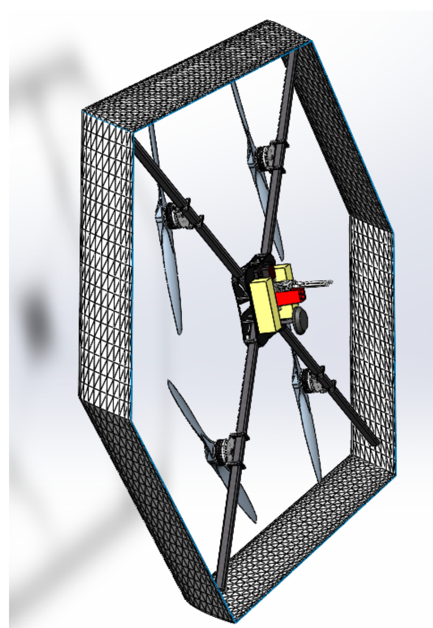
Project Portfolio - Dhruv Srinivasan

Project: *Kuka Medical Robotic Arm, Fischell Department of Bioengineering*
Status: *Ongoing*
Description:

In this project, I am working on programming and creating end effectors for the Kuka Med 14 Robotic Arm. I am currently the sole student working on this robotic arm, with the principal investigator of the lab acting as an advisor. The goal of this project is to program the robotic arm to be able to take 3D head scans of a human face, allowing for fast and efficient scans that would otherwise be laborious and time consuming. The second stage of this project is creating end effectors to interact with the rest of the arm, specifically mounts for testbeds to test and calibrate small sensors, as well as one that can hold a multitude of cameras and scanners. I am using the RoboticsAPI Library on Java to program it, Solidworks to model the end effectors, and Prusa 3D Printers to print end effectors.

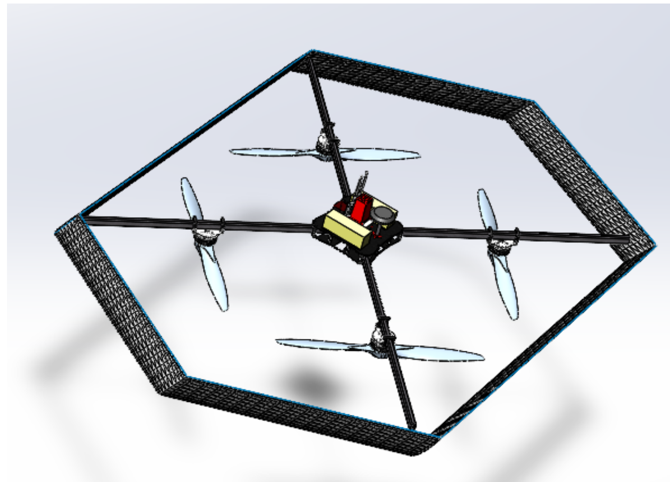
Project: *Autonomous Micro Air Vehicle Team, Maryland Robotics Center*
Status: *Ongoing*
Description:

In this project, I am the design team lead, responsible for designing, prototyping, manufacturing parts, constructing, and programming the drone. What separates this project from typical drone projects is the mechanical and programming complexity that is being taken. We are designing a 6.5ft diameter drone with shrouded NACA Airfoils that surround the drone and are angled 30 degrees from the vertical. This enables the drone to take off vertically, rotate 60 degrees while hovering, and fly/glide like an aircraft, while being able to securely hold a minimum cargo of 2lb. A team of four people are working on this project, with me being the design lead. We are currently finalizing the design stage, and I have created the drone's 250+ part CAD in Solidworks that accounts for all systems in the drone (including center of gravity), ensuring that our theoretical calculations –which I used MATLAB for in conjunction with the Analysis Team Lead –matches real world performance. The manufacturing and construction



