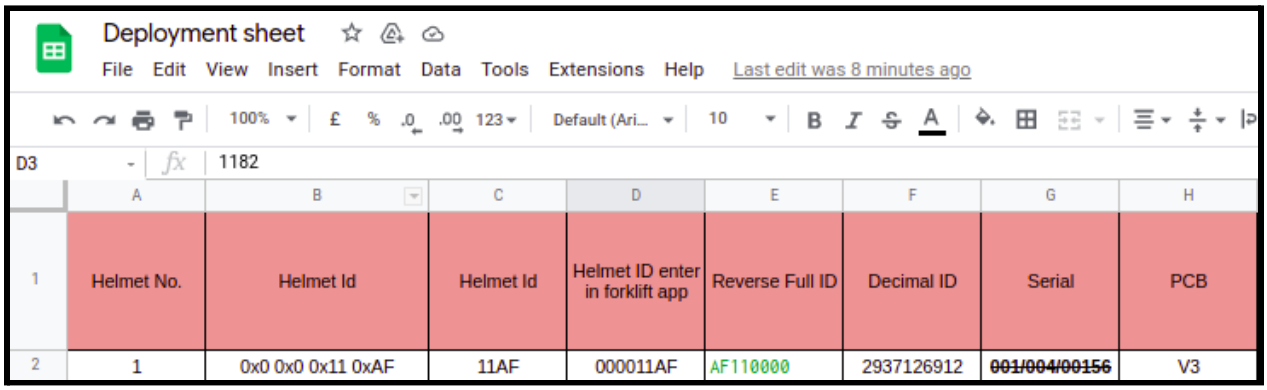
Operator helmet id configuration with PDB by forklift app:

Note:Refer operator helmet sheet in deployment sheet for decimal,reverse decimal ids and hexadecimal ids.



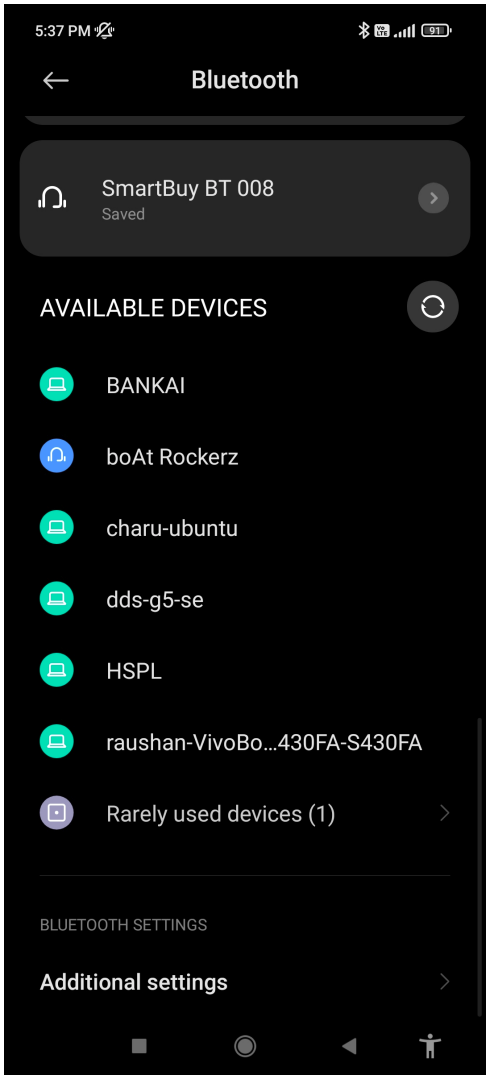
Deployment sheet

File Edit View Insert Format Data Tools Extensions Help Last edit was 8 minutes ago

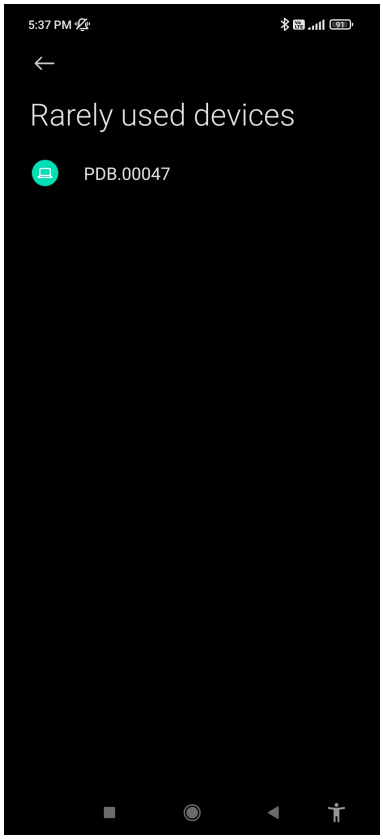
D3 | 1182

	A	B	C	D	E	F	G	H
1	Helmet No.	Helmet Id	Helmet Id	Helmet ID enter in forklift app	Reverse Full ID	Decimal ID	Serial	PCB
2	1	0x0 0x0 0x11 0xAF	11AF	000011AF	AF110000	2937126912	~~001/004/00156~~	V3

