

CDE2310 Group 6

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### **Class Exercise 2: Part 1**

#### **Concept for ball delivery mechanism**

We are considering using a flywheel mechanism for accelerating the balls

And a solenoid/servo for the feeding mechanism to bring balls from the gravity fed magazine to the flywheels.

#### **How you might achieve the motions required**

The flywheel is more than sufficient for accelerating the balls to a considerable height

The shape of the magazine and the barrel need to be carefully tuned to make sure only one ball is fired off at a time, such that we can control the interval between the balls firing.

#### **List out the mechanics important in the process**

Flywheel

- Motor speed must be high in order to transfer enough energy to the ball
- Wheel must have enough friction to transfer energy effectively to the ball too
- Motor torque must be high enough to not slow down significantly when in contact with the ball

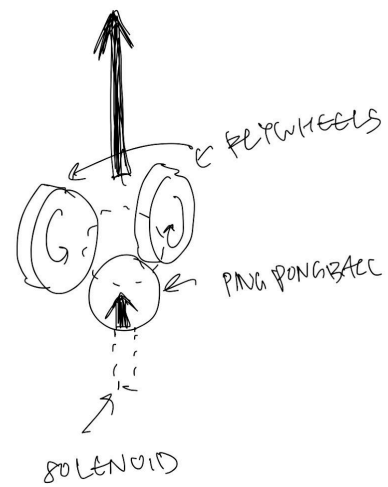
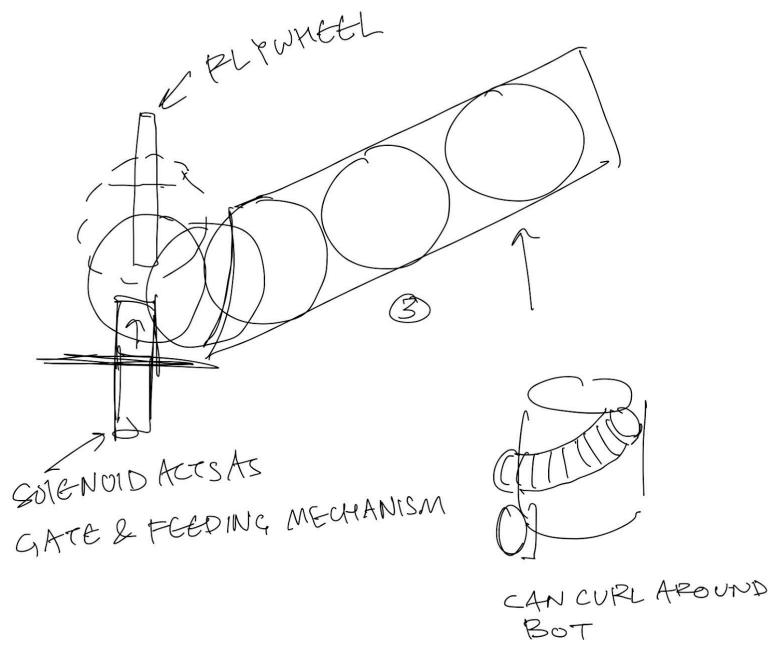
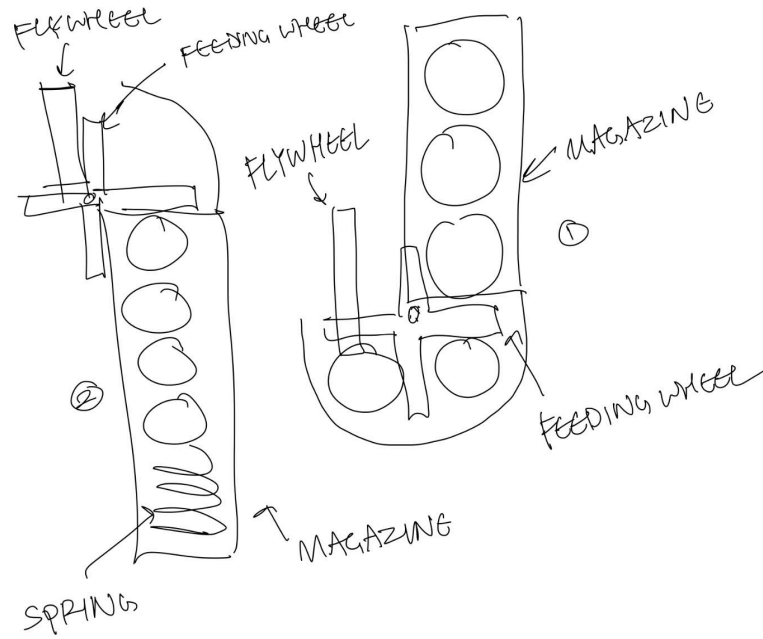
Solenoid

- Synchronisation with the flywheel's readiness to avoid jamming

Magazine and Barrel

- Must be correct shape in order to allow smooth transmission of balls
- Must have low friction to allow transmission of balls

**Initial sketches:**

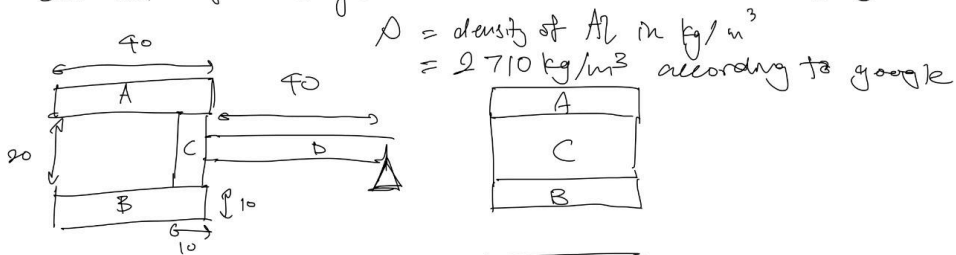


### What are some problems that may arise

1. Ball gets jammed between the magazine and feeding mechanism or between the feeding mechanism and flywheels.
2. Since the mechanism is gravity fed, the mechanism may not function if the robot tilts too much.
3. 3d printed parts have too much friction for the light balls to travel down the magazine

### Class Exercise 2: Part 2

Simplify diagram by assuming flat sides & pivot on far corner of object as differences negligible at 2s.f.



Torque applied by A+B

$$= (0.040 + 0.020) \cdot (0.040^2 \cdot 0.010) \cdot 2 \cdot \rho g$$
$$= 1.92 \times 10^{-6} \rho g$$

Torque applied by C

$$= (0.040 + 0.005) \cdot (0.020 \cdot 0.040 \cdot 0.010) \cdot \rho g$$
$$= 3.6 \times 10^{-7} \rho g$$

Torque applied by P

$$= (0.020) \cdot (0.010 \cdot 0.010 \cdot 0.040) \cdot \rho g$$
$$= 8.0 \times 10^{-8} \rho g$$

Torque anticlockwise

$$= (1.92 \times 10^{-6} + 3.6 \times 10^{-7} + 8.0 \times 10^{-8}) \cdot 2710 \cdot 9.81$$
$$= 0.06274 \text{ Nm}$$

$\therefore$  Torque required = 0.063 Nm //