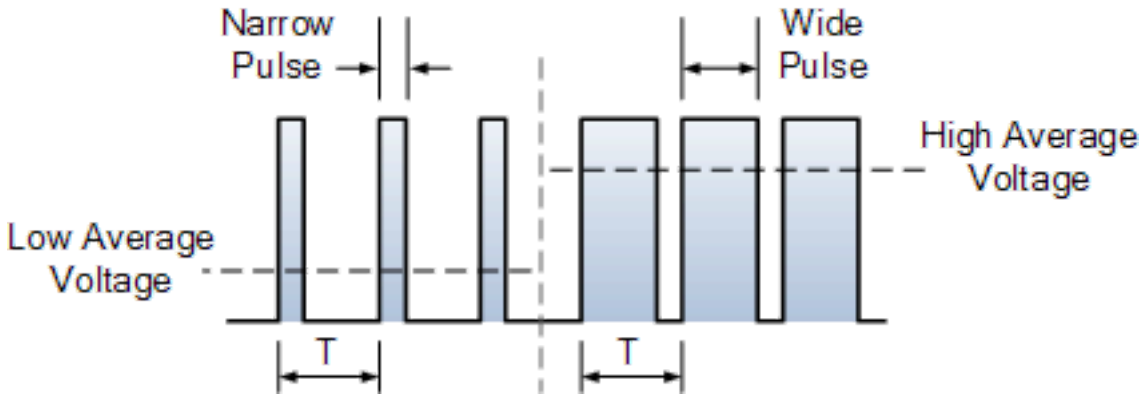
VEX ROBOTICS



PORT CREDIT
REGIONAL SCITECH PROGRAM

Kush Parhar 10/28/2016 Mr. Mizen TMJ 20R

A) A motor controller is a device used to get input from a microcontroller, and turn it into a larger signal. It takes signals from the microcontroller, and turns it into a larger signal using the battery. Most microcontrollers use about 0.1 amps as a signal, and most electric motors need several amps, and the motor controller supplies that. Pulse Width Modulation is a technique that turns varying levels of power(digital inputs) into a blocky signal in pulses(analog inputs). It creates two states: an on state, where it will receive maximum voltage, and an off state, where it will receive no voltage. This is done by getting the average voltage signal, and creating pulses from that. If the average voltage signal is low, that means that the pulses will be thin. If the average signal is high, the voltage will be thick. This is done by using capacitors and a timer chip. If the average voltage is high, the capacitor can charge more and create a thicker wave. If the average voltage is low, it cannot charge as much and will create a thinner wave. This is useful in DC motors when a low RPM is needed. Motors generally require high amounts of amps to function, so using PWM to vary the speeds is much more efficient than using more linear methods.



B) A continuous motor is an electric DC motor that continuously spins when power is applied. It will rotate in all degrees, continuously. It uses PWM to control its speed. They can run at a very high RPM. A servo motor, on the other hand, only has a 180 degree range of motion, but the VEX servos only have 100 degrees. It has many parts: a DC motor, a gearbox, a control circuit(which can sometimes be on the motor controller), and an position sensor, which is usually a potentiometer. A while a servo motor does have a small range of motion, it is made up for as a servo motor is very precise. It uses PWM to power and control it. Also, once stopped, a servo motor will hold its position, unless pushed past its maximum torque. They also have 3 terminals instead of 2, as they need an extra terminal for control.

D)

Collar - A device that clamps onto a shaft. It is used to hold spacers on a shaft or to hold a shaft in place.

Bearing - A device that is used to hold and guide a shaft. It is attached via the 2 holes on the sides and the central hole is for the shaft.

Keps Nut - A nut that has a washer attached to it. It is used with the #8-32 UNC screws in. It is used to hold an object in place, or to hold an part to another part.

Axle/Shaft - A long, metal rod that is used to connect wheels, motors, and gears together.

Lock Nut - A nut that resists movement from screws. It locks onto a screw and is very tight.

Hex Key - A key that is used to screw a screw that has a hexagonal top piece. It acts much like a screwdriver, just at a different axis.

Motor Controller - A device that acts as a controller for the Vex motors by getting the power and control signal from the cortex and powering and controlling the motor.

Bearing Block - A device that is used to hold and guide a shaft perpendicular to the object it is mounted on. It is attached via the 2 holes on the sides and the central hole is for the shaft.

