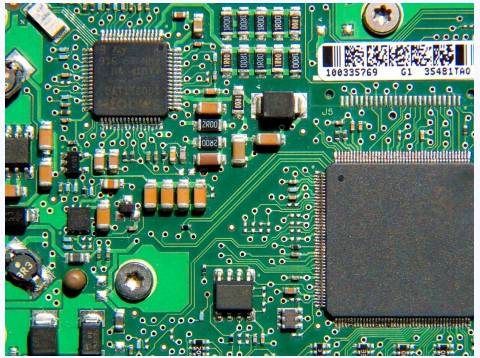
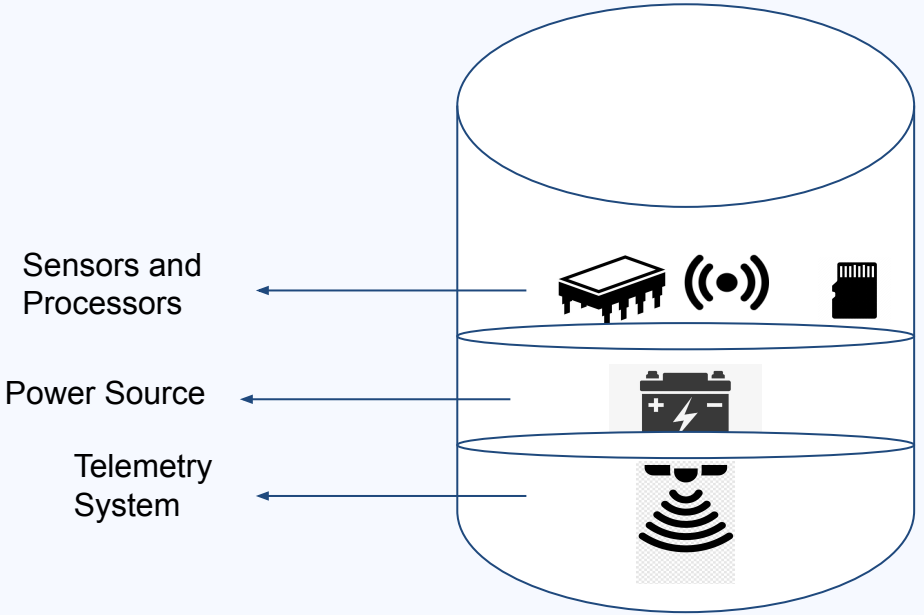
Power Budget and PCB

Components	Quantity	Maximum power consumption		
		Voltage(V)	Current(mA)	Power(mW)
GY87	1	5	3.9	19.5
APC220	1	5	30	150
DS18S20	1	5	1.5	7.5
Atmega 328	1	5	16	80
LED	1	2	3	6
GPS Module	1	3.3	67	221.1
DHT11	1	5	2.5	12.5
SD-Card module	1	5	50	250
Resistor(1kΩ)	1	3	3	9
Resistor(4.7kΩ)	1	5	1.06	5.3
Total	10			760.9



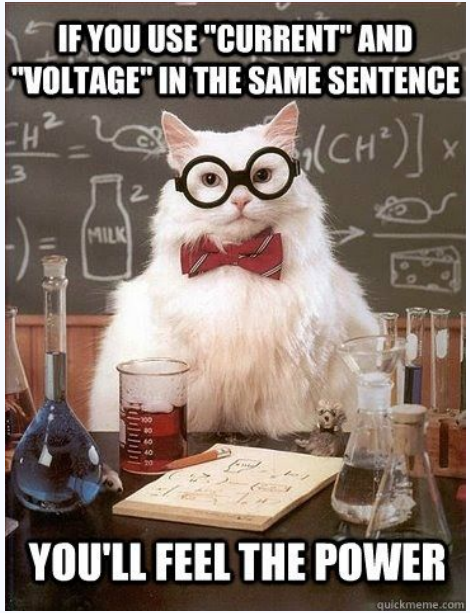
Quick Recap!

