

HW 1 Individual Design Concept Proposal

1. Design Concepts/ Brainstorming

My idea is to use a launching mechanism like a baseball pitching machine. This launcher will be placed at a fixed angle on a platform that can move side to side. The platform would be built out of one of the scanners that are available in lab. Ideally, the rails of the scanner will allow enough side-to-side motion that we will not need to add a pivot to the launcher. In order to vary the distance the launcher will shoot we will need a secondary servo to increase or decrease the angle of the shot.

In order to load the balls into the launcher I think we should use a vertical tube as a hopper. We can then use a disk with a wedge cut out of it as a loading mechanism. I think this would be best since it would be easy to connect it to a motor to have it do one complete rotation when we want to load a ball. The action of the rotation would be when the wedge passes under the tube the bottom ball would drop out of the tube into the loading mechanism, then when the wedge has passed the solid disk would hold the rest of the balls in the hopper. Since the hopper is vertical gravity would ensure that the next ball was always ready to go.

In my senior project I have worked with a little bit of computer vision. It is my hope that we can implement a HSV object tracking scheme to identify and track the ping pong ball. This would be useful as a way of getting feedback from previous shots to adjust launcher calculations on the fly. Additionally, this system could be used to identify which cups are in play and have the computer decide which to aim for. Finally, if the computer vision system is accurate enough we could use it to detect when a ball bounces and have it trigger a defense/ swatting arm.

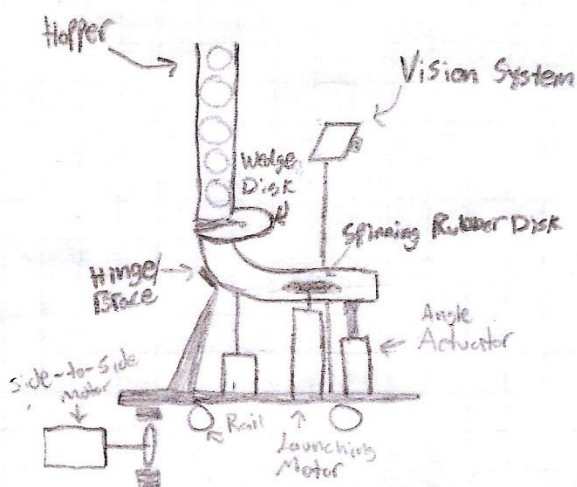
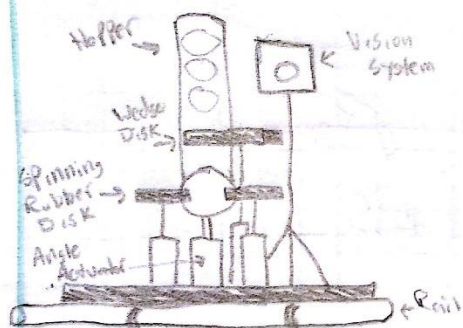
In order to stop opponents from making bounce shots against us I think we should use a fist or a square piece of wood on a linear actuator that pushes out in a punching motion. This way we can track where the ball is coming from and then push the "fist" forward to knock the ball backwards. I think this approach would be the simplest way to implement a blocking motion because it does not require analysis of the vertical component of the incoming ball's motion.

2. Functional Goals

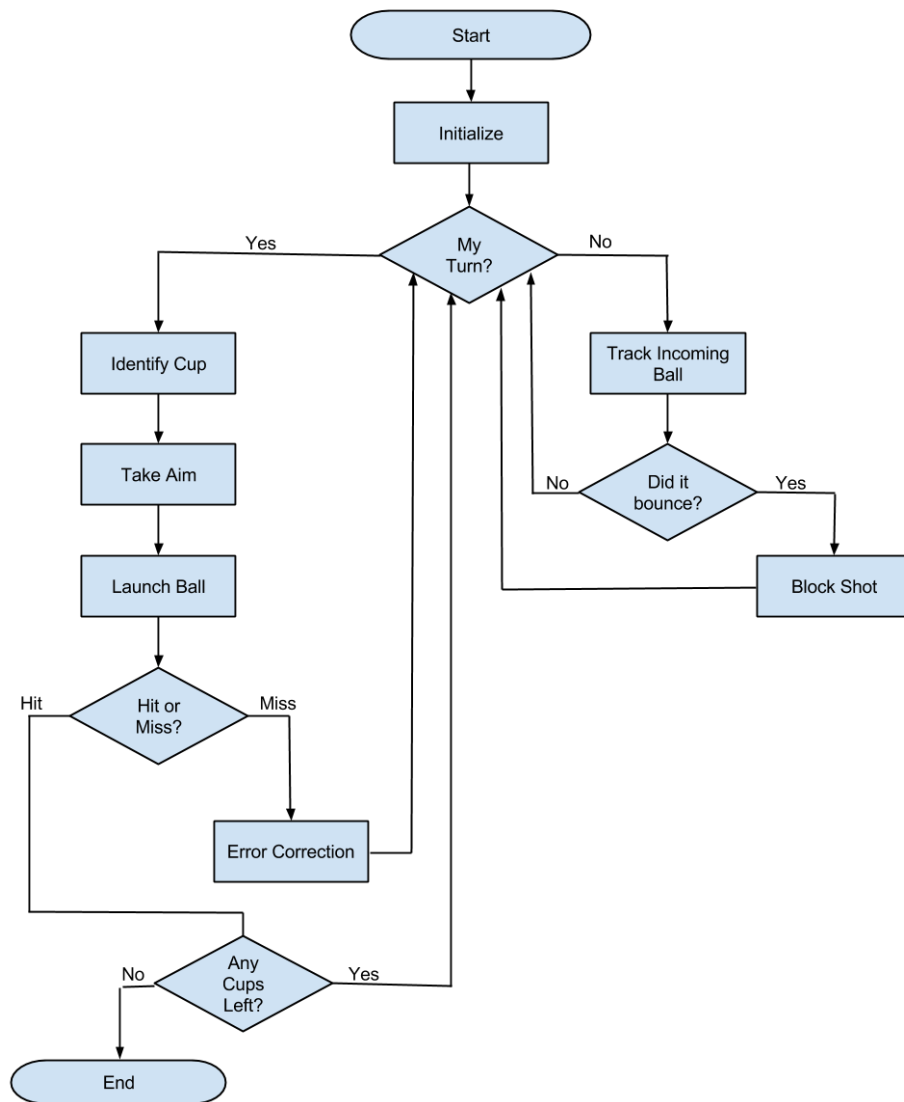
- 1) Be able to repeatedly launch ping pong balls to a desired location.
- 2) Load ping pong balls into the launching mechanism reliably.
- 3) Identify and track a ping pong ball in real time.
 - a) Adjust trajectory of the ping pong ball based on previous shot.
 - b) Track an incoming ping pong ball to start a block movement.
- 4) Extend an arm block an incoming ping pong ball.

