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2015-04-02
ROB 421

Individual Design Concept Proposal

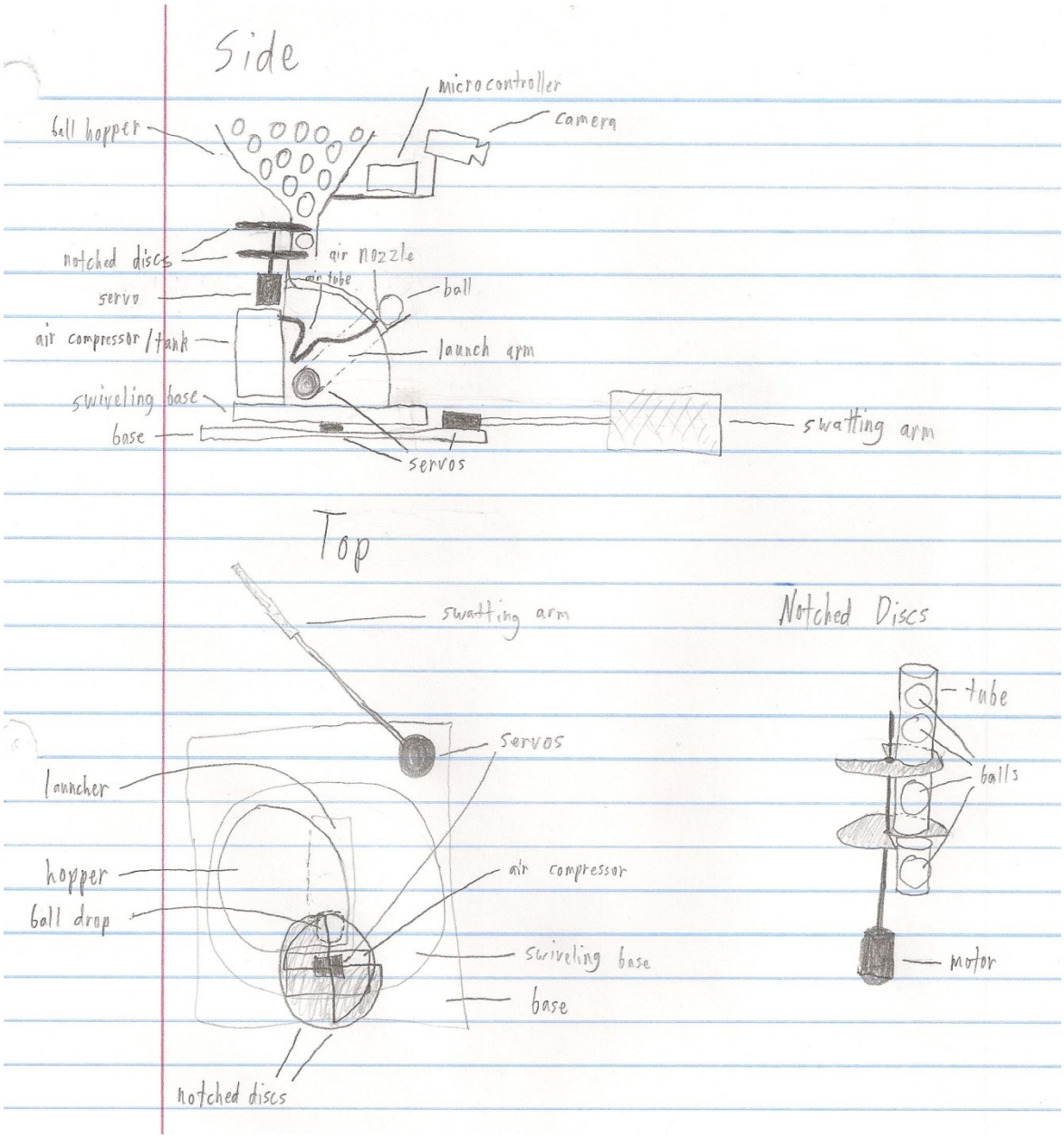
Design

The primary launching mechanism will be an electronically controlled air nozzle that is connected to an air compressor/tank to release a blast of air that will propel the ping pong ball. This is a fairly simple mechanism that should be easy to control. The force and length of the blast will remain constant, and the distance of the shot will be adjusted by a servo that aims the launching arm up or down. The shot will be moved left or right by a servo that swivels the entire assembly horizontally. The balls are held in a hopper at the top of the device, and are dispensed through a tube with two offset notched discs partially inside it. The chamber between the discs is small enough to allow only one ball to be held at once, and only one of the discs leaves the chamber open to the tube at once, so this mechanism should