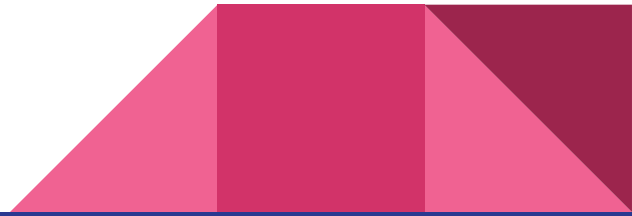
Welcome to I^2C!!!!

Oh and the IMU’s here too

What is I^2C?

- Serial protocol to transmit data to “slave” devices and receive data from master device
- There is a general I^2C bus, and certain parts of the device of the bus use specific registers to transmit/receive data



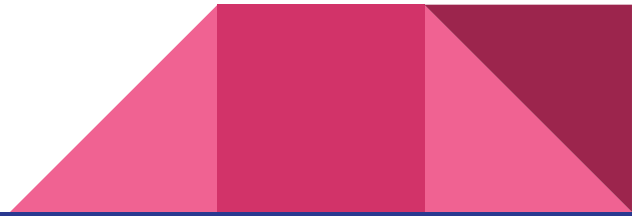
Registers: Reading and Writing

- Each component of the slave device has specific registers
-

Binary and Hex

Binary is a base-2 system that uses two digits — 0 and 1.

Hexadecimal is a base-16 system that simplifies how binary is represented. It uses 16 digits: 0 1 2 3 4 5 6 7 8 9 A B C D E F. Each hex digit reflects a 4-bit binary sequence.

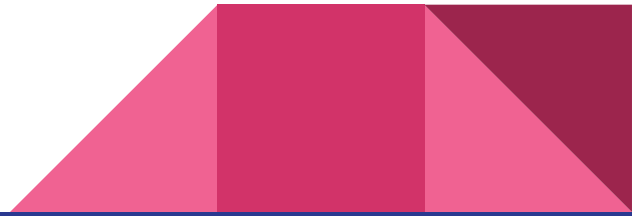


Binary (Base 2)	Hexadecimal (Base 16)
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

https://teacher.desmos.com/activitybuilder/custom/5ca3977f77b19b0afb470ed9

Sensors in the IMU

- Accelerometer: measures acceleration of system
- Gyroscope: measures the rate of change of angle of system(tilt)
- Magnetometer: provides an orientation with respect to Earth’s magnetic field



Magnetometer Registers

Enabling the sensor:

(address [0x6B], 0x12, 0x00)

Data collection:

- X-axis: 0x09
- Y-axis: 0x0B
- Z-axis: 0x0D

Units

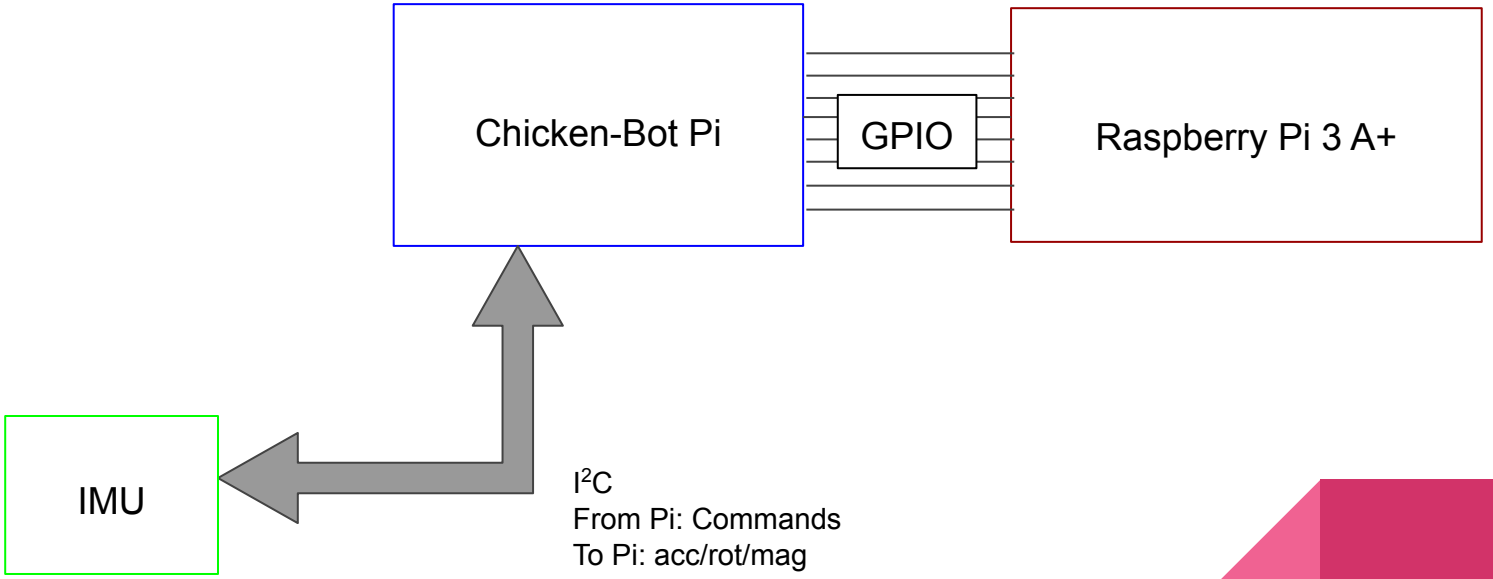
- We converted the the values returned by the accelerometer to values measured in meters/(second)^2
- The gyro values are in degrees/second
- magnetometer measures magnetic field strength in uT (micro Tesla) or Gauss ! 1 Gauss = 100 uT
-

