# Ball Catching Drone

Sebastian Baldini, Enrique Pohl, Connor Thompson, Nitin J. Sanket
Perception and Autonomous Robotics (PeAR) Group, Worcester Polytechnic Institute

## Goal

This project presents design, development, and evaluation of an autonomous aerial robot capable of detecting when the ball has been thrown into its workspace and moving to catch.

## Overview

### Tracking

We tracked the ball and the drone utilizing IR reflectors and the Vicon tracking system. This gave us high speed and precise localization of the whole system.

### Prediction

Using this data, we compared both physics based and best fit point methods for extrapolating the throw data to predict the future arc of the throw. With that extrapolated data we then found the target point by using the k-means algorithm along with additional math to find the drone the most time to reach the ball.

### Autonomy

We programmed this system to autonomously navigate to the target position until receiving a target point. We utilized a PID acceleration controller to rapidly and responsively navigate from its home position to the target location.

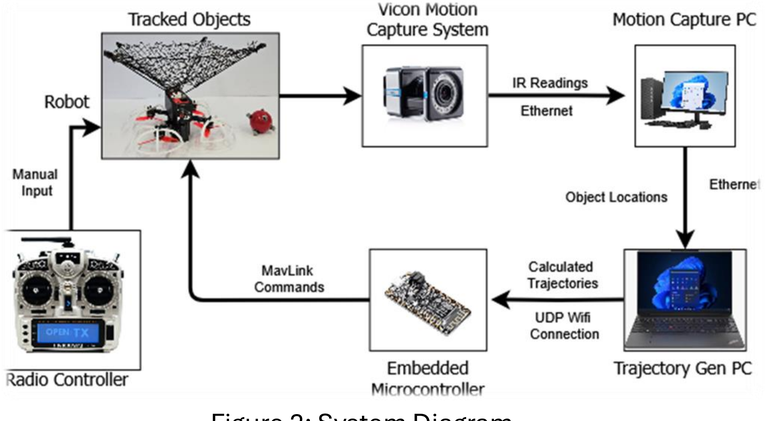


Figure 2: System Diagram

Figure 1: Drone mid catch

## Results

**Drone Range and Accuracy:** Our group achieved a catch radius of 1 meter surrounding the drones location with a catch rate of 50%

**Non-Optimal Catches:** The elastic nature of the net absorbs impact on the edges and reduces drone movement from ball impact

**Data Noise:** In cases of poor data input the drone moves to the first gathered point, and updates target in real time

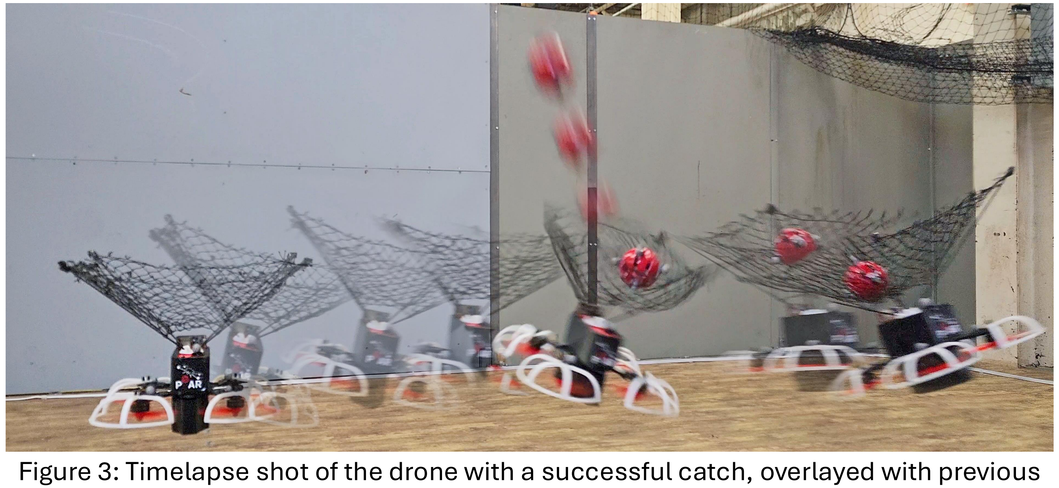

Figure 3: Timelapse shot of the drone with a successful catch, overlayed with previous frames to illustrate its motion.