Drone in forward flight position

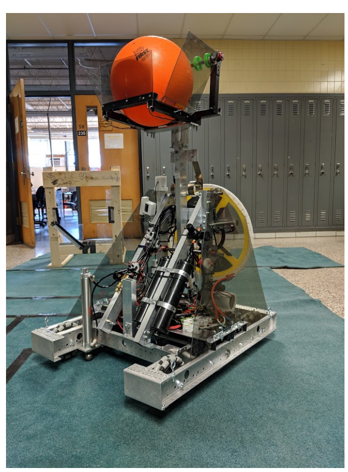
process will begin at the end of this month, using Laser Cutters for Carbon Fiber fuselage plates, 3D Printing technologies for landing gear, hardware housing and camera mounts, and other subtractive manufacturing methods (CNC, Water Jet Cutter) to construct the drone. I will also use a custom EPP Wire Cutting Foam rig to create the 1.4 meter wings and 0.7 meter fins that surround the drone. Programming the drone, tuning PID Control and autonomous waypoint navigation will be done using px4 Autopilot.

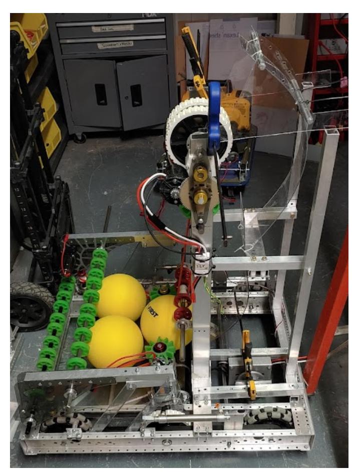


Drone in takeoff/landing position

The link below is the Preliminary Design Report for the drone that we filed at the beginning of December:
https://drive.google.com/file/d/1CkbC6F_NFrcpEasx90xVbDeWBgXAJyfr/view?usp=sharing

Project: *FIRST Robotics Competition Team 1727 Robots*
Status: *Complete*
Description:
In this project, I oversaw all three technical aspects of the robot: Design, Hardware and Programming. The robot was designed to intake from the field and shoot 6 inch diameter foam balls to a target 10 feet from the plane of the robot. The robot was also designed to hang on top of an uneven bar. Aside from assigning tasks for the subteams, I primarily designed and built the indexing and intake system, along with the mechanism that allowed the robot to lift itself up and hang (the robot weighed 125lbs). I also tuned PID for the shooting mechanism, and chiefly fabricated parts using CNC Machinery (VCarve Desktop), and conducted calculations for motor and hardware selection.Components were designed using Autodesk Inventor. For the non-shooting robot, I primarily designed the intake and lift mechanism, which was pneumatically actuated and collected orange balls using a high speed compliant roller with lexan glides.





The link below is to the latest robot's technical binder:
https://drive.google.com/file/d/1XD0r-K6npCsjIBnhfoy8PsutBSsqs1Mc/view?usp=sharing

Project: *VEX Robotics Competition 1727C*
Status: *Complete*
Description:
As captain of a VEX Robotics Team, I designed, built and programmed the robots for both teleoperated and autonomous operation. I used ultrasonic sensors, potentiometers, motor encoders and vision sensors for both the robot's autonomous programs and for automating specific processes during teleoperation. The latest robot (pictured top left) picked up small, hard tennis-sized balls from the field and shot them at a row of three flags. The robot used motor encoders with a four bar linkage to be able to automatically adjust the angle at which the ball left the robot, with the capability of shooting two rows of flags in under one second, without requiring the driver to adjust the position of the robot. I also developed an off-season robot testbench (pictured bottom left) with ultrasonic and vision sensors, programming it to follow objects based on their color, shape, and proximity to the center of the camera's field of view. The final robot (pictured top right) was designed to pick up multi-colored cubes and index them into a tray, stacking them vertically across a field. It used the aforementioned sensors to autonomously go towards rows of cubes and stack them. Because of the starting 18"X18"X18" size constraints, the tray that held the cubes folded outwards through a linkage that activated following the intake rollers spinning (pictured bottom right).