Meet the Team

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Introduction

What is the Hover Hand Glove?

- Glove that uses sensors placed about the hand to control a quadcopter

How does a quadcopter fly?

- Four controls as input
  - Throttle - Height Control
  - Yaw - Vertical Axis Rotation
  - Pitch - Forward/Back Movement
  - Roll - Left/Right Movement
Throttle

- Manipulated by fingers
  - Index finger down increases throttle
  - Middle finger down decreases throttle
Yaw

- Manipulated by turning hand when index finger, middle finger, and thumb brought together
- Allows freedom of moving the hand when yaw is not in use
Pitch

- Controlled by rotating hand forward and backwards
- Uses exponential mapping to prevent unstable movement in center
Roll

- Controlled by rotating hand left and right
- Uses exponential mapping to prevent unstable movement in center
Dual-Brand Support
System Block Diagram

- Battery
- Control Algorithms
- Microcontroller
- Transmitter
- Quadcopter Drone
- IMUs
  - Finger IMUs
  - Inertial Measurement Units
  - IMU
Parts

Microcontroller

Nordic nRF52832

- Processing
  - ARM Cortex M4 architecture
  - 64 MHz clock speed
  - 512 KB flash memory
  - 64 KB RAM
  - 1.8V - 3.6V supply

- Communication
  - Two I²C interfaces
  - 2.4 GHZ transceiver
    - Supports Bluetooth Low Energy (BLE)
Parts

Sensor / IMU

InvenSense MPU-9250

- 9-axis sensor
  - 3-axis accelerometer
  - 3-axis gyroscope
  - 3-axis magnetometer
- On-chip digital motion processor outputs quaternion values
Parts

Transmitter

FRSky DHT 2.4GHz Module

- Bind button to connect to quadcopter
- Handles much of the heavy lifting involved with RF transmission
- PPM input
Auxiliary Parts

TI TCA9548APWR Multiplexer

- 8-to-1 I²C
- Links sensors to microcontroller

LT 1300 Voltage Converter

- Steps voltage up from 3.3 to 5V
- Powers transmitter
Power Distribution

- 3.7V battery is stepped down to 3.3V and then Boosted to 5V
- All components except the FRSky transmitter use a 3.3V supply
- FRSky Transmitter uses a 5V supply
Assembled PCB
Completed Glove
Software Overview - Data Types

Quaternion Inputs

- X, Y, Z Acceleration Vector and Rotation Angle

YPRT Values

- Yaw, Pitch, Roll, and Throttle

Pulse-Position Modulation (PPM) outputs

- PPM is a transmission method used to interface with the flight controller
Sensor Filtering

- Accelerometer
- Gyroscope
- Magnetometer

Madgwick Filter

ΔT

Quaternions

- Yaw
- Pitch
- Roll
Control Algorithms
Android Companion Application
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