- Configuration of XBee using XCTU
- Programming XBees for transmitting and receiving data.
- Using functions to make the code understandable



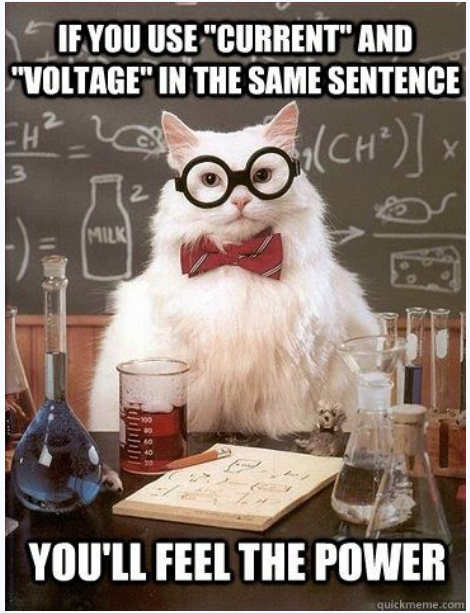
How to Power up?

- Generally, Arduino Nano is connected to the laptop's USB port providing it with a 5V power source.
- How do we power up our electronic components in mid-air?

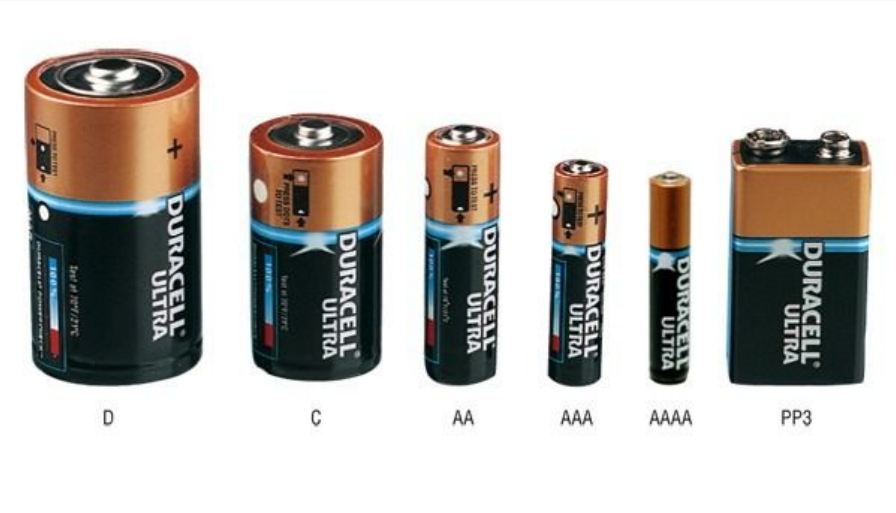


How to Power up?

- Generally, Arduino Nano is connected to the laptop's USB port providing it with a 5V power source.
- How do we power up our electronic components in mid-air?
- **BATTERIES**!!!



Battery Types



AAA battery
Nominal => 1.2 V - 1.6V
400 - 2000 mAh

AA battery
Nominal => 1.5 V - 3.7V
500 - 1200 mAh

Zinc - carbon, alkaline, lithium Ion, lithium polymer, lead acid and nickel cadmium batteries etc

How to Select a battery?

- Primarily, we will have to know how much power will the electronic components in the satellite totally consume.
- We come up with the **POWER BUDGET** to select the suitable battery for the electronic system.
- Power budget will include the total current consumed, voltage required per component, current capacity and power capacity.

Datasheet

DATASHEET : document that has all the data from its dimensions, electrical specifications to its performance specification. Basically a complete biography of a component.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Operating temperature	T_A	operational	-40		+85	°C
		full accuracy	0		+65	
Supply voltage	V_{DD}	ripple max. 50mVpp	1.8	2.5	3.6	V
			1.62	2.5	3.6	
Supply current @ 1 sample / sec. 25°C	I_{DDLOW}	ultra low power mode		3		µA
	I_{DDSTD}	standard mode		5		µA
	I_{DDHR}	high resolution mode		7		µA
	I_{DDUHR}	Ultra high res. mode		12		µA
	I_{DDAR}	Advanced res. mode		32		µA
Peak current	I_{peak}	during conversion		650		µA
Standby current	I_{DDSBM}	@ 25°C		0.1	4[1]	µA
Relative accuracy pressure V_{DD} = 3.3V		950 . . . 1050 hPa @ 25 °C		±0.12		hPa
				±1.0		m
		700 ... 900hPa 25 . . . 40 °C		±0.12		hPa
				±1.0		m