ensure that only one ball is dispensed at a time, while being simple enough to be controlled by just one motor. A camera will be mounted near the top of the robot, allowing it to see the cups and any oncoming ping pong balls. If it detects a bounce shot, a small arm fixed to the base of the robot will swing outward in an attempt to swat it away.

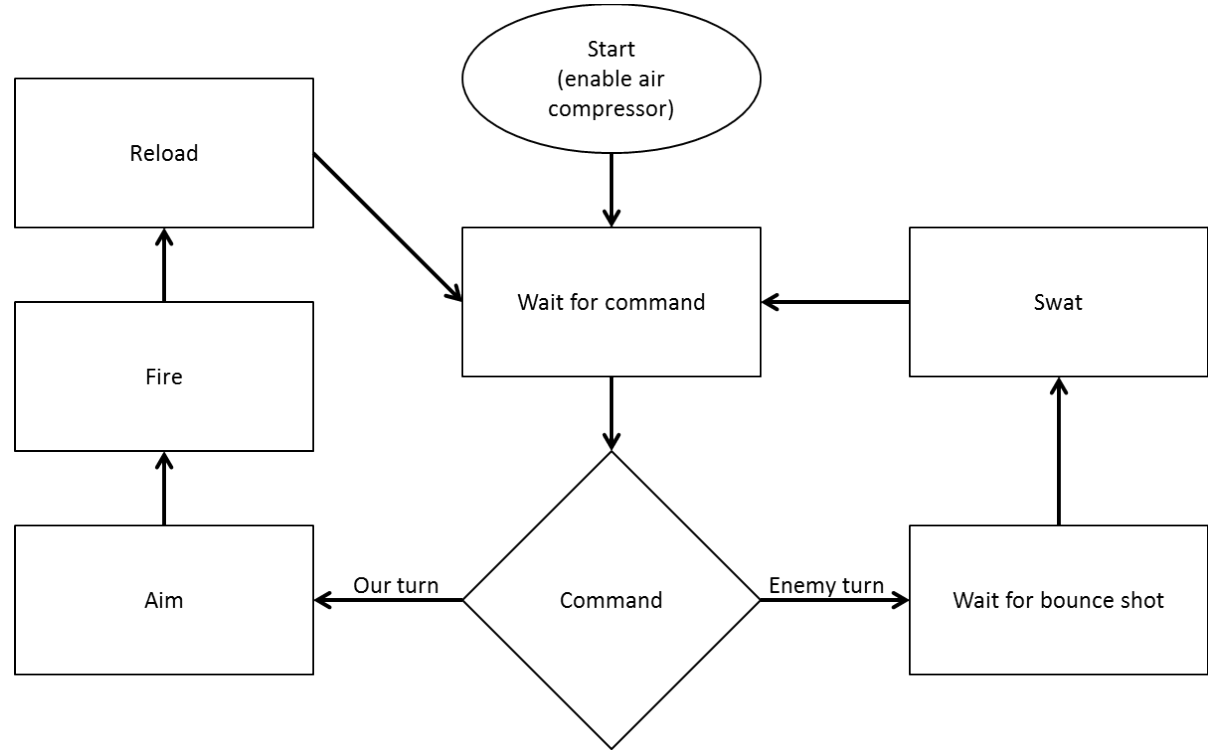
Goals

- High priority:
  - Robot shoots balls in a controllable and predictable manner
  - Loading mechanism reliably loads balls
  - Web cam feed is visible to remote controller
  - Robot responds correctly to remote commands
- Medium priority:
  - Robot detects cup locations and distances automatically
  - Robot can calculate necessary angles for bounce shots
- Low priority:
  - Robot can swat at balls
  - Robot can detect a bounce shot by sound
- Very low priority:
  - Robot can detect a bounce shot by vision
  - Robot can calculate bounce shot physics to swat the ball reliably