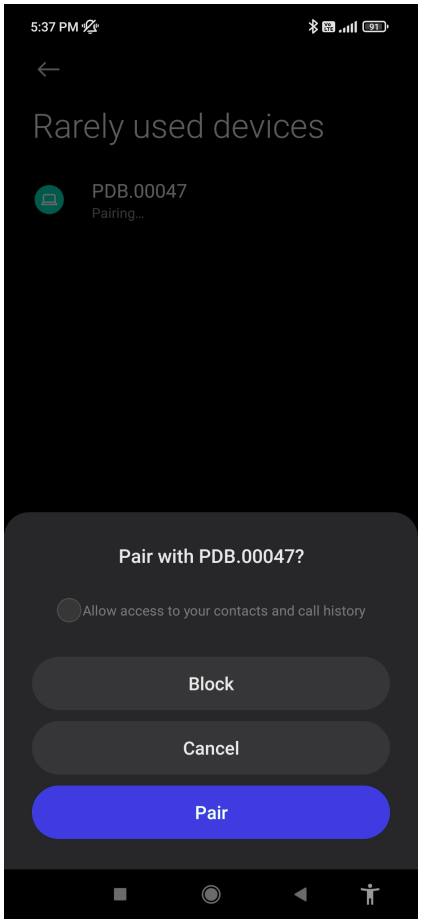
Step 1: Pair bluetooth in mobile by going to settings of mobile then go to rarely used devices.



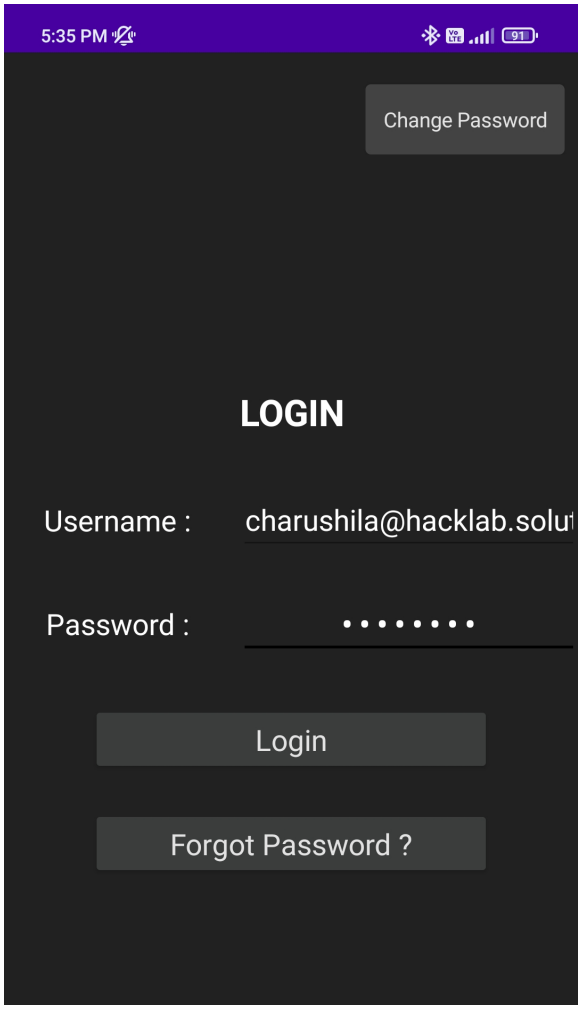
Step 2:connect the available pdb device by bluetooth



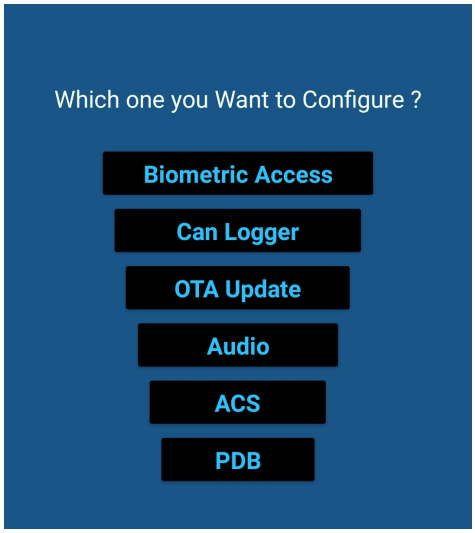
Step 3:Pair with respected bluetooth device



