Johns Hopkins University

Project 9

Quad Copter downloading IMU RPi to Host over Bluetooth

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EN.605.715.81.FA19 - Software Development for Real-Time Systems

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11/24/2019

Contents

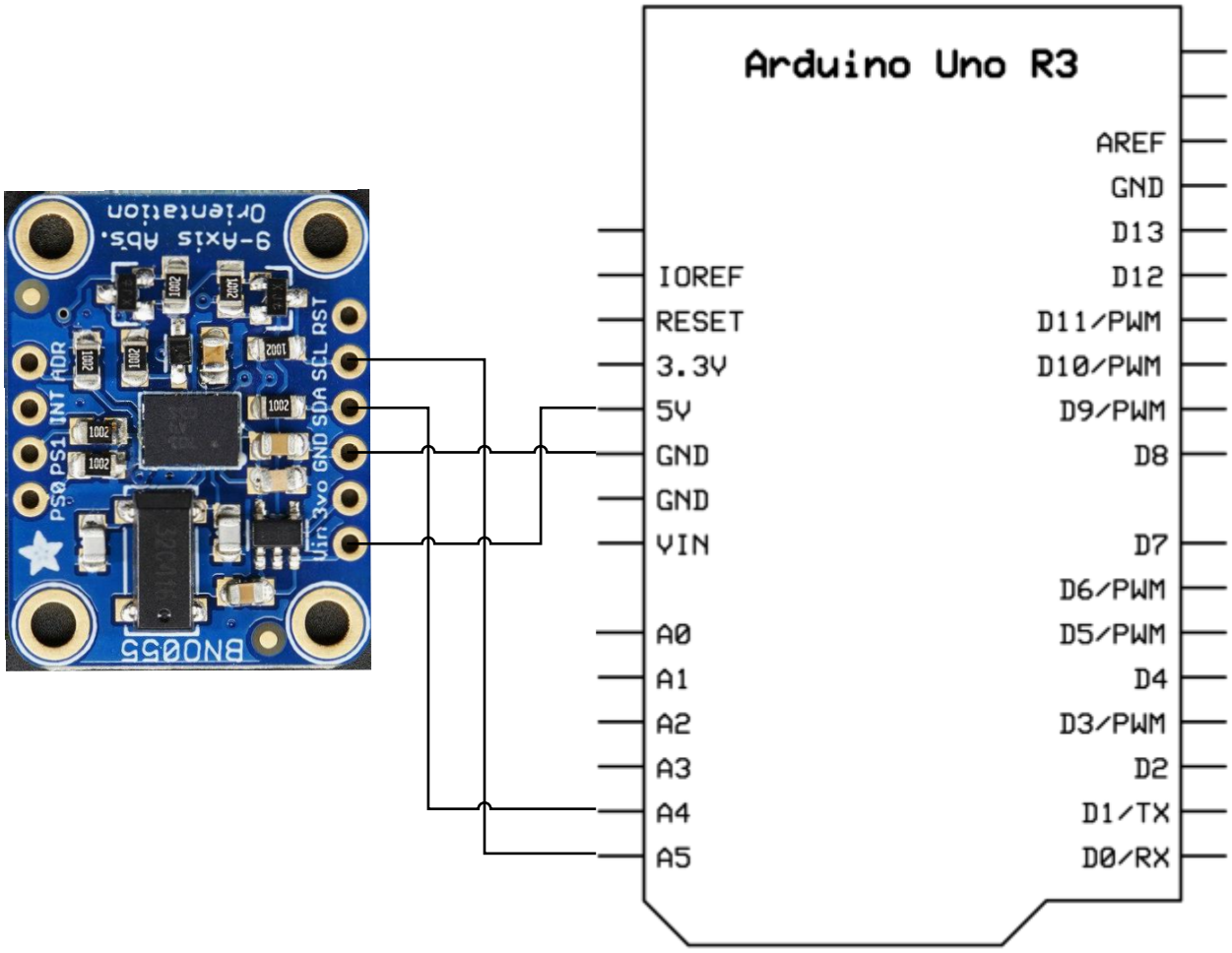
Derived Requirements

The following requirements were derived from the Project 9 Quad Copter Downloading IMU RPiToHostBluetooth document:

- The Arduino shall periodically read orientation data from a BNO055 IMU sensor connected via an I2C bus.
- The Arduino shall transmit the orientation data as comma-separated roll, pitch, and yaw (RPY) values over a serial connection (USB).
- The Raspberry Pi shall periodically receive the comma-separated RPY values from the Arduino over a serial connection (USB).
- The Raspberry Pi shall transmit the RPY data over a socket to a host machine via Bluetooth.

