Indoor Autonomous Drone Navigation with Aruco Markers

Faaris Khilji
Advisor: Venki Muthukumar
Dept. of Electrical and Computer Engineering
University of Las Vegas, Nevada

Today, we can see an increasing usage of drones in a variety of applications such as engineering, construction, monitoring, shipping, and more. Within the foreseeable future, it is evident that the use of drones will expand to usage indoors in areas such as warehouses, homes, or other buildings. For this reason, it is crucial that the drone be able to autonomously navigate these areas safely while being able to complete a desired mission. The intent of this project is to demonstrate the use of aruco markers as waypoints for indoor drone navigation. Using a DJI Tello, paired with a laptop, and given a map with aruco markers strategically placed, we can process data sent from the Tello and create programs that can send commands to the drone. After marking no-fly zones and designating waypoints, we can find the best possible path to a given node for maximum efficiency. At NASA, UAVs are a large focus for engineers. Just recently, NASA landed its Perseverance rover on Mars which is equipped with a mini drone for separate missions. As we send more robots to Mars and eventually humans, it is important that we have autonomous drone capability. Furthermore, path planning using the method of waypoints is a critical feature as finding the best possible path can result in energy saved and, consequently, greater opportunity and time to complete tasks. Upon completion, this project implements computer vision and PID controllers for aruco marker detection and accurate drone movement. Utilizing the path-planning GUI, we are able to connect waypoints together to create a variety of possible paths for the drone to take as well as a simple 2D drone visualization system that runs concurrently with the path-planning application.