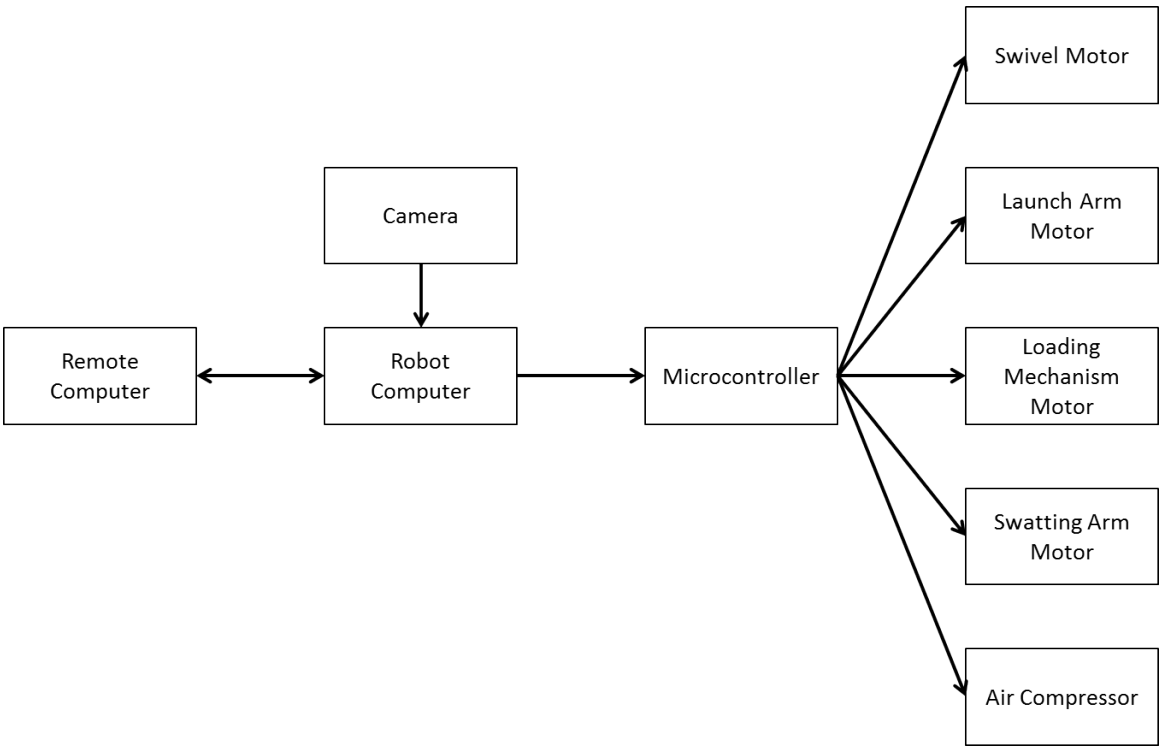
Sketch


Side
microcontroller
Camera
ball hopper
notched discs
air nozzle
air tube
ball
servo
air compressor / tank
launch arm
swiveling base
base
servos
swatting arm
Top
swatting arm
Notched Discs
tube
Servos
balls
launcher
hopper
air compressor
ball drop
swiveling base
motor
base
notched discs

Flowchart of Functions



Block Diagram



Responsibilities

As the computer science major of the group, I will focus on the computer vision, physics calculation, remote control, and other high-level programming required to let the robot see the cups and ping pong balls, control the angles of the shot, provide webcam feed to the remote controller, and react to input from the remote controller.

Plan of Action

I will focus on researching the physics and remote control aspects first since those will allow us to choose and hit targets via remote control. I will focus on the computer vision afterward, since it will likely be the hardest problem to solve and is also not absolutely critical to the function of the robot (though it would be extremely useful).

Martin, our electrical engineer, will focus on researching the necessary microcontroller, motor controllers, and motors, as well as wiring them together and getting them to interface with the computer.

Brett, our mechanical engineer, will focus on designing and building the physical structure of the robot, ensuring all pieces can handle the wear and stress placed on them while still allowing the robot to load, aim, and launch its shots reliably.