

Single-Hand Controller for Quadcopter

Senior Project

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Project Goal

The controller should be able to control the drone by single hand.

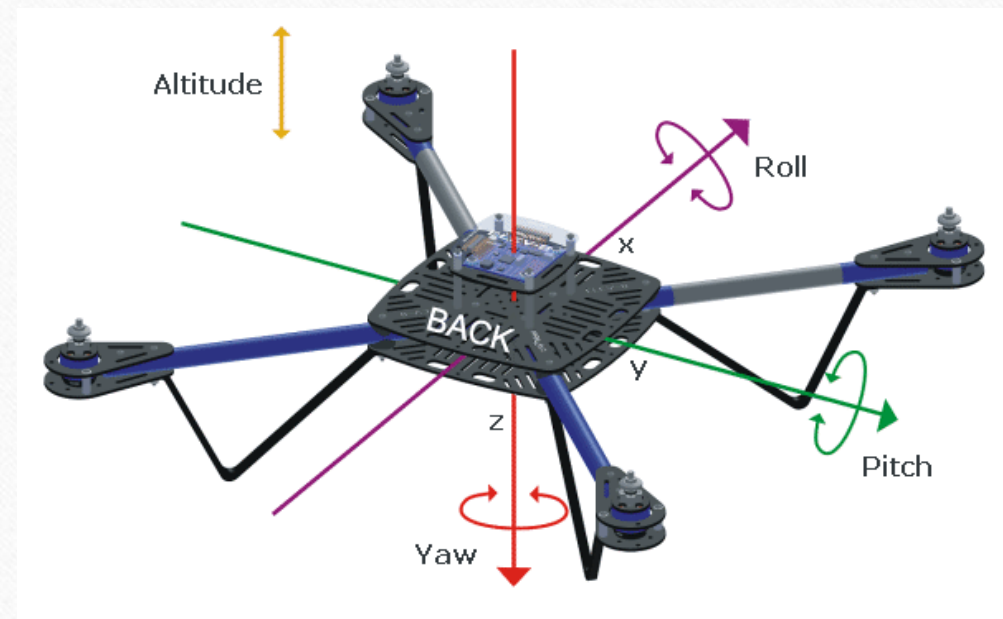


Project Definition

- What: a single-hand controller to control a drone by hand gestures.
- Why: in most drone applications, only one hand of the user is free.
- Example: Architects inspecting buildings.

Basic Movements of the Drone

- Altitude (including fly and land)
- Pitch/ Yaw/ Roll
- Balance in air



Performance Criteria

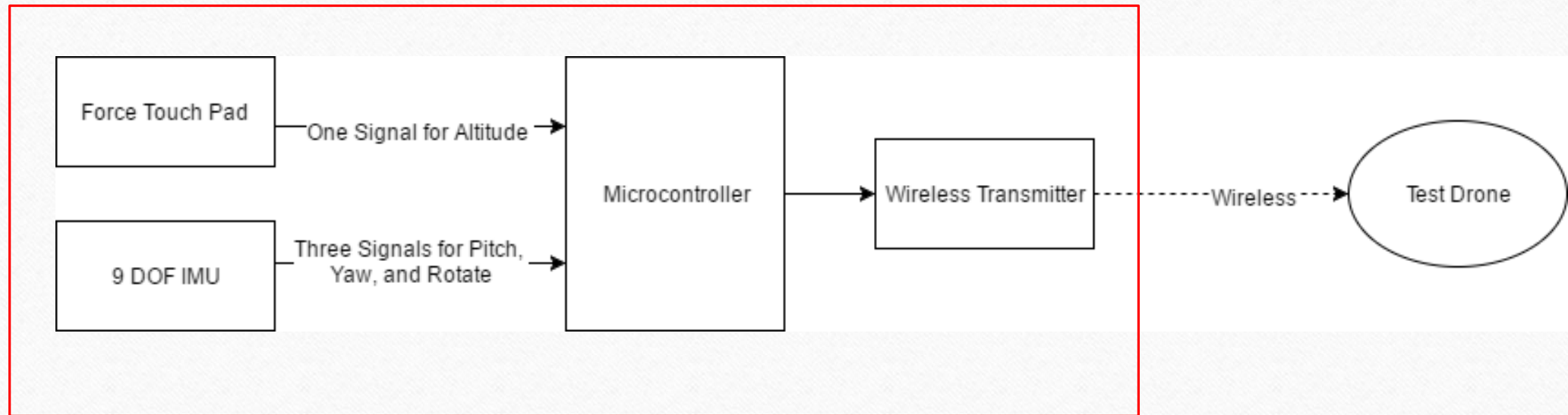
- The controller should attach to a single hand and detect hand movements.
- The drone should stay balanced in the air.
- The drone should respond to Roll and Pitch commands in real time.
- The drone should change in Altitude and Yaw smoothly.