Wrench - An object used to hold a nut in place while it is being tightened or it is used to tighten a nut.

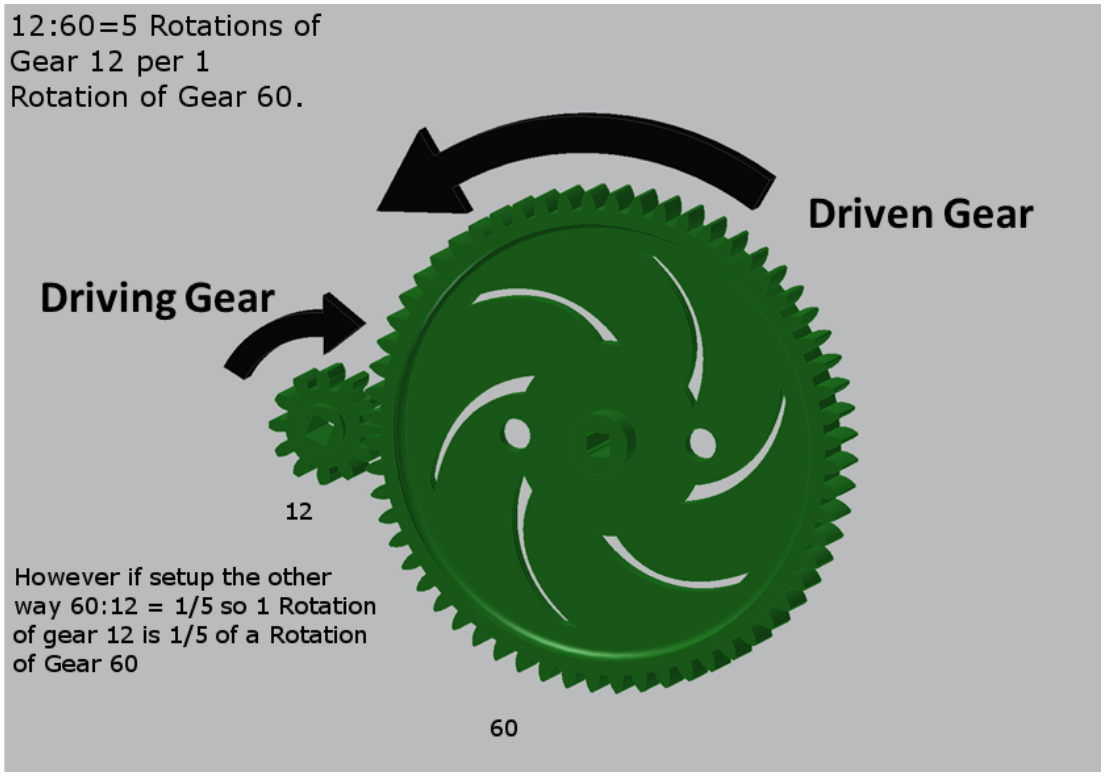
Spacer - An object put on axles to spread things away from each other on the axle. It can distance gears, wheels, and parts of the robot from each other.

Stand Off - A device used to separate parts from each other. It uses #8-32 UNC threads and can be used without an axle.