Power Budget

Module	Current (mA)	Voltage(V)	Power(W)	Duty Cycle(hr)	Power consumption (Wh)	Current consumption (mAh)
name	Supply current	Supply voltage	Voltage x current	Duration of use	Duration x power	Duration x current

Total current Capacity in mAh	Add all the current consumption values

Voltage Regulator:
Are used to maintain a constant voltage. In SATCAN we will use it to maintain a constant 3.3 V.

Boost Converter:
It will amplify the voltage value according to the input voltage. We will use it here to amplify the given input voltage.

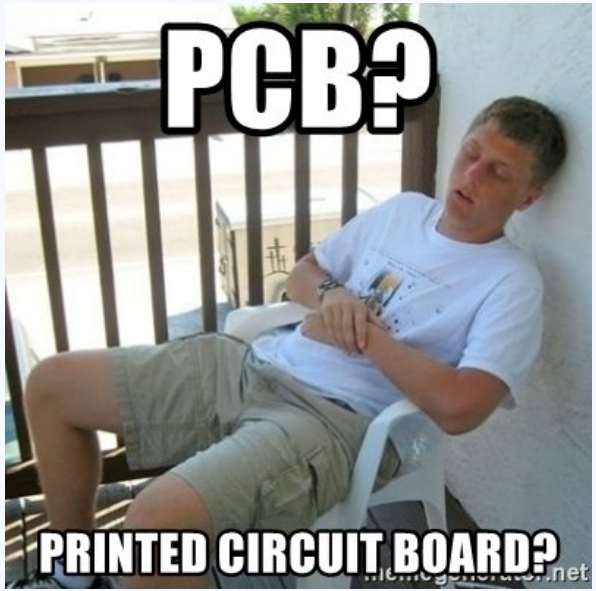
Power Budget

POWER BUDGET

Module	Current (mA)	Voltage (V)	Power (W)	Duty cycle (hr)	Power cons (mWh)	Current cons (mAh)
BMP180	0.005	3.3	0.009042	2	0.018084	0.00548
XBee	33	5	165	2	330	66
SD card module	80	5	400	2	800	160
Arduino nano	20	6	120	2	240	40
Total					1370.018084	266.00548

