Autonomous Verti-Pro Flight System

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Background:

Small drones and unmanned aircraft have displayed a range of capabilities from drug delivery to search and rescue (S.A.R.). These aircraft are powered by a range of different software and hardware technologies [1]. When testing the software for these machines, software bugs can cause the system to malfunction and crash.

In order to test control software, many resort to using simulations as it is impossible to test control software on undeveloped hardware. Even if the hardware is developed, it might be impossible to test the software on the hardware due to large expenses damage may cause. Therefore, a simple test environment is needed for these cases

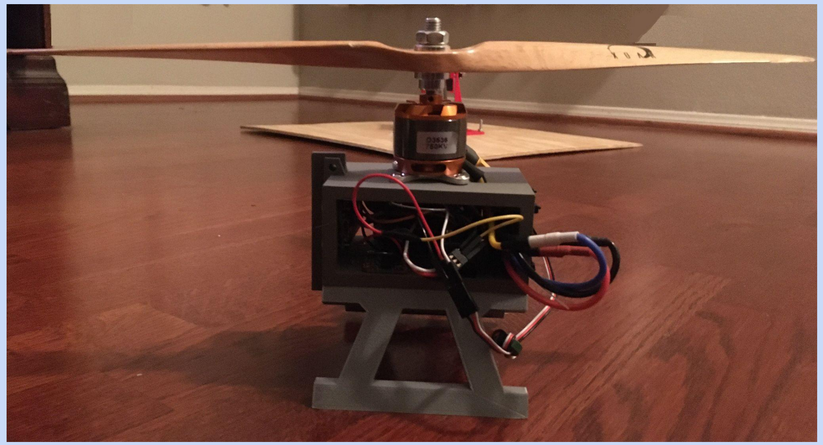
Project Goal:

Our system is a single-propellor microcontroller controlled helicopter attached to a base by a carbon fiber tube. The system provides a testbench for deploying software into a simplified environment to bootstrap the software development process. This will allow for rapid development of S.A.R. and control software

Materials:

Motor, propeller, ESC, carbon fiber tube, arduino microcontroller, battery, servo, orientation sensor, base

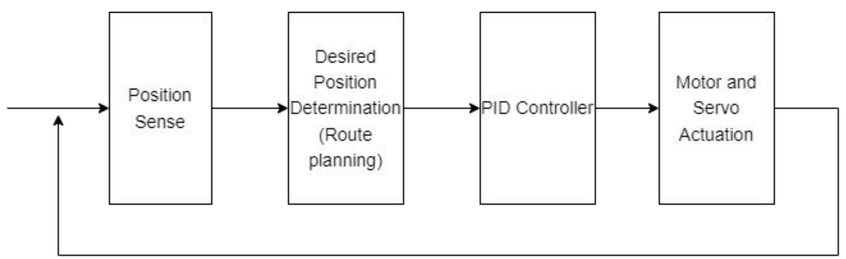
Implementation:



Verti-Pro Helicopter

The helicopter will contain most of the electronics including sensors, the motor, and the microcontroller. It will connect to a base through a carbon fiber tube which will house the battery and constrain the movement of the copter

The flight software can maneuver the helicopter along a pre planned route. For our choice of control software, we developed two linear PID controllers to control the vertical and horizontal movement of the helicopter. The software pipeline is shown below



Results:

We have developed the helicopter system as well as demonstrated control of the system through the use of software. Moreover, we have navigated the system along a predetermined. By the fact that the developers had no prior experience with control software, it demonstrates that this system is a feasible testbench for trying out new software solutions and achieves its goal as a simplified testbench for S.A.R. and control applications.

Improvements:

Even though the helicopter can fly by itself, there are other features that can be added to improve it. An electromagnet/hook and camera can be added to give the helicopter the ability to autonomously pick items from the ground. The camera can be used with image recognition to identify and locate the item [2]. The magnet/hook can be used to retrieve the item after the helicopter autonomously flies over the item.

References:

[1] T. J. W. R. and K. Munson, *Jane's Pocket Book of remotely piloted vehicles: Robot Aircraft today*. New York: Collier Books, 1977.

[2] S. J. Russell and P. Norvig, “Chapter 26 Robotics,” in *Artificial Intelligence: A Modern Approach*, Fourth., Hoboken, New Jersey: PEARSON, 2021, pp. 925–975.

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