Step 4:open forklift app and login with credentials (pass:HACK@LAB)



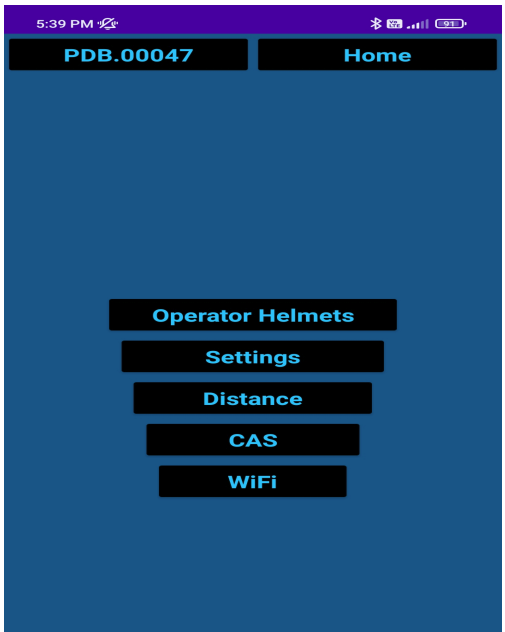
Step 5:select PDB device for configuration



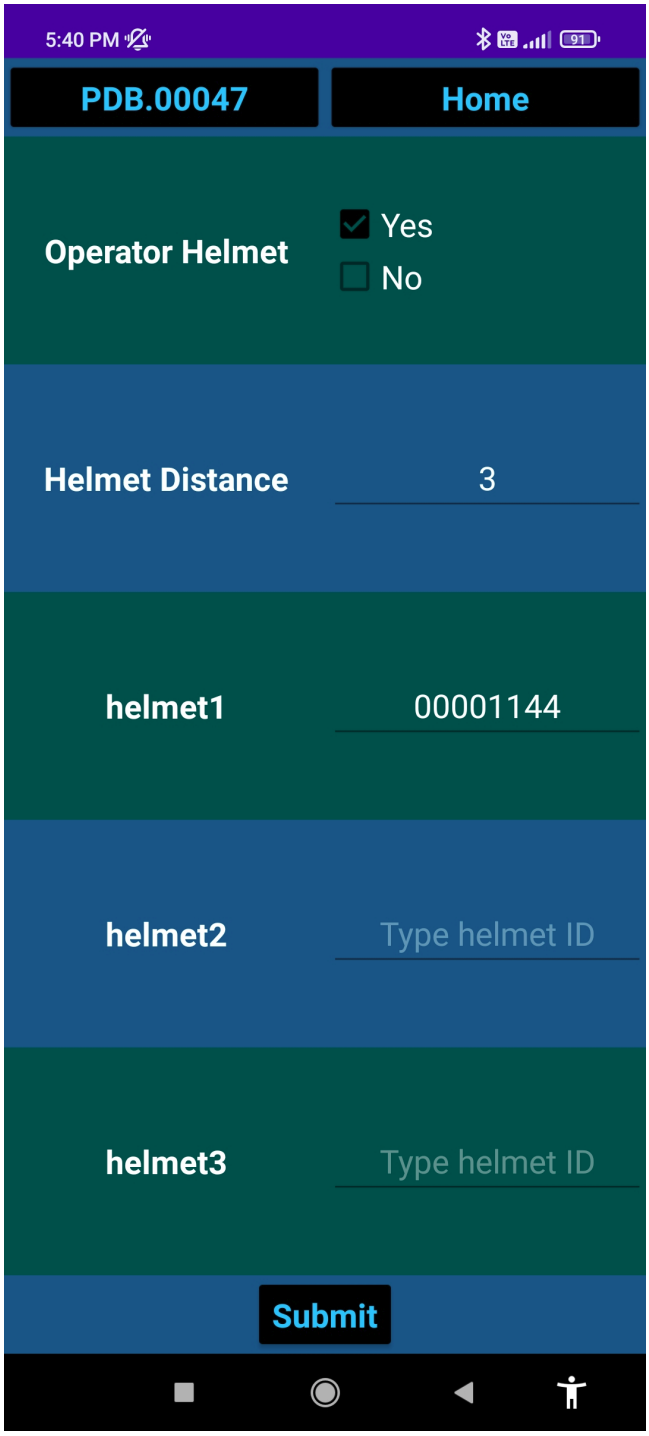
Step 6:select bluetooth device name of respected PDB

Here we can select PDB.00047 bluetooth device

Step 7:now we can edit settings as per requirements