PCB

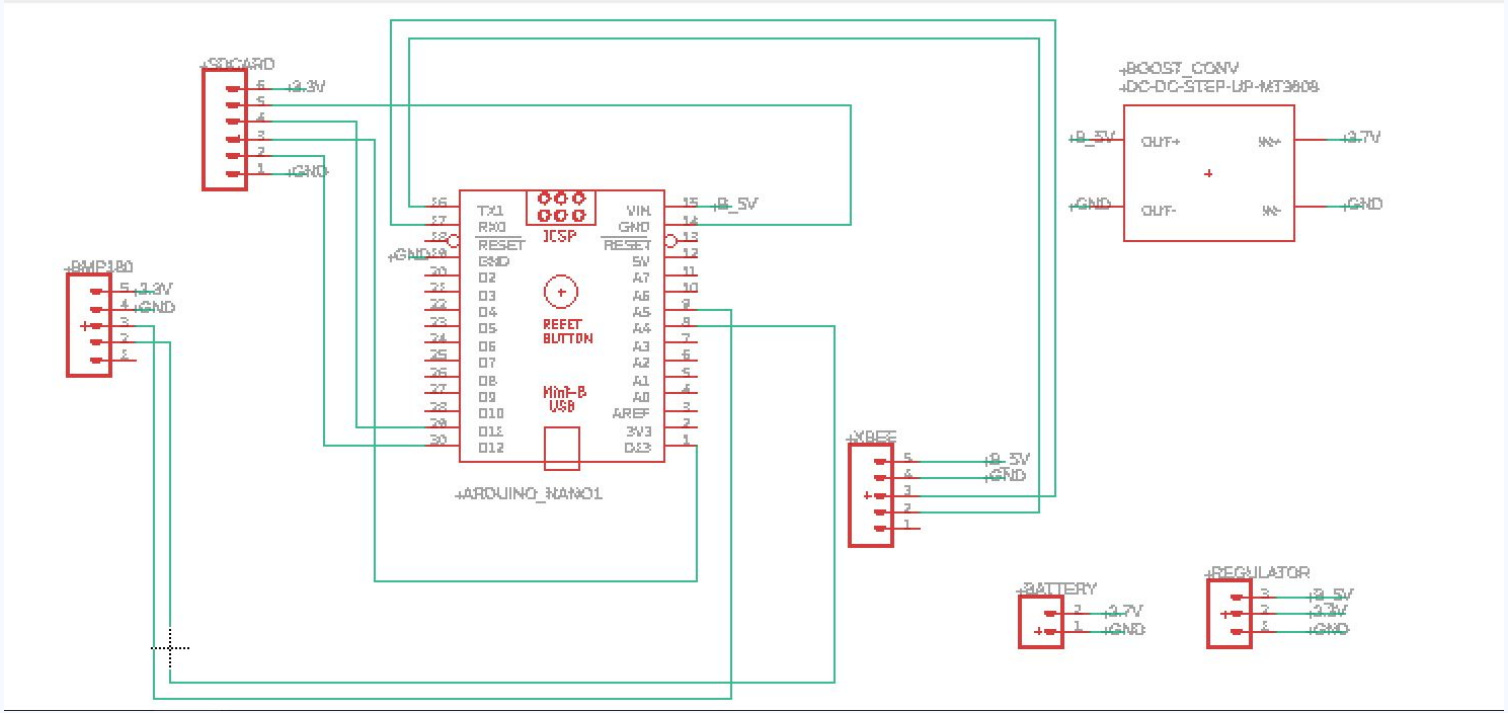
- PCB - printed circuit board
- Printing the designed circuit in board. This cannot be changed once printed.
- For designing a PCB a good knowledge about sensors and its characteristics.
- Like dimensions, number of pins and type of communication.



PCB

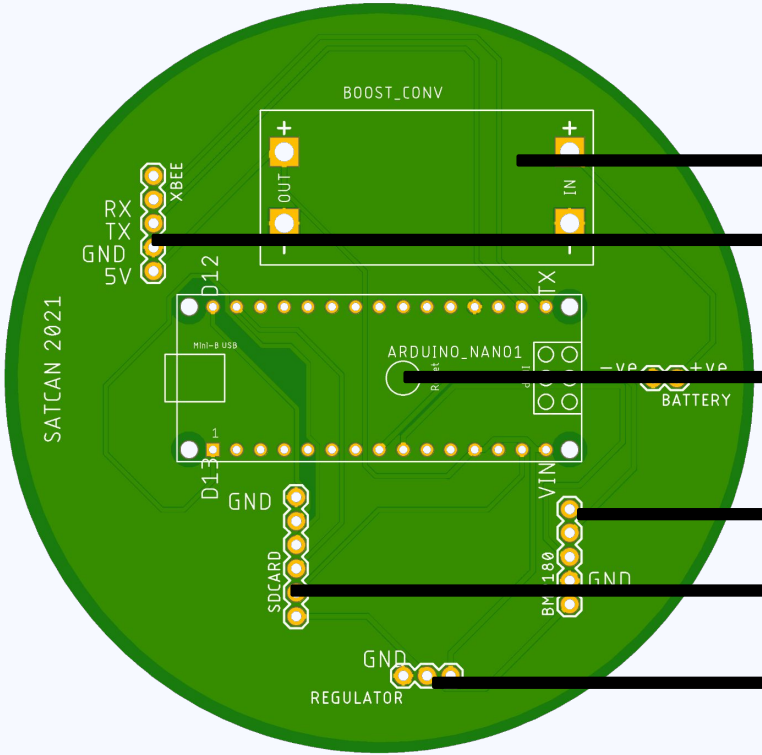
- Softwares for making PCB Autodesk Eagle, Altium, Proteus, Tinkercad and Fritzing etc.
- Two parts : Schematic and Board
- Schematic : where you make your circuits with all your components connected
- Board : where you measure the dimensions of the board size and components and place them accordingly and place the connections so that they don't overlap

