DESIGN AND IMPLEMENTATION OF ROBUST DRONE CONTROL

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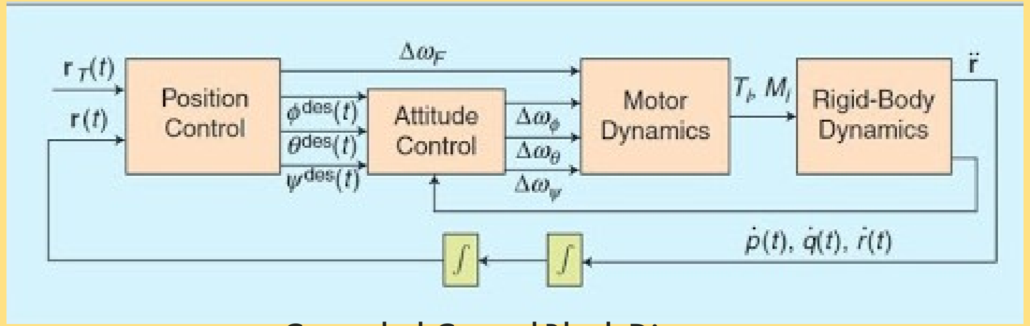
MOTIVATION

The ability to responsively control a drone during its flight is a prerequisite towards autonomous control and higher-level API commands such as directing it from point to point.

THEORY

Uncertainty and Disturbance Estimator:
- Uncertainties in plant dynamics are estimated dynamically.
- The controller is designed to compensate for the effects of these uncertainties and unknown external disturbances
- it does not require any knowledge of the uncertainty and/or the disturbance, such as their magnitude



Cascaded Control Block Diagram

IMPLEMENTATION

* The quadrotor model used is PlutoX with WhyCon marker integration
*The position and orientation of the drone are obtained after localization of the marker
*This is fed into the controller running on the laptop using ROS framework, connected to the drone using WiFi
*The controller then decides the next optimal control move and sends it to the drone

WhyCon marker

Pluto X

ANALYSIS

Metric	Tuned PID	UDE with virtual forces
Rise time T_r in x	1.12	1.47
Rise time T_r in y	1.13	1.47
Rise time T_r in z	∞^1	1.41
Settling time T_s in x	2.76	3.33
Settling time T_s in y	2.77	3.34
Settling time T_s in z	∞^2	3.31
Maximum overshoot in x	12.01	6.88
Maximum overshoot in y	12.01	6.83
Maximum overshoot in z	84.65	11.52

Comparitive study

RESULTS & CONCLUSION

*Different control strategies were studied , UDE based controller was found to be optimal .
*Two controllers based on UDE namely Small Angle Controller and Virtual Force Controller were designed , both of which were simulated and using MATLAB/SIMULINK .Virtual Force controller was implemented on the PlutoX via the ROS interface and was also directly flashed onto the drone using Cygnus IDE , both were unsuccessful due to hardware limitations.