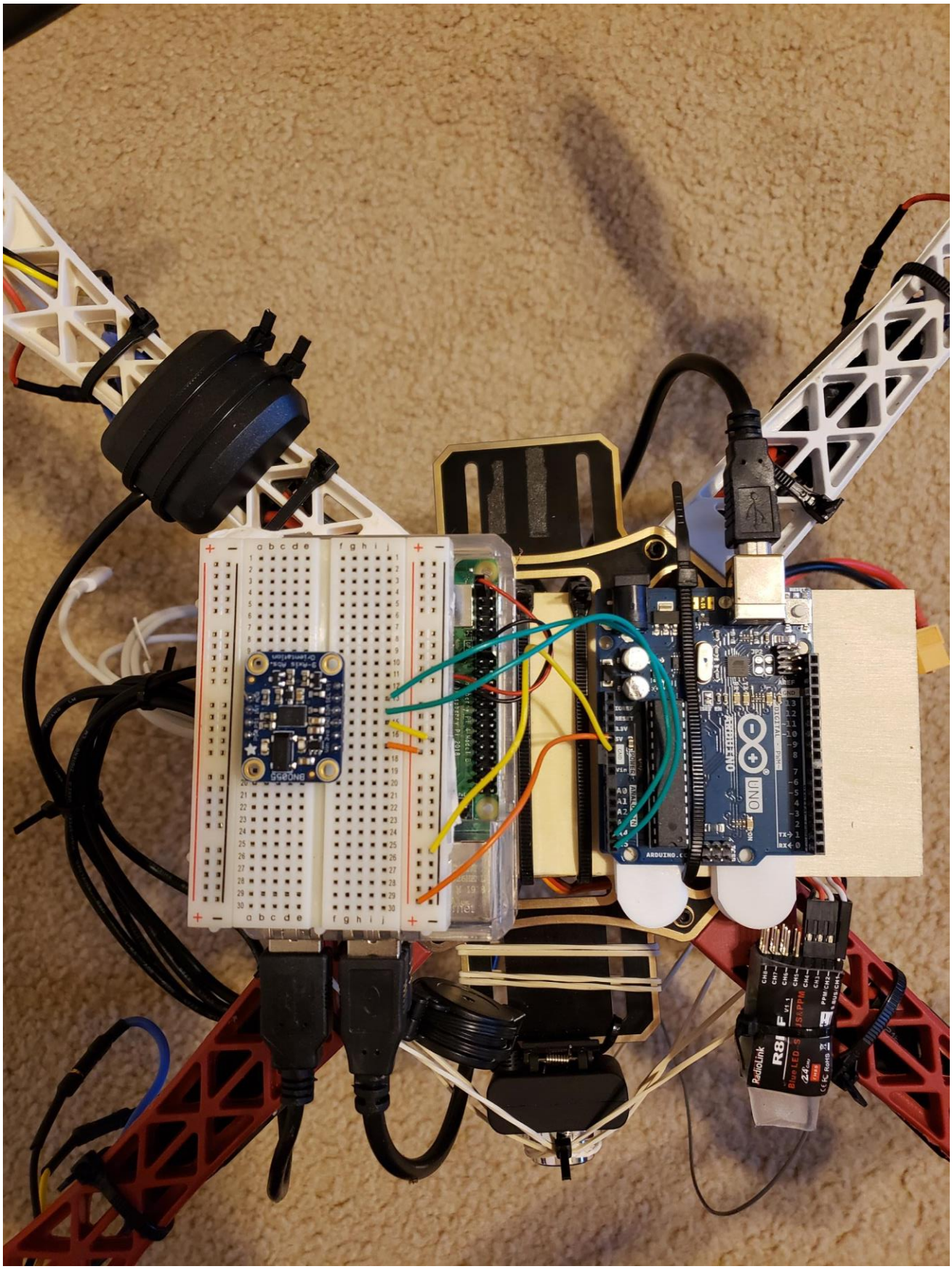
Hardware Design

The following diagram is a schematic of the circuit connected to an Arduino Uno (rev. 3) that receives orientation data from a BNO055 IMU sensor using an I2C bus. The orientation values, which are Euler angles, are read at a rate of 10 Hz and transmitted over serial (USB).

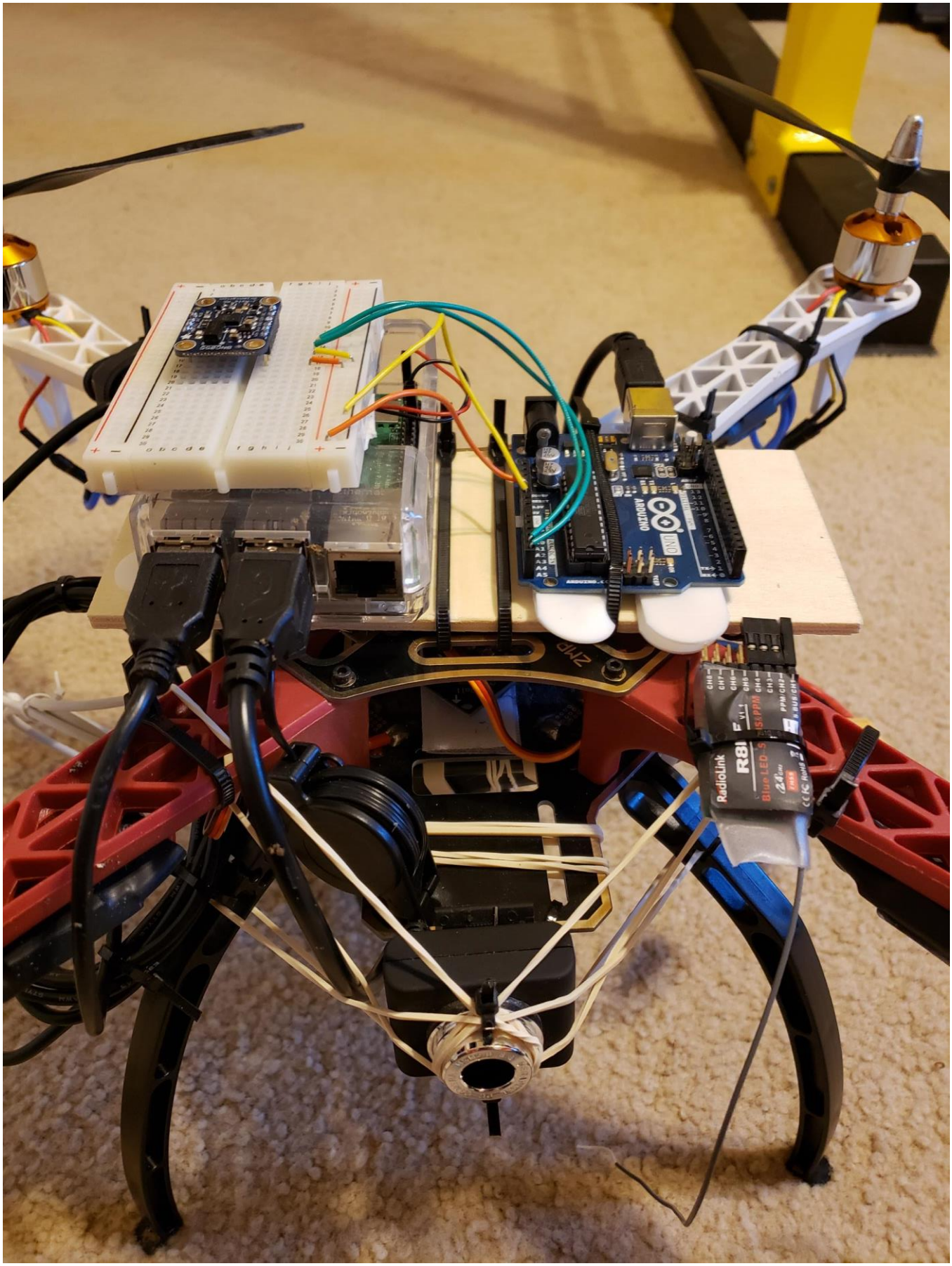


QuadCopter and Board Layout

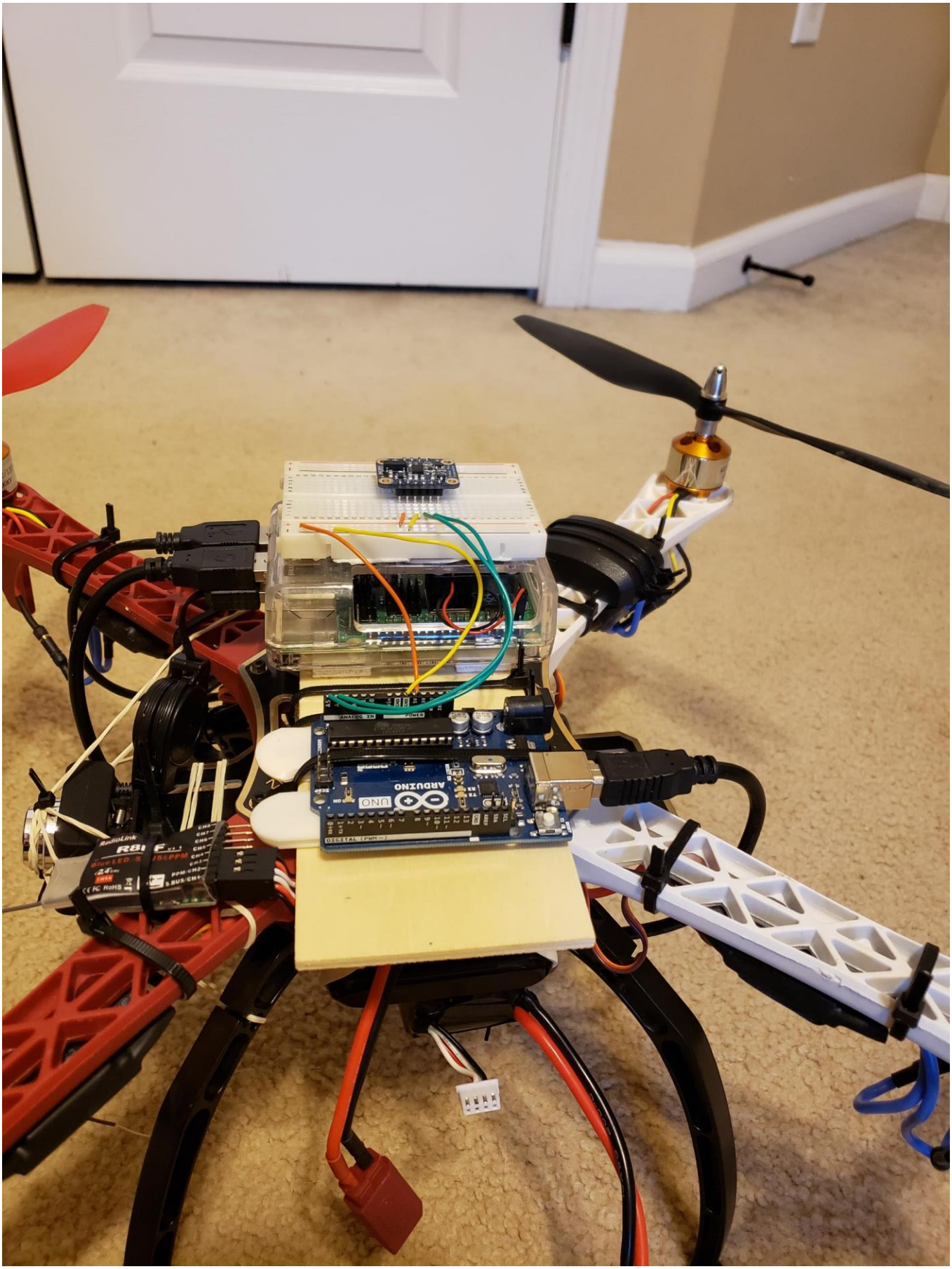
Top view of how the Raspberry Pi, Arduino, and BNO055 IMU sensor are connected and attached to the Quadcopter:



Front view of how the Raspberry Pi, Arduino, and BNO055 IMU sensor are connected and attached to the Quadcopter:



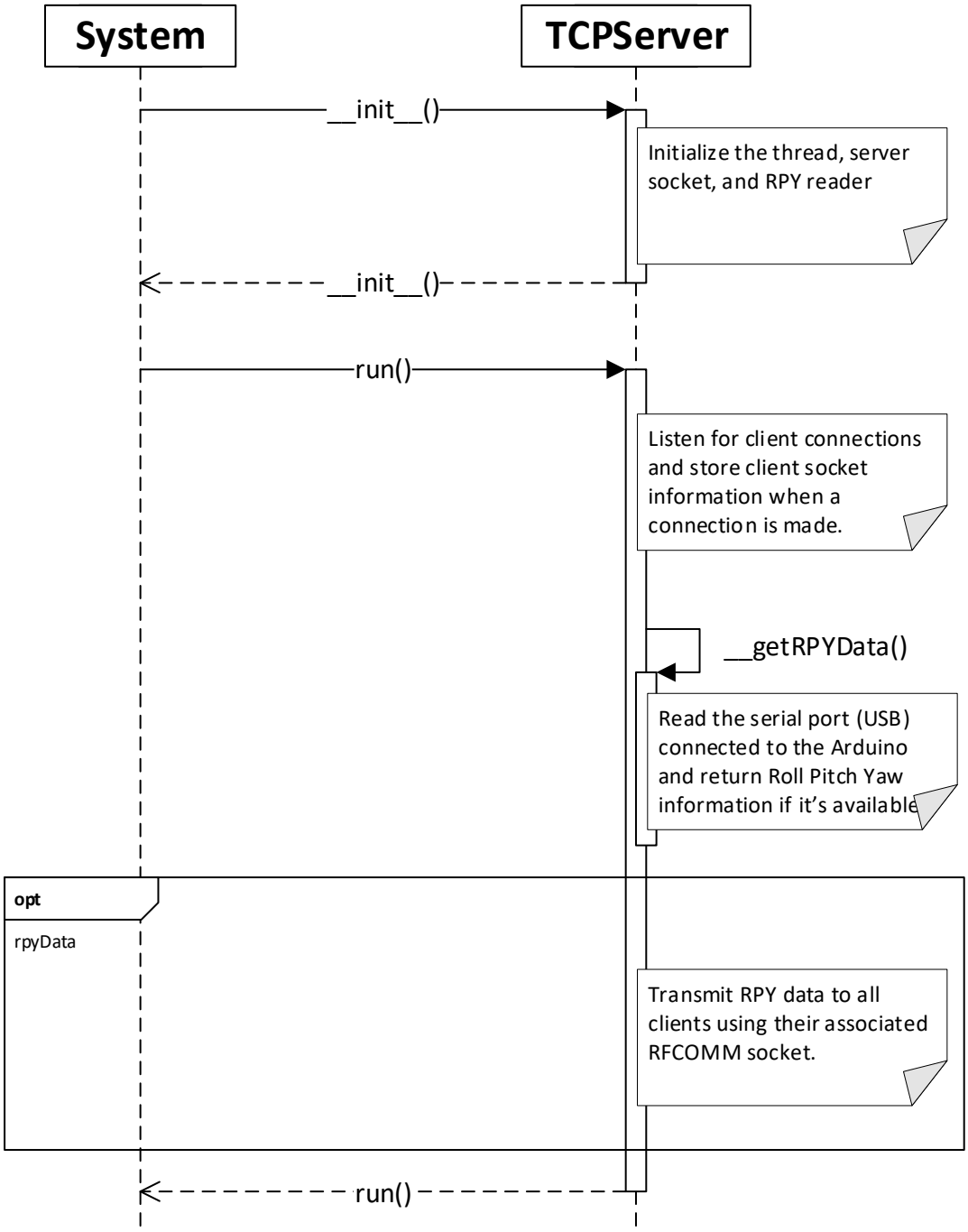
Side view of how the Raspberry Pi, Arduino, and BNO055 IMU sensor are connected and attached to the Quadcopter:



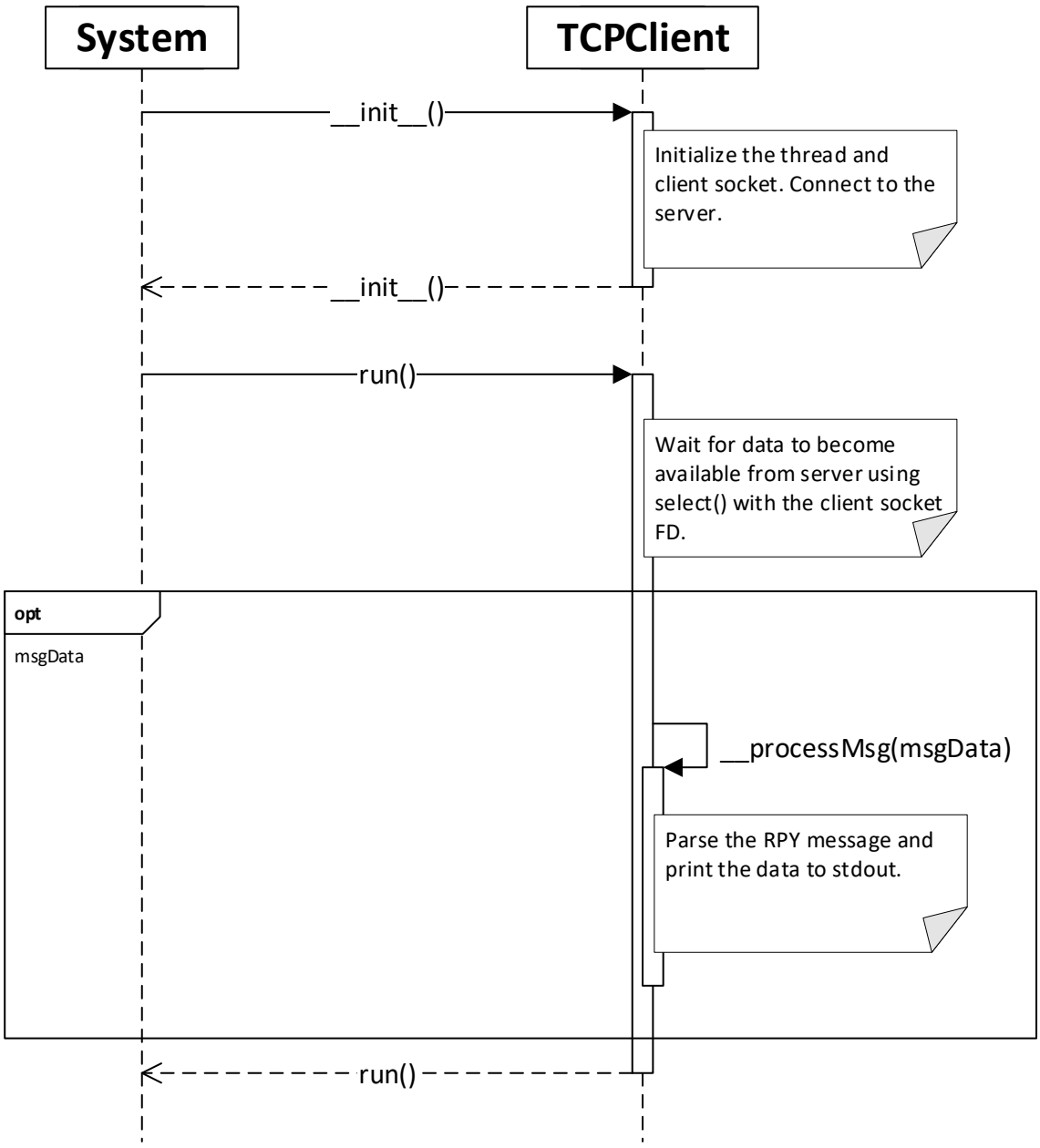
Software Design and Implementation

Sequence Diagrams

The following diagram is a sequence diagram of the server that reads and transmits RPY data to a client:



The following diagram is a sequence diagram of the client that receives the RPY data from the server and prints the information to stdout:



Video Demonstration

The following video demonstrates the Raspberry Pi streaming RPY data from the quadcopter to a host machine using Bluetooth. The video starts off with a brief description of the project, followed by a demonstration of the roll, pitch, and yaw data being displayed on the host machine while the vehicle is rotated by hand. The video shows that same manual demonstration from a separate camera, followed by the actual flight.

Flight

https://www.youtube.com/watch?v=taYzoe4OgmE

https://www.dropbox.com/s/suxctsz7qsokjjo/Miles_Gapcynski_EN_605_715_81_Project_9.mp4?dl=0