PCB

● Power
● Signal

Antenna

LoRa Module
RFM9SW

Button

GPS

LCD

ESD

Micro controller
ESP32? STM32?

IMU

USB

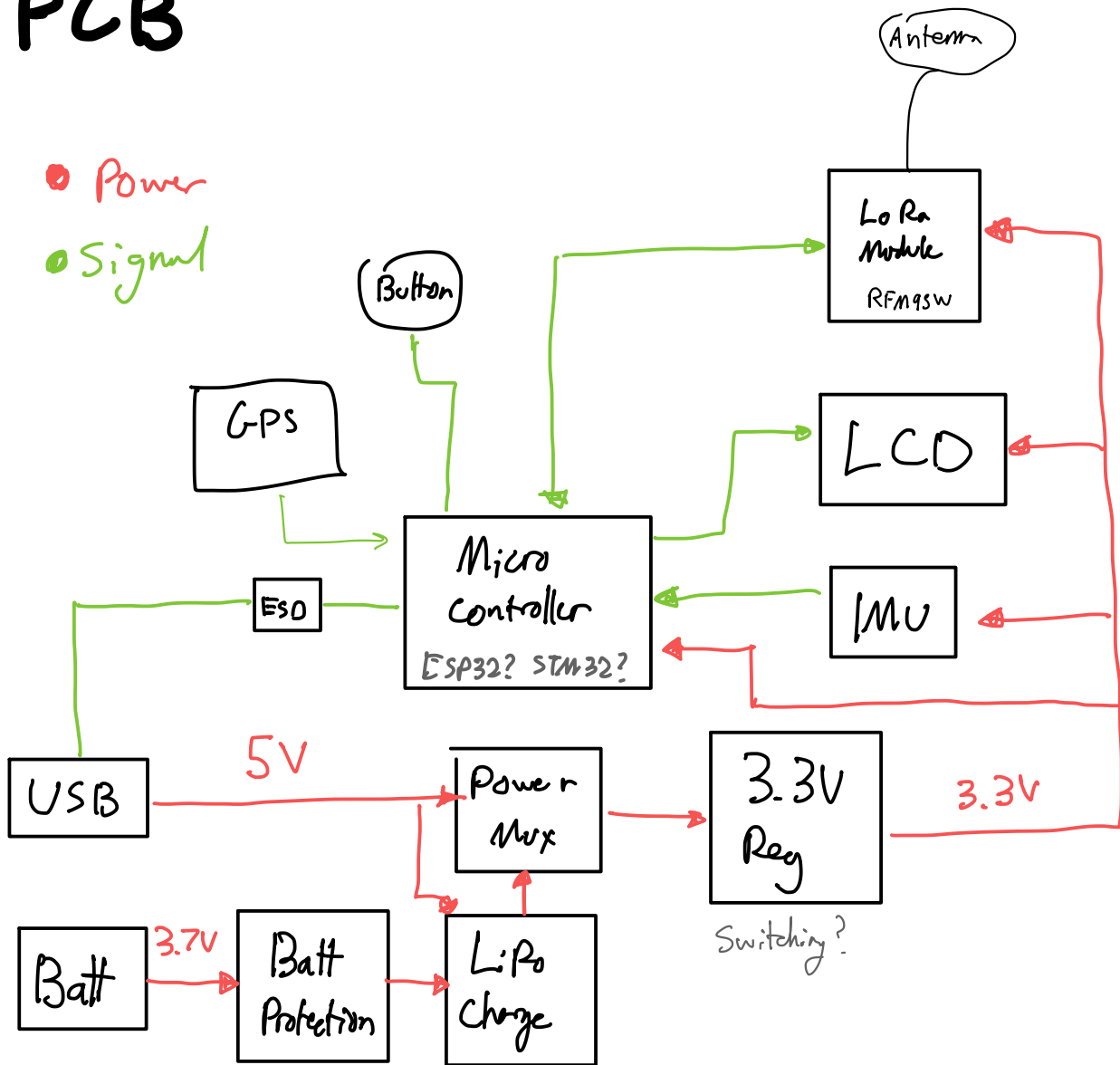5V

Power Mux

3.3V Reg
Switching?

3.3V

Batt

3.7V

Batt Protection

LiPo Charge

• Need LCD driver board?

• More UI devices?

• Additional supporting circuitry for K?

Power Draw

Battery : 1s LiPo → 3.7 V ; 500 mAh

Target battery life: 3-5 hrs

  ↳ Acceptable Avg. Current Draw : 100 - 160 mA

Regulator Efficiency :

Microcontroller :

IMU :

Screen :

GPS :

Lora Module :

RX: 12 mA

TX:
  +20 dBm: 120 mA
  +17 dBm: 87 mA
  +13 dBm: 29 mA
  +7 dBm: 20 mA

Sleep: 0.2 mA
Idle/ Standby: 1.5 mA

w/o idle mode

Let n = # paired devices

$$I_{avg} = \frac{1}{n} I_{TX} + \frac{n-1}{n} I_{RX}$$

For 3 devices : n = 3

$$I_{avg} = \frac{1}{3}(120 \, mA) + \frac{2}{3}(12 mA)$$

$$= \boxed{48 \, mA \ @ \ +20 \, dBm}$$

w/ idle mode

Worst Case Time on Air : 400 ms

Max n : 10

$I_{avg, active} = 48 \, mA$

$T_{active} = n \times ToA = 10 \times 400 \, ms = 4s$

$T_{idle} = $ Update Period $ - T_{active}$

$\qquad = 60s - 4s = 56 s$

$$I_{avg} = I_{active} \times \frac{T_{active}}{\text{Update Period}} + I_{idle} \times \frac{T_{idle}}{\text{Update Period}}$$

$$= 48 mA \times \frac{4}{60} + 1.5 \, mA \times \frac{56}{60}$$

$$\boxed{= 4.6 \, mA}$$

MCU Selection

	STM32 F401RCT6TR	STM32 L476RETG	ESP32 S3-WROOM-1-N8	ESP32 C3-WROOM-02-H4	RP2040
$	$5.85	$6.34	$3.2	$2.00	$1.00
RAM	64k	128k	512k	400k	264k
Flash	256k	512k	8M	4M	...
Freq	84 Mhz	80 Mhz	240 MHz	160 MHz	133 MHz
Light sleep	2.4 μA	120 nA	8 μA	130 μA	...
Typ	128 μA/MHz	100 μA/MHz	$\approx$ 208 μA/MHz	175 μA/MHz	280 μA/MHz
IO Count	81	114	45 (Programble)	16	30
SPI	4	3	2	3	
I²C	3	3	2	2	
WiFi/BT			X	X	

* Req. Ext. Flash

GPIO / Port Map

IMU:

VCC
GND
SCL / SCLK : 0
SDA / SDI
~~EOA~~
~~ECL~~
ADO / SDO
INT : Interrupt DIO
NCS : Chipsel
~~FSYNC:~~

UI:

Button x2

Screen:

RST
CS
DO
SDA
SCL : 0
GND
VCC

Lora:

VIN
GND
EN
GO: Interrupt
Sck : 0
MISO
MOSI
CS
RST

GPS

VCC
GND
TX } UART
Rx