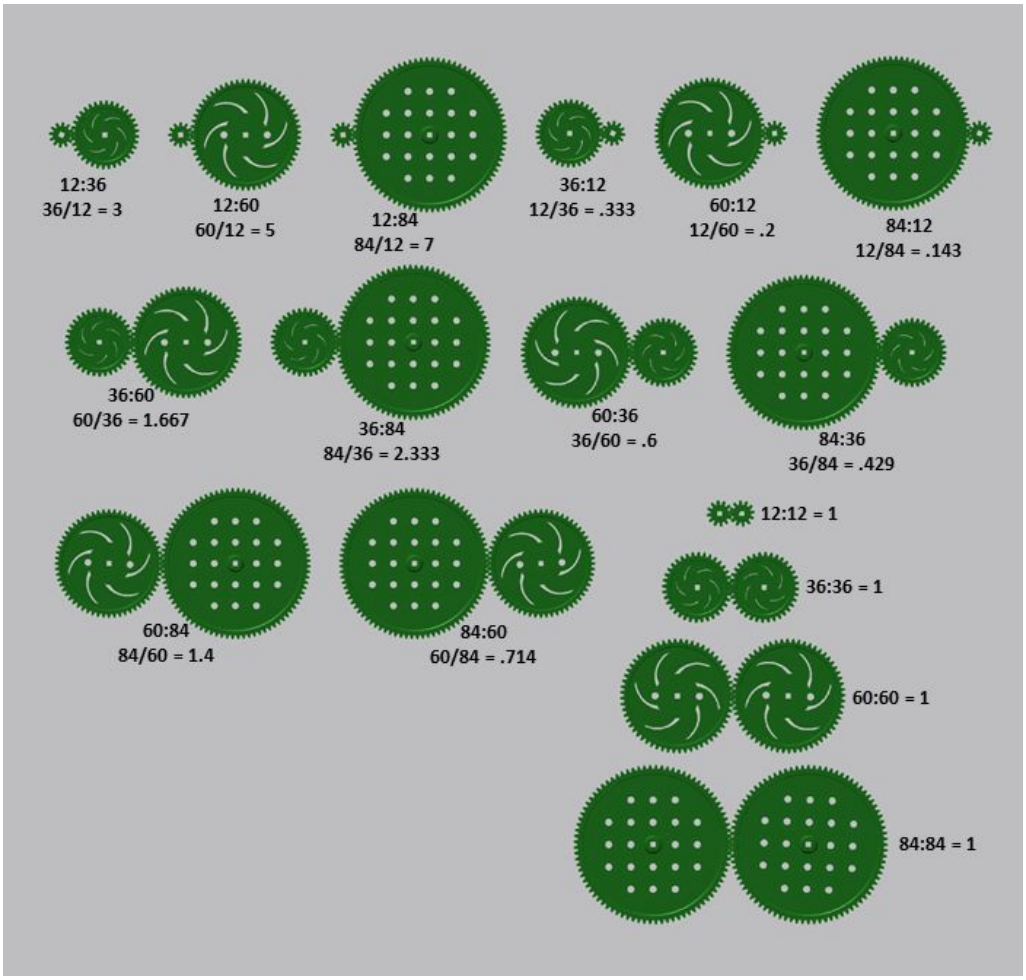
Lock Plate - A device used to lock an axle in place and prevent it from rotating.

Intake Roller - An object used to collect balls using its rubber fingers, which can grip and roll balls. It is used in a ball intake system to gather, move, and store balls.

E) 1) Torque is the force acting on an object which causes that object to rotate,rather than the number and speed of revolutions in an allotted time. Torque is measured in newton meters, while speed of the motor is measured in Revolutions per Minute (RPM).



2) As you can see in the image above, with the motor attached to gear 60(which is the driving gear), gear 12(which is the driven gear), spins 5 times for every 1 time that gear 60 rotates. This is because the gear ratio is now 12:60, which is 5. This will prioritize speed over torque, as the driven gear is moving quickly but it won't have the same amount of force. Also, if you reverse the motor setup, then gear 60 will spin about 1/5 of the way for every 1 time gear 12 spins, because the gear ratio is now 60:12, which becomes 1/5.



3) To calculate the increase in rpm of the driven gear, you must use the gear ratios. Divide the driving gears number of teeth by the driven gears number of teeth and multiply that by the motors rpm to calculate the driven gear's rpm. For example if you have a gear with 2 teeth as the driving gear and a 6 teeth gear as the driven gear, every turn of the 2 teeth gear, the 6 teeth gear spins 2/6, which is 1/3, of the way. In this setup, if you have a motor spinning at 200 rpm then 200 rpm x 1/3 ratio will give you 80 rpm, which means the driven gear will spin at 80 rpm. But due to the conservation of energy, it will have more torque, even though the rpm is smaller. However, this method does not include all the factors, such as the smoothness of the teeth or other external factors.

F) 1) The 8 in the fastener name stands for the diameter, which is 4.1656 mm in this case. The 32 in the fastener name is the threads per inch, or the TPI. The UNC stands for the tolerance class. The fastener is used for securing parts larger parts together, such as securing parts of the drive together or securing parts of the claw to the arm. It can

also be used to secure standoffs of the same type in place.

2) The 6 in the fastener name stands for the diameter, which is 3.5052 mm in this case. The 32 in the fastener name is the threads per inch, or the TPI. The UNC stands for the tolerance class. The fastener is used for securing the motors in place.