Project Title: BALL IS LIFE

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Project Goal

This project will create a moving basketball net cart that will calculate the trajectory of your rebound, actuate the motors, catch the rebound, and return the basketball to you.

Project Approach

The project will model the trajectory of a basketball once it has been shot and attempt to determine its location after hitting either the rim of a hoop or gone through the net. The sensors utilized will be a Kinect and/or a 640x480 webcam. Then a Raspberry Pi will determine trajectory and direct the Teensy 3.1 as to how to power the motors. The ultimate goal is to accurately calculate trajectory of the basketball and to have the robot react and catch the basketball with a net-like chassis.

Resources

Our plan is to use a Teensy 3.1 to actuate the motors, and a Raspberry Pi to process the Kinect and webcam optical data using ROS and OpenCV. The motors currently chosen are high torque motors suitable for the applications of this project (quick response time to react to basketball deflections). As these motors require high current, we've selected a motor controller to fit the role of driving these motors properly. We'll mount the Kinect and camera on top of our chassis which will look similar to http://www.amazon.com/Large-PVC-Nylon-Equip-Cart/dp/B00BY0F7DU. The Raspberry Pi will do the heavy lifting in terms of detecting the basketball through CV algorithms, and calculating trajectory of the ball. Once this is accomplished, it will serve data to the Teensy 3.1 to actuate the motors and drive the robot where it needs to be to catch the basketball.

Microcontrollers: Raspberry Pi, Teensy 3.1/KL25Z mbed
Motors: http://www.robotshop.com/en/banebots-rs-550-motor-12v-19300rpm.html#Specifications
Motor Controller: http://www.pololu.com/product/707
Sensors: Kinect, possibly 640x480 webcam, IR Distance/Ultrasonic to prevent crashing
Power Supply: 12V Rechargeable Battery Supply
Chassis: PVC Pipes and Nylon Netting

Schedule

- October 21: Project charter (this document)
- October 28: Platform finalized and parts (motor, chassis, camera) ordered. Start modeling state machine virtually.
- November 4: Have Kinect up and running. Tracking an orange sphere. Start hardware architecture.
- November 11: Have the hardware schematic and layout finished. Start trajectory mapping.
- November 18: Print PCB and have final hardware planned out. Finish trajectory mapping algorithm.
- November 25: Finish building the basketball catching hardware. Have motors up and running.
- December 2: Integrate the hardware with kinect detection algorithms for basketball.
- December 9: Begin testing while tossing a basketball towards camera field of view.
- December 16: Demonstration video made, powerpoint prepared.
- December 17: Final presentation and demo.
- December 19: Project report and video turned in.

Risk and Feasibility

Catching a basketball in a gym is quite difficult as a basketball weighs around 22 oz. If our robot misses the rebound we could risk potentially damaging components. Additionally, there is a risk that while chasing the rebound we might run into an obstacle such as the bleachers on the side of the court or people standing by and watching. The most infeasible portion of this project is being able to track and catch the ball before its bounce is

not high enough to catch. We will need to make our algorithm track the ball’s trajectory and make the catch within one bounce.