1. Research into collision detection and avoidance techniques
2. Components used (dual-lens camera for depth perception)
3. Exploration of simulation practices, tools, and design
4. Component research for compatibility and solution practicality (ex. camera/object detection systems, precise precision and speed measurements, precise control systems for movement, etc.)
5. Creating and training a model upon the simulated environment
6. Components must be purchased
7. Drone assembly
8. Precision control training
9. Integration with the simulated movement patterns
10. Interfacing/network connection objectives
11. Testing
12. Modification for performance
13. Live performance visualization, presentation, and possibly a paper

DO SIMULATIONS BEFORE PURCHASING ANYTHING!

Do some baseline calculations to see if this is possible. How fast is a punch? How fast is bluetooth or wifi? How fast can an image recognition algorithm run? How fast can a drone accelerate?

* A punch is thrown at approx. 25-35mph
* A dodgeball can be thrown up to about 60mph
* An arm is about 2-2.5 feet long
* Dodgeball can be thrown from say 10-20 feet away
* A punch takes about 200ms
* 60mph = 26.8m/s, 10 feet = 3 meters, v = d/t, 26.8 = 3/t, t=0.111s
* 30mph = 13.4m/s, 20 feet = 6 meters, v = d/t, 13.4 = 6/t, t=0.5s
* Nissan [GTR drone](https://asean.nissannews.com/en/releases/release-31e8ec72e40241d87163a580d101f58d-nissan-creates-gt-r-drone-0-100-kmh-in-just-13-seconds) : 0-100kph in 1.3s. V = V0 + at, 28 = 0 + a\*1.3, a = 21.5 m/s2.
* Assume that the drone must move 1 foot to evade any obstacle. Assuming straight upwards or forwards acceleration, is this possible within .1 or .5 seconds? By how much? How much processing time will we have left?
* d = v0t + ½ a\*t2. 0.3 = .5\*21.5\*t2, t=0.167s

Idea: build a drone with propellers not all lined up with the vertical axis such that the drone need not turn or tilt to move out of the way.

Question: Is a propellor on the start of a turned tube the same as a propellor at the end of a turned tube? Could I use a tube system and a rotating opening/covering mechanism in the middle to change thrust vectors from up to down/right to left.

First develop an environment representing a drone and an obstacle with realistic 3D aspects. Have the drone learn to evade the incoming obstacle.

<https://gamedevelopment.tutsplus.com/tutorials/how-to-create-a-custom-2d-physics-engine-the-basics-and-impulse-resolution--gamedev-6331>

<https://developer.ibm.com/tutorials/wa-build2dphysicsengine/>

<https://towardsdatascience.com/implementing-2d-physics-in-javascript-860a7b152785>

Then make it work such that objects can come repeatedly.

Then make it work such that multiple repeated objects can come.

^^ Research some collision avoidance techniques and algorithms so that an appropriate scoring algorithm can be used. Distance? Algorithm taking into account original position? Resource usage?

Research sensors to use and make code to analyze incoming object and perform trajectory analysis (preferably a camera)

* Stereo Vision
* Ultrasonic (Sonar)
* Time-of-Flight
* Lidar
* Infrared
* Monocular Vision

Put these two together so that they can run simultaneously, with the real life ball working as input, and the simulated drone evading the object.

Find a way to represent the drone avoidance path such that it can be easily and efficiently interpreted as input.

Build drone

Have drone learn to move given example drone avoidance representations

Feed the original simulation into the drone as input and test

<https://news.stonybrook.edu/homespotlight/drones-used-to-improve-healthcare-delivery-in-madagascar/>