Orientation using the three sensors

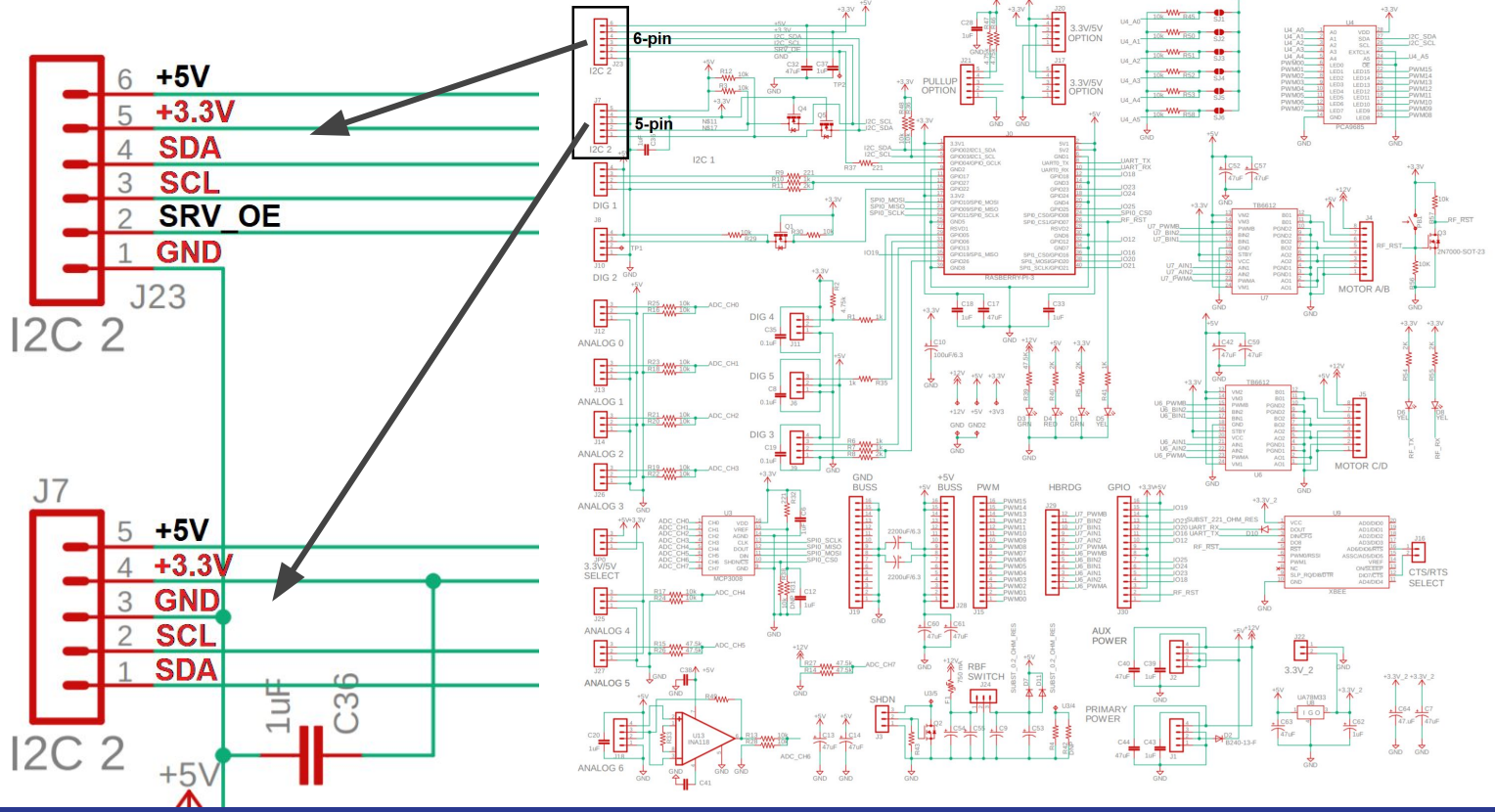
We determine the orientation of the system by analyzing the tilt of the system, the acceleration of the system, and the amount of deviation from magnetic North