PCB


+SDCARD
+3.3V
+GND
+BMP180
+3.3V
+GND
+ARDUINO_NANO1
TX1
RX0
RESET
GND
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
VIN
GND
RESET
5V
A7
A6
A5
A4
A3
A2
A1
A0
AREF
3V3
D13
ICSP
REFET BUTTON
Mini-B USB
+5_5V
+GND
+BOOST_CONV
+DC-DC-STEP-UP-MT3608
OUT+
OUT-
IN+
IN-
+3.7V
+GND
+XBEE
+5_5V
+GND
+BATTERY
+3.7V
+GND
+REGULATOR
+5_5V
+3.3V
+GND

PCB

Software used in EAGLE



Boost converter

XBee

Arduino Nano

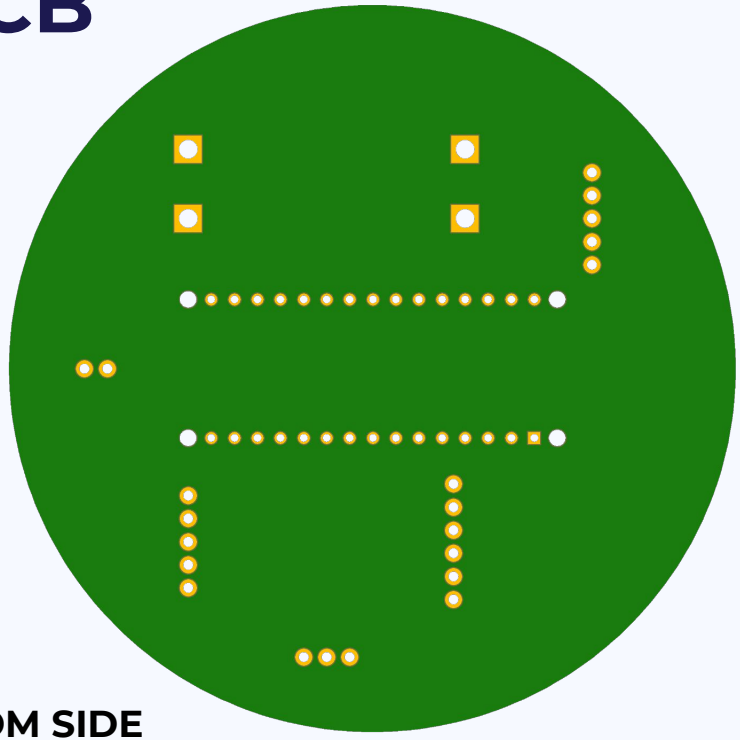
BMP180

SD card

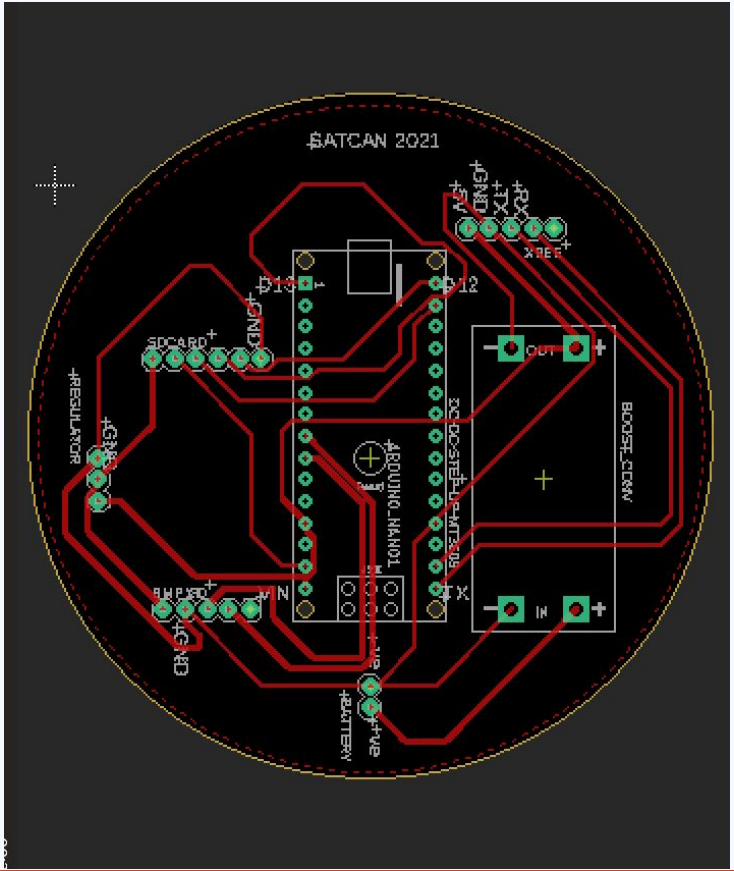
Voltage regulator

TOP SIDE

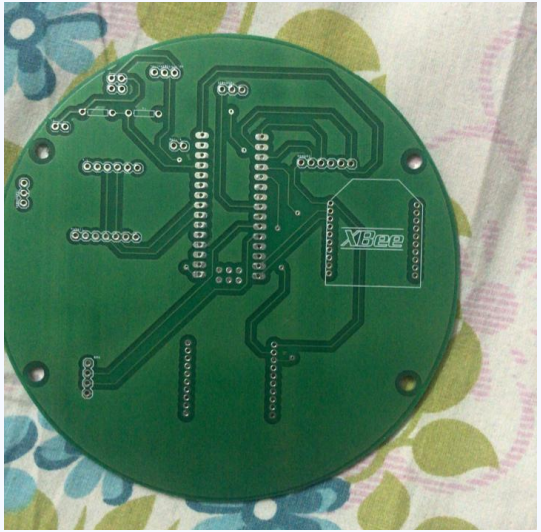
