Flexible Payload Drone System

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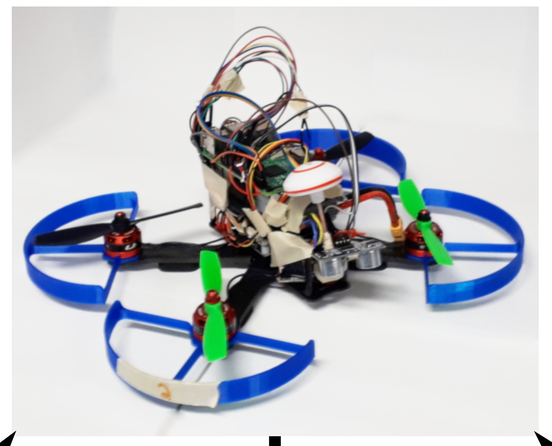
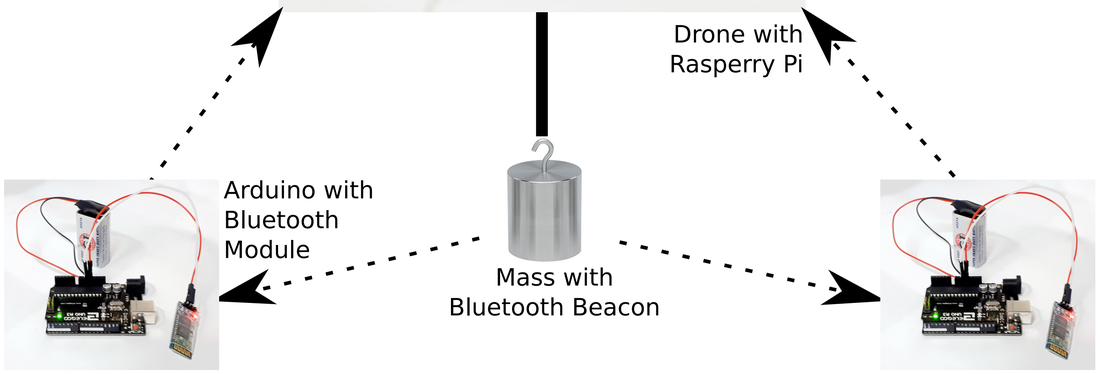
System Overview



•Arduinos relay signal strengths to the Pi to provide locations for both the Drone and the attached mass



Problem Statement

•Drones are becoming cheaper and more widely used

•Cargo drones are designed to carry items of specific shapes and masses, limiting what they can carry

•Need a system to allow any drone to be converted into a cargo drone for a flexible payload

•This would allow for the rapid deployment of drones as part of emergency response

•Divided problem into two: Localization and Control

Control

•A stream of sampled locations is used to determine the motion of the drone and mass

•A gyroscope is used to determine the drone's heading

•An ultrasonic sensor is used to verify the height

•A two-level cascaded Fuzzy Logic approach is used to transform the positions into control signals:

•Level 1: determines the control signals when only the drone's motion is considered

•Level 2: corrects the control signals to account for the motion of the mass

•Control programs are ran on the Raspberry Pi which is controlled remotely via WiFi

•Control programs are implemented in Python

Localization

•Need to locate the mass relative to the drone to correct for its motion

•Choose a wireless based solution to reduce number of sensors and processing required

•Components Used:
Bluetooth Beacon
3 HC-06 Bluetooth Modules
3 Arduinos
Raspberry Pi with internal Bluetooth and WiFi connections

•Bluetooth devices measure relative signal strength indicator (RSSI) to determine connection quality

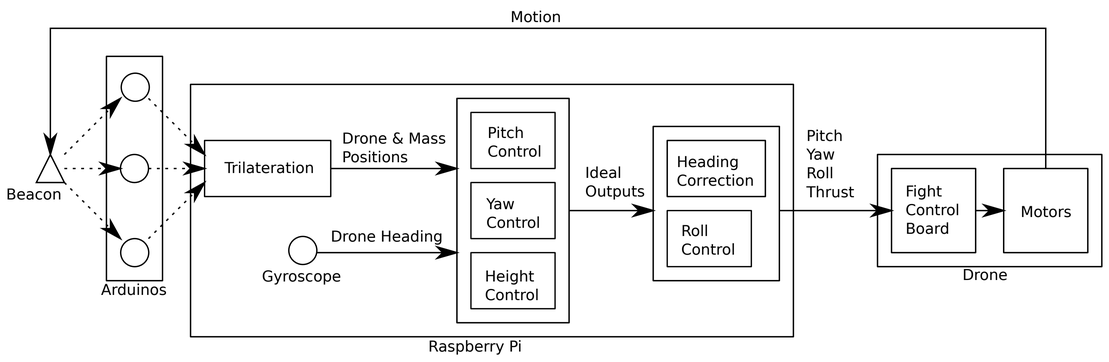
•RSSI can be converted into distance through the path-loss formula

•RSSI between the Beacon and the Arduinos are sent to the Pi to obtain the position of the mass

•RSSI between the Pi and Arduinos is measured to determine the location of the Drone

•Trilateration is used to converted between distances to the Arduinos and a global co-ordinate system

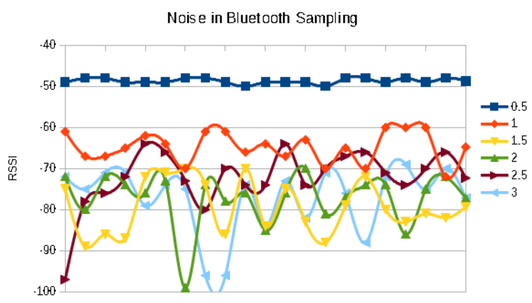
Controller Design



Sources of Error

•Bluetooth RSSI is inaccurate beyond 1.5 metres

•Standard Bluetooth interfaces only provide access to RSSI during discovery or sampled in decibels, making the noise problem expontially worse



Future Work

•Improve localization solutions, such as GPS

•Test complex loads which include internal dynamics

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Computer