3. Sketch of System

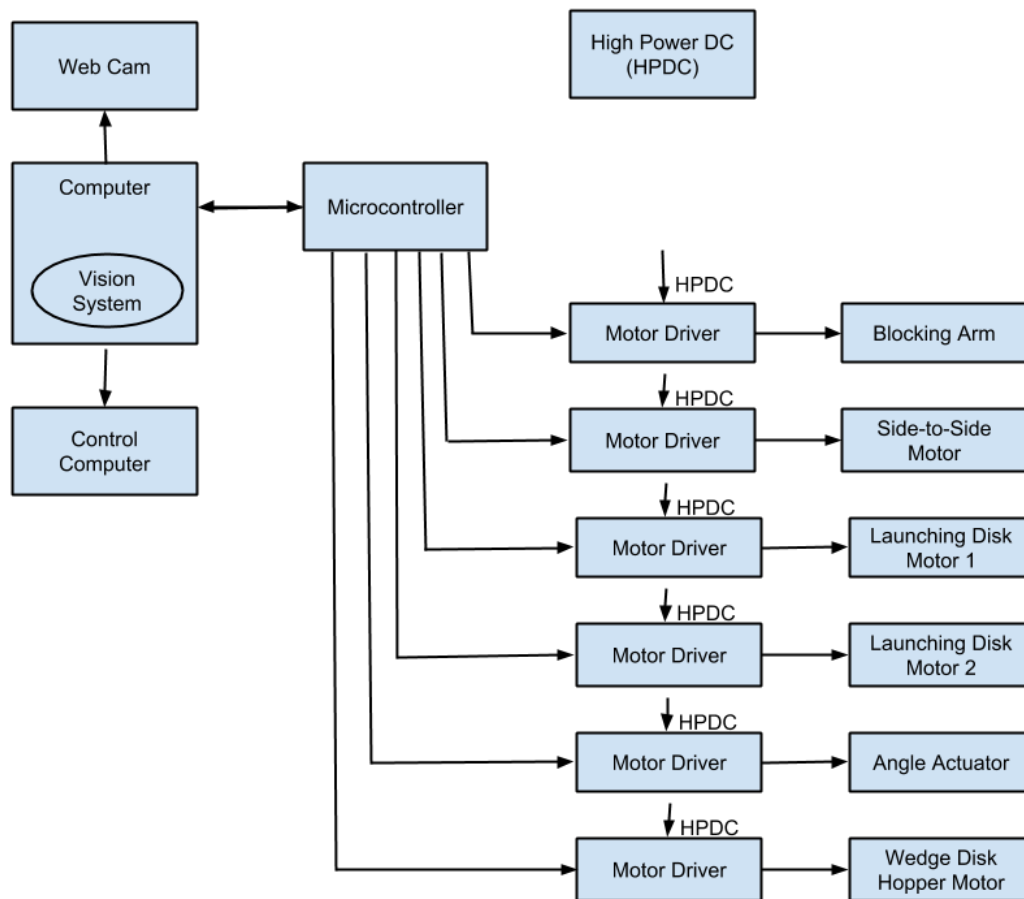
3. System Sketch



4. Flowchart of Functions



5. Block Diagram



6. Primary Responsibilities

I will primarily work with the electrical systems. This will include programming the microcontrollers, working with the motor controllers, any electrical feedback systems, board to board communication, and the power systems/ feeds that are needed to run the system.

Since I have some experience with computer vision. I would like to have a supporting role on developing the ping pong ball tracking system.

7. Initial Plan of Action

The first thing that needs to be done is to build the ball launcher mechanism. This needs to be done first because it is required to build and test the hopper and the vision system. Additionally, we must test if the system is accurate enough for our needs. If the system is unreliable then we need as much time as possible to redesign this system as the entire project will not work without an accurate ping pong ball launcher mechanism.