Giotto implementation for rotor craft Unmanned Aerial Vehicle(UAV)

Jongho Lee (15879038)

Abstract

Giotto is a time-triggered programming language for embedded control systems. It specifies time-triggered sensor reading, task invocations, actuator updates and mode switches. It separates platform-independent functionality and timing concerns from platform-dependent scheduling. Thus it gives flexibility in choosing control platform and modularity in building control programming. What I’m doing is reimplementing current Unmanned Aerial Vehicle(UAV) controller codes to Giotto code. Current controller code has event-triggered architecture. Main scheduling is triggered by Global Positioning System(GPS) and Inertial Navigation System(INS) input timing. GPS has variable time delay in reading position data up to 20 ms, which ceases execution of control program temporarily. INS data does not come to control program with an exact period either. But in Giotto, the control program is triggered by given Giotto period not by sensor input, which makes control software be independent from platform. Our Giotto program has three modes: Initialize, Estimate and Actuate. Giotto program starts in the Initialize mode. Initialize mode invokes systemup() task which initializes serial communication and GPS, INS sensors. systemup() is executed only one time and mode is switched to the Estimate mode automatically. Estimate mode invokes the filter() task every 10ms. In the filter() task, GPS driver checks if there are available bytes and reads when there is one set of available bytes. INS driver also checks every 10ms and reads INS messages if available. Velocity and Euler angles from INS messages are used to predict current position and predicted position is corrected with fresh position data from GPS messages. When 'Enter' key is pressed, mode is switched to the Actuate mode. The Actuate mode invokes the control() task which includes filtering function and uses calculated high speed position data to calculate control outputs. The Actuate mode invokes actuator port(servos()) every 20ms. The servos() reads current servo positions, adds calculated control outputs to them and sends added servo input data to each servos through serial communication. Then actuators work. When 'Enter' key is pressed in Actuate mode, the mode switches to the Estimate mode. Currently, illustrated above things work on the ground. Implementations for ground station and TCP/IP communication are required to test Giotto program in the air.