Design and Implementation

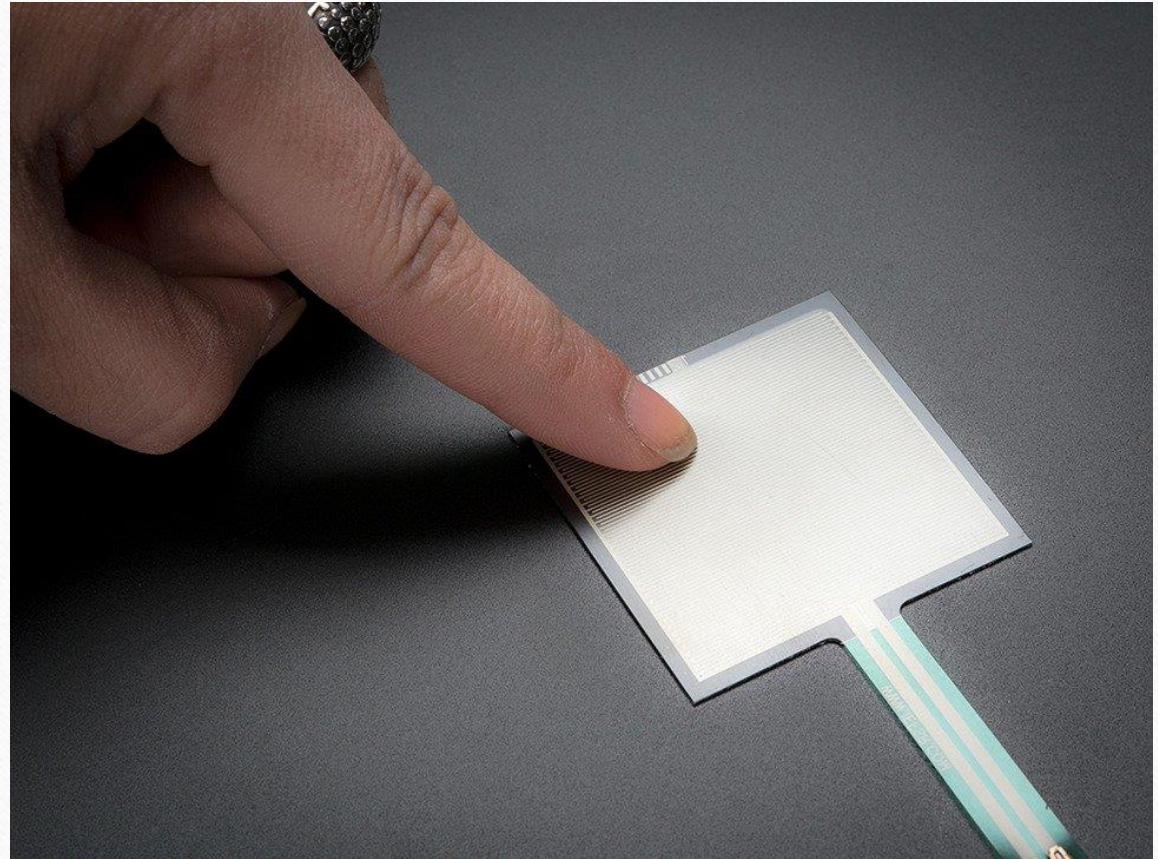
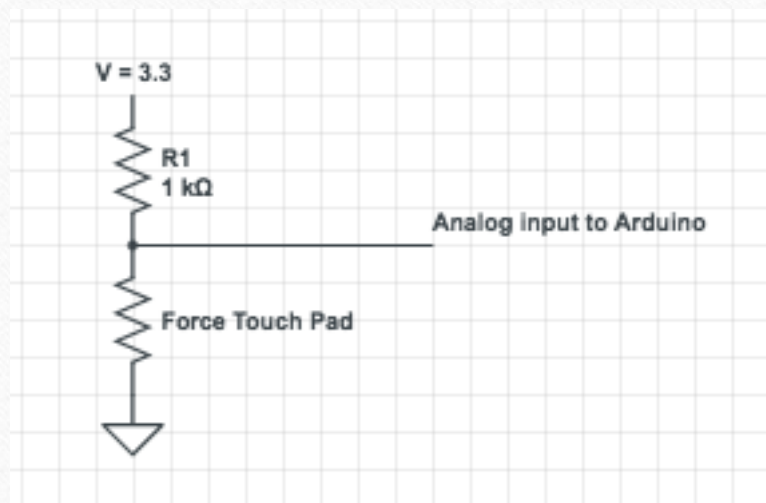
Hardware Design

	Touch Sensor	Gesture Sensor	Microcontroller	Drone
Choice 1	Short Flex Sensor	Adafruit 9-DOF Absolute Orientation IMU Fusion Breakout BNO055	Adafruit Metro Mini 328	DBPOWER MJX X400W
Choice 2	Square Force-Sensitive Resistor (FSR) – Interlink 406	Adafruit 10-DOFIMU Breakout – L3GD20H+LSM303+BMP180	Teensy 3.2	UDI U818A
Choice 3	Muscle Sensor Surface EMG electrodes – H124SG + MyoWare Muscle Sensor	L3GD20H Triple Axis Gyro Breakout Board – L3GD20/L3G4200 Upgrade – L3GD20H	Arduino Pro Mini 3.3V 8MHz	SYMA X5C-1

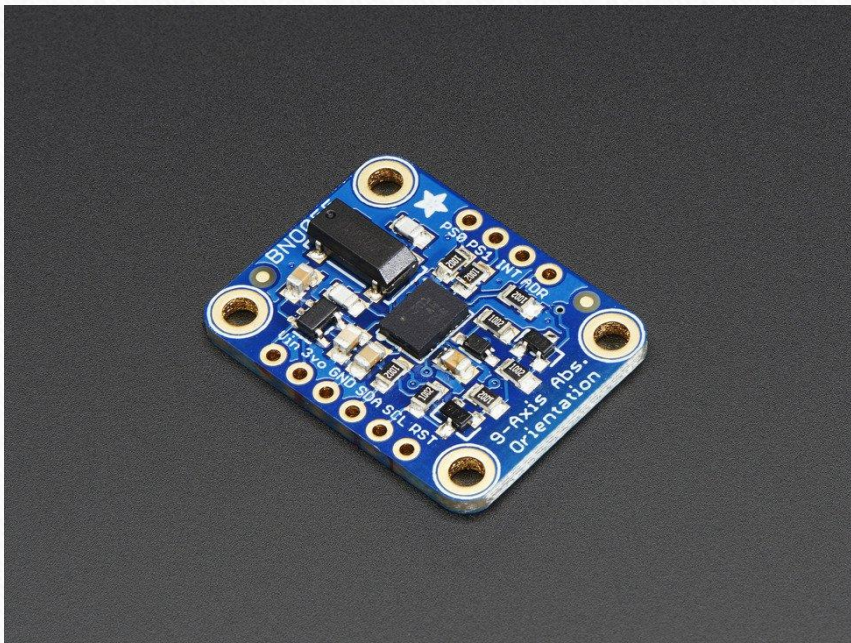
Block Diagram



Force-Sensitive Resistor



9DOF IMU



	X Axis	Y Axis	Z Axis
Max	360	180	180
Min	0	-180	-180

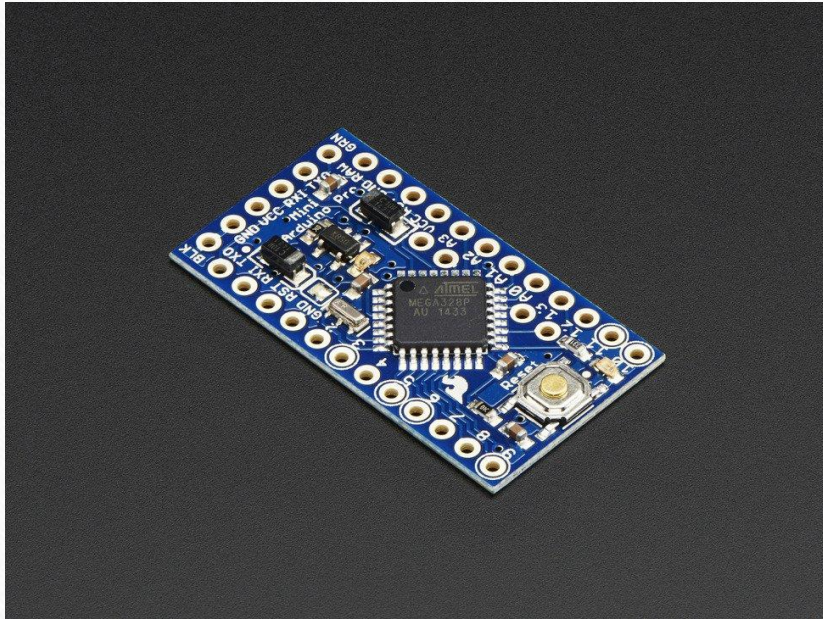
Drone

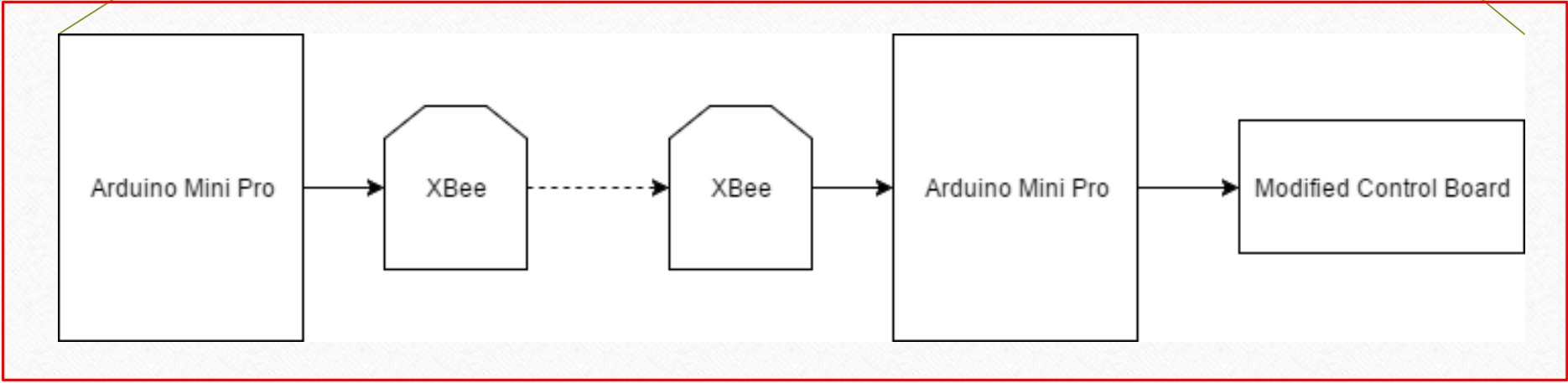
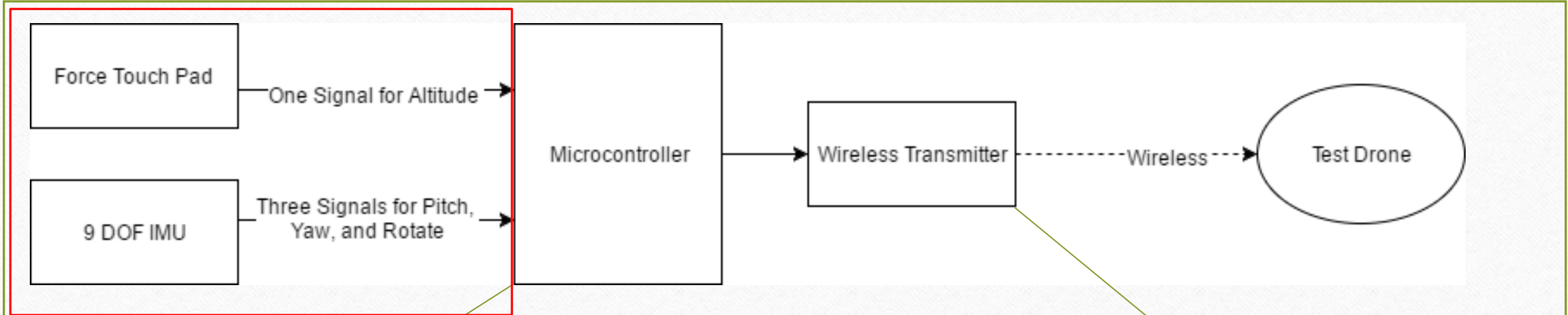