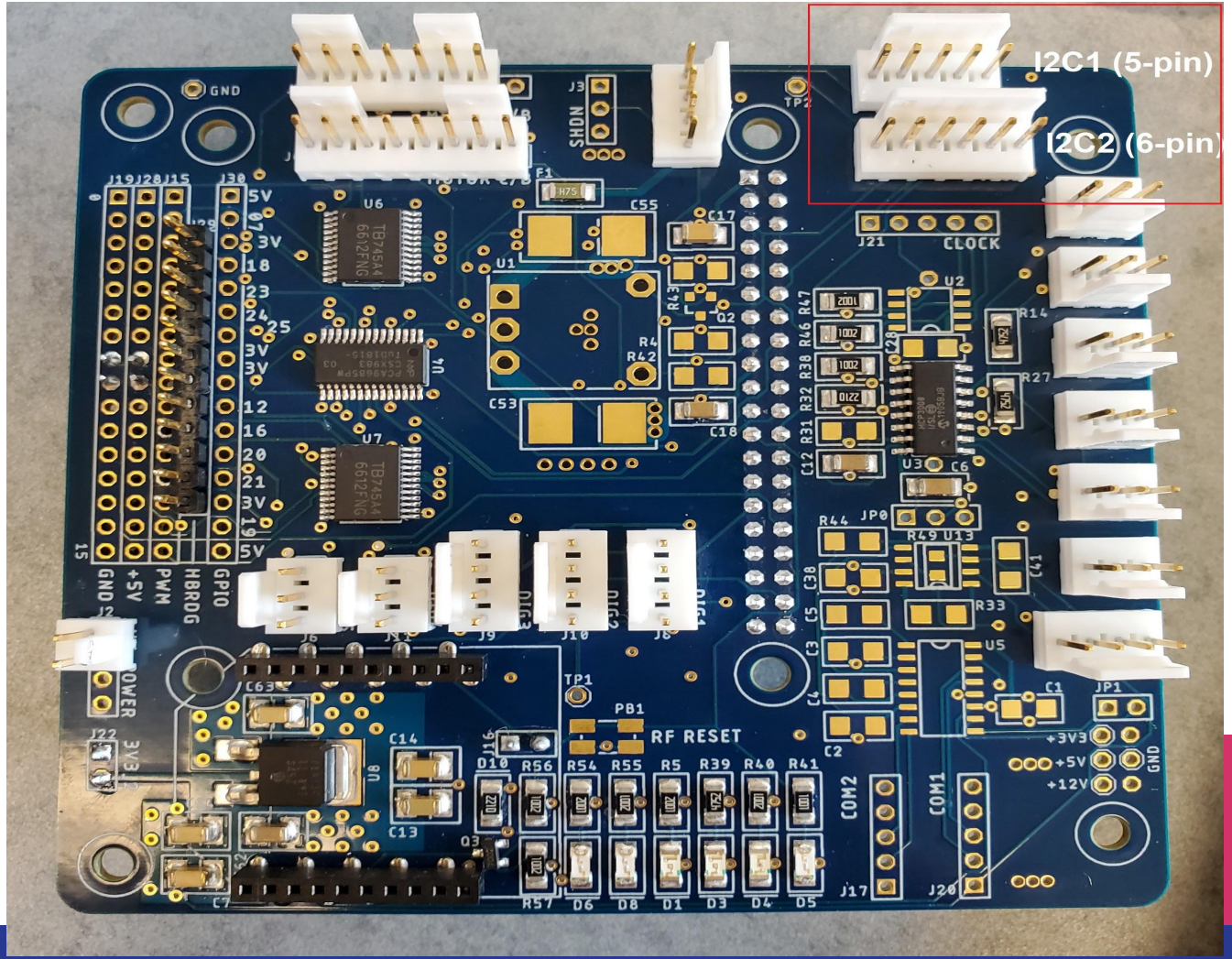
ICDs

Block ICD

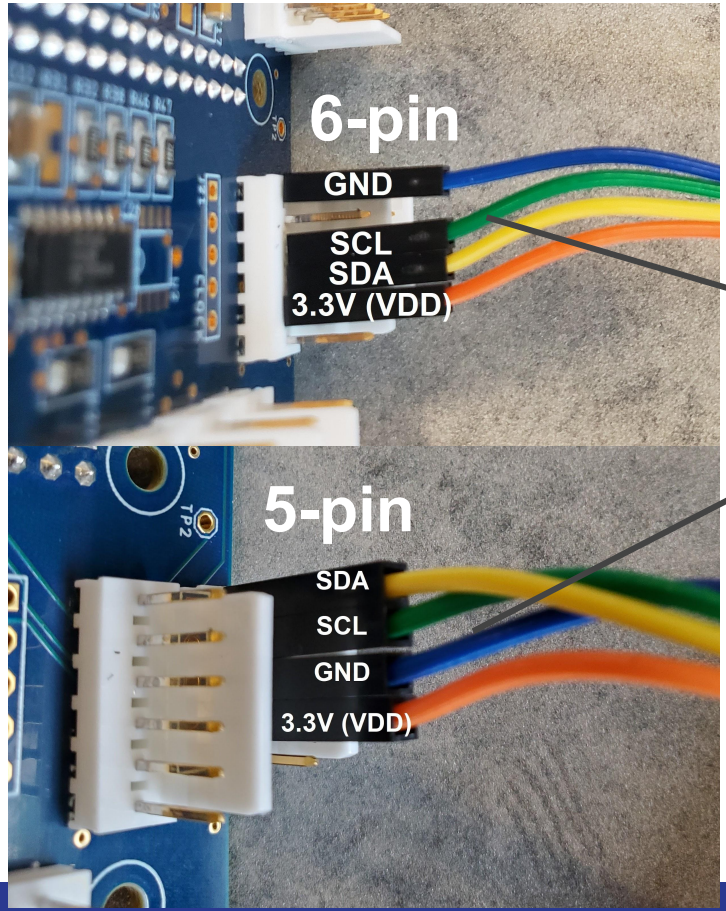

Chicken-Bot Pi
GPIO
Raspberry Pi 3 A+
IMU
I²C
From Pi: Commands
To Pi: acc/rot/mag

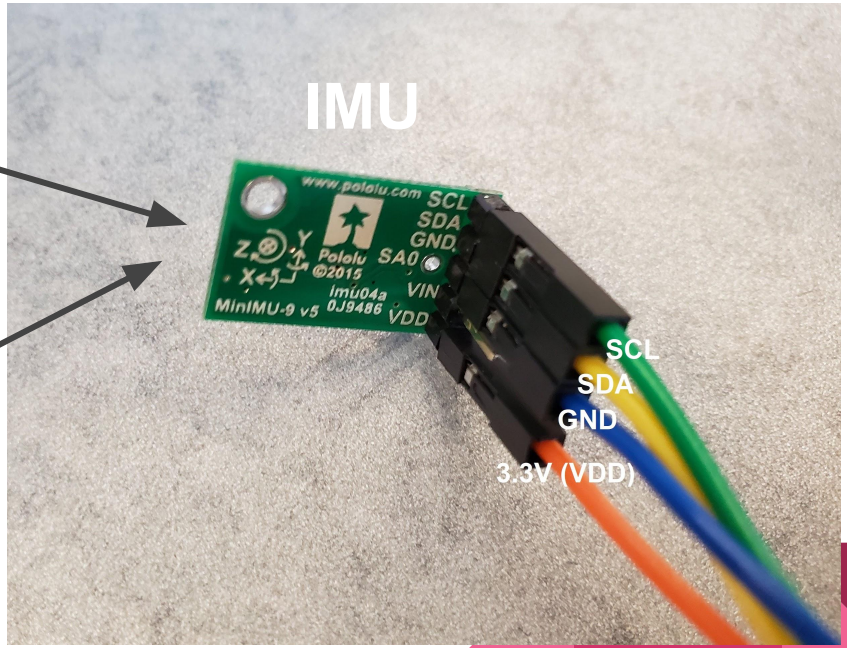
Electrical Schematics




I2C1 (5-pin)
I2C2 (6-pin)
GND
SHDN
CLOCK
RF RESET
COM1
COM2
+3V3
+5V
+12V
GND

Wiring Chicken-Bot-Pie → IMU





Mechanical ICD

The IMU should be mounted in a safe location on one of the side panels or part of the frame of the CubeSat. It could be mounted using a nylon standoff or two hex nuts.

Software

https://github.mit.edu/ZipCube2019/Drivers/tree/master/IMU