PCB

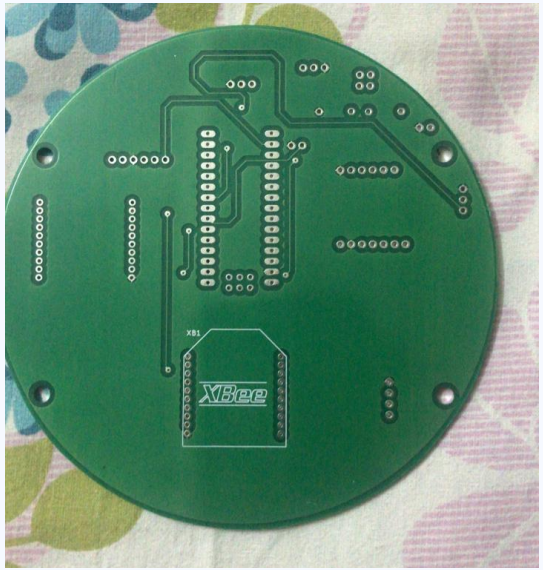


BOTTOM SIDE



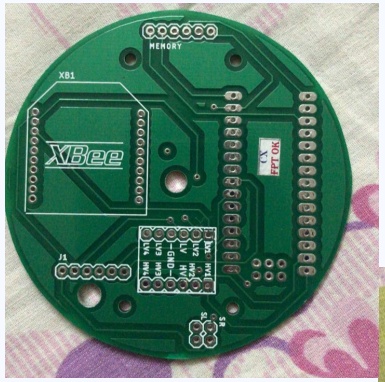
PCB





PCB


MSS611
TESTERG
TESTER
BNO080R
BATTERY
TX
FFT OK
BNO080L


MEMORY
XB1
XBee
TX
FFT OK
J1

That wraps up the basics of electronics that goes into any electronic project, including the SATCAN. But there is more than just electronics!

What will we see next?

- How to design the parachute for satellite.
- Glimpse of designing satellite body.
  - How to make it stable?
  - How to choose your materials?
  - Can we 3D print our satellite?

THANK YOU