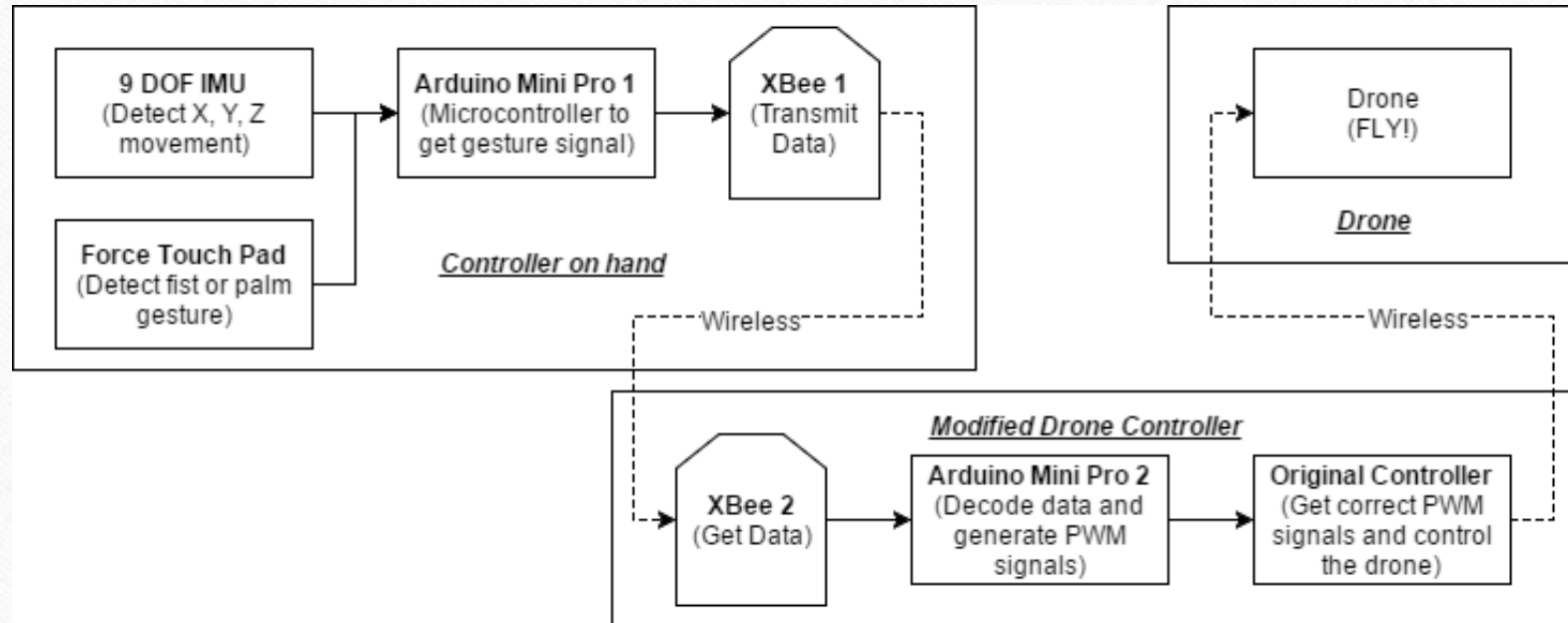
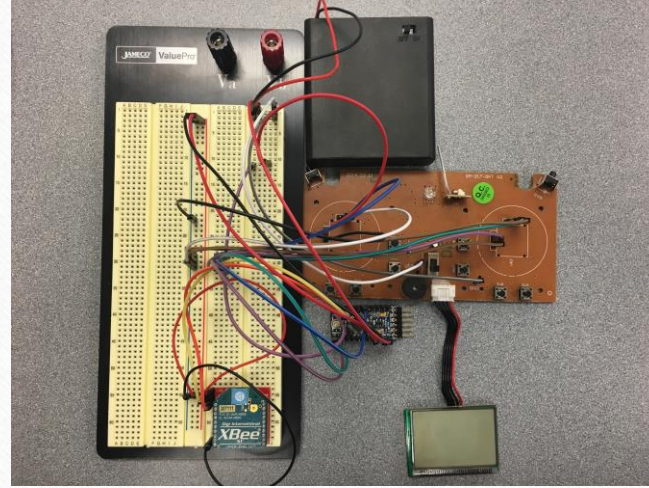
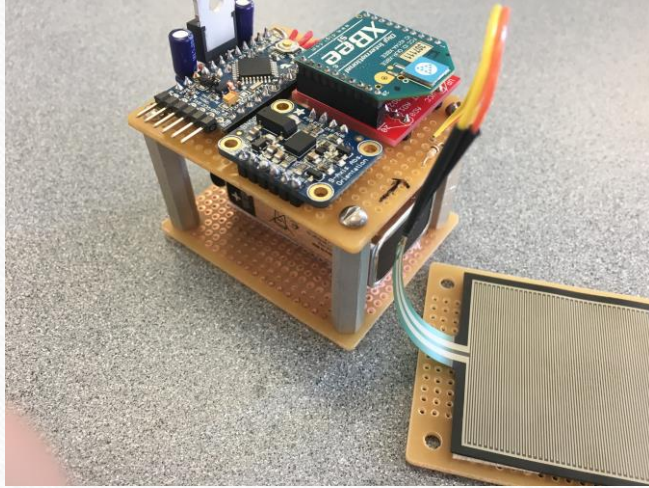
X5C-1 Upgraded version



Hardware Decomposition





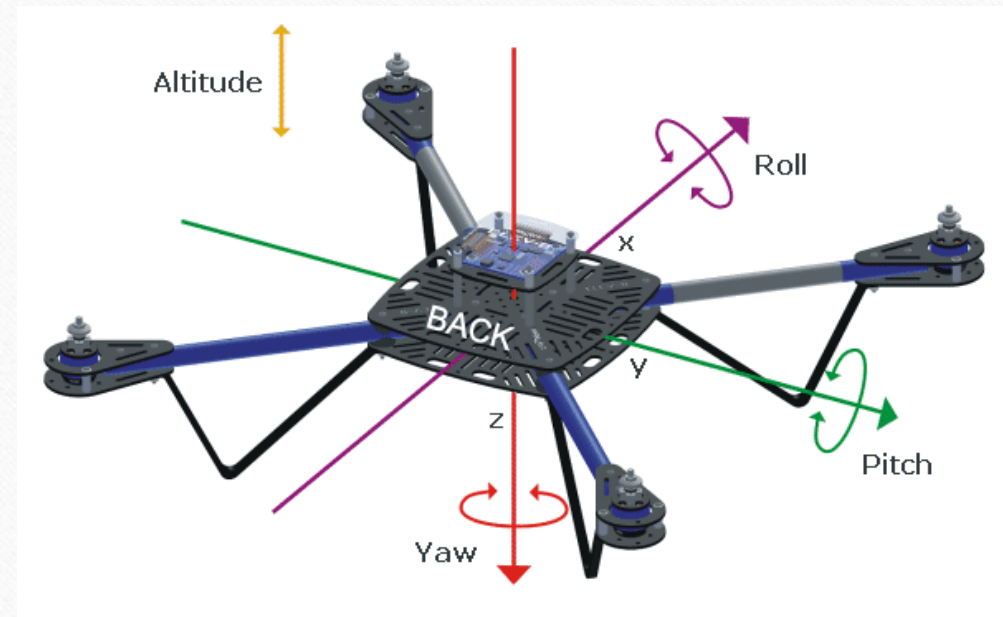


Design and Implementation

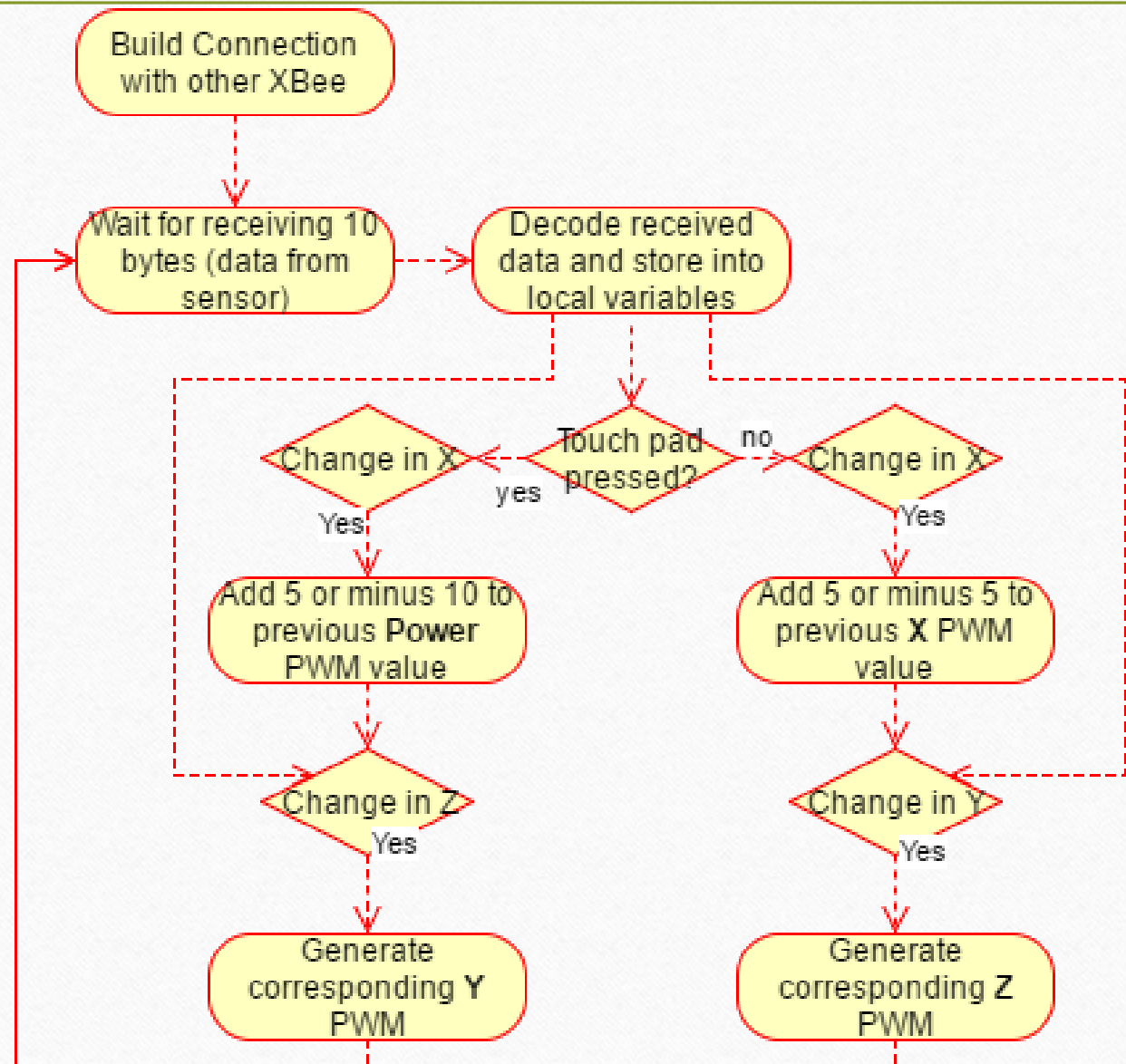
Software Design

Correlating Gestures:

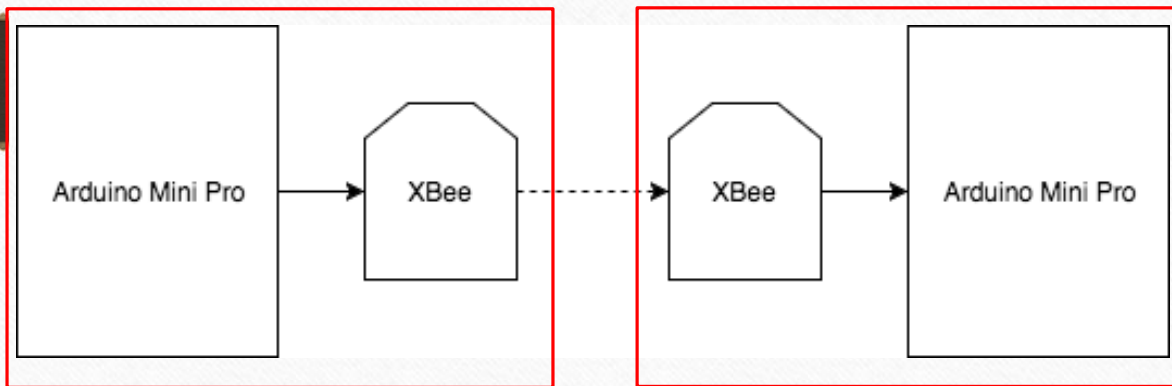
- Press the touch pad & move in Y axis → Change Altitude
- Un-press the touch pad & move in Y axis → Pitch
- Move in X or Z axis → Roll or Yaw



Software Flow Diagram



XBee Connection



Transmitter:
Send sensor data with
header

Receiver:
Decode and store data into
local variables when 10
bytes is received

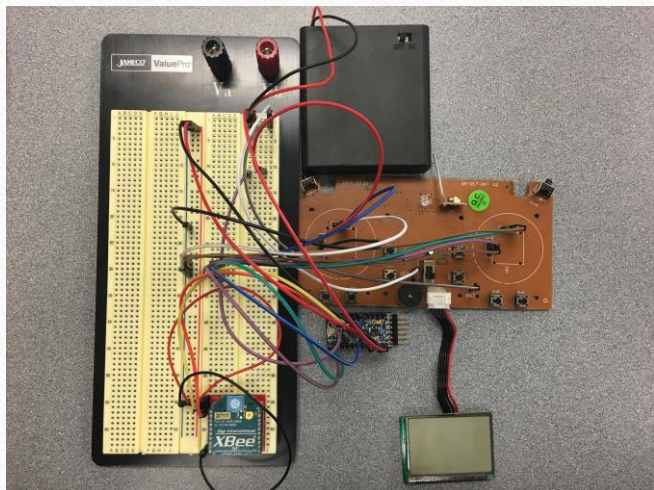
```
test7Rec | Arduino 1.6.12  
test7Rec  
while(mySerial.available() < 10);  
char x = mySerial.read();  
char y = mySerial.read();  
char z = mySerial.read();  
if (x == 'x' && y == 'y' && z == 'z'){  
  valX = mySerial.read() << 8;  
  valX |= mySerial.read();  
  valY = mySerial.read() << 8;  
  valY |= mySerial.read();  
  valZ = mySerial.read() << 8;  
  valZ |= mySerial.read();  
  touch = mySerial.read();  
  Serial.print("X: ");  
  Serial.print(valX);  
  Serial.print(" ");  
  Serial.print("Y: ");  
  Serial.print(valY);  
  Serial.print(" ");  
  Serial.print("Z: ");  
  Serial.print(valZ);  
  Serial.print(" ");  
  Serial.print("Touch: ");  
  Serial.print(touch);  
}
```

Done uploading.

Sketch uses 7,234 bytes (23%) of program storage space. Maximum is 30,720 bytes.
Global variables use 551 bytes (26%) of dynamic memory, leaving 1,497 bytes free.

117 Arduino Pro or Pro Mini, ATmega328 (3.3V, 8 MHz) on /dev/cu.usbserial-A505WVHD

PWM Output



```
/dev/cu.usbserial-A505WVHD
X: 53; Y: -8; Z: -45; Touch: 1; Success!Ypwm:147
Xpwm:145
Power pwm:0
X: 53; Y: -7; Z: -44; Touch: 1; Success!Ypwm:144
Xpwm:145
Power pwm:0
X: 53; Y: -7; Z: -45; Touch: 1; Success!Ypwm:144
Xpwm:145
Power pwm:0
X: 52; Y: -4; Z: -44; Touch: 1; Success!Ypwm:137
Xpwm:145
Power pwm:0
X: 55; Y: -4; Z: -41; Touch: 0; Ypwm:137
Xpwm:145
Zpwm:231
X: 56; Y: -3; Z: -39; Touch: 0; Ypwm:134
```

Autoscroll No line ending 9600 baud

	PWM
Altitude	Add 5 or minus 10 each time
X	Add or minus 1 each time
Y	$pwmYVal = ((0-valY)*255)/100+127;$ Or $pwmYVal = ((50-valY)*255)/100;$
Z	$pwmZVal = ((0-valZ)*255)/100+127;$ Or $pwmZVal = ((50-valZ)*255)/100;$

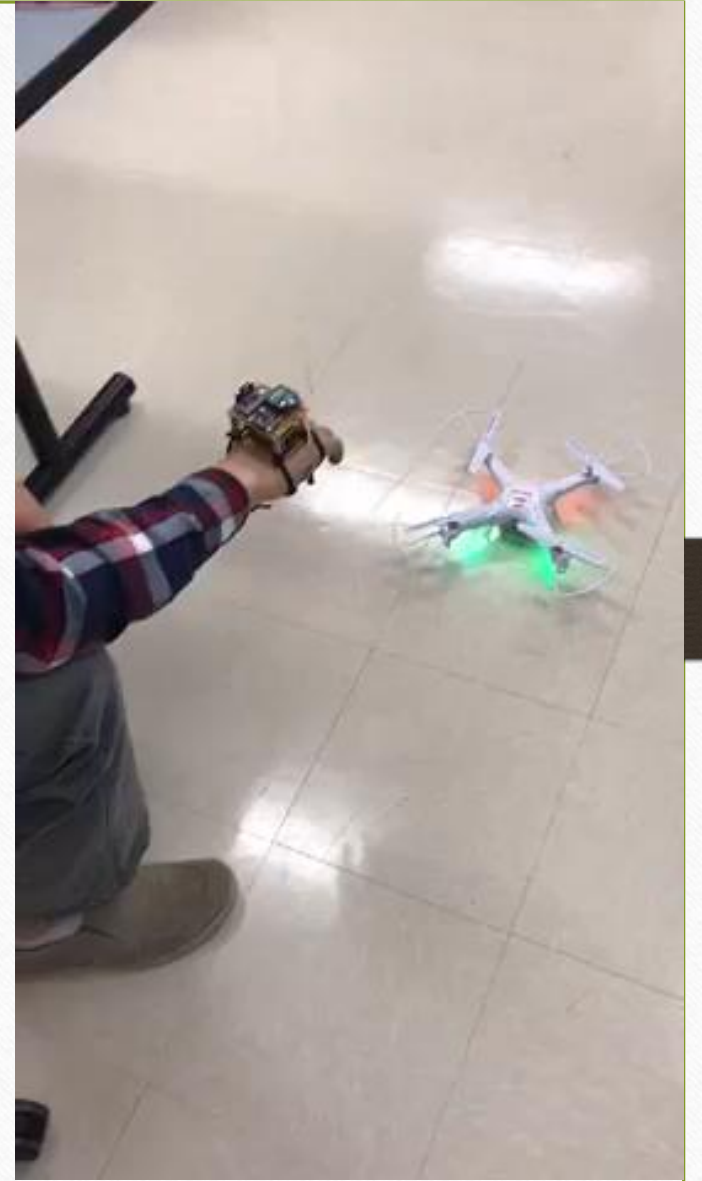
Test and Result

The controller should attach to a single hand and detect hand movements.

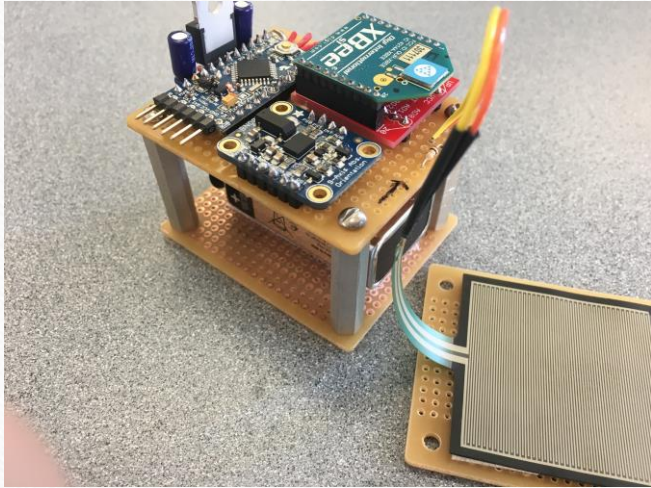
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Future Works



Thanks for your time!

Questions?