ME 144 - Robotics
LAB 6

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The goal of this lab is to design a way for the turtlebot to be capable of shooting a penalty kick. The tbot can start from anywhere around the ball with any orientation. The tbot should analyze the situation and determine where to position itself. Then, it should " kick" the ball into the goal.

Our approach is to start off with the camera not facing forward, but 90 degrees to the left. This is beneficial since the robot can move around and behind the ball while always tracking it, thus ensuring its always on the correct path. With this setup, the first step is to locate the goal and center it in the camera's view. We used the HSV filters on our image to track the orange ball and green goal. Then the tbot is to turn by an angle phi, until the center of the ball is in the center of our view. This angle phi (positive or negative) determines whether the goal is on the right or the left of the ball, respectively. We use a P-controller for rotational velocity in order to keep the ball front and centered. The bot is given linear velocity using another P-controller. This one is dictated by comparing the centroids of the ball and goal. These two controllers cause the tbot to move in an arch, getting around and behind the ball. Once the tbot is lined up, i.e, the center of the ball coincides with the center of the goal, the tbot turns 90 degrees CCW, so the front of the tbot is now facing the ball. Next, the tbot needs to “kick” the ball into the goal. The tbot is given the command to travel in a straight line and impact the ball, in order to shoot and score.

We account for different scenarios in our code, i.e, the tbot is to check it is already “lined up” behind the ball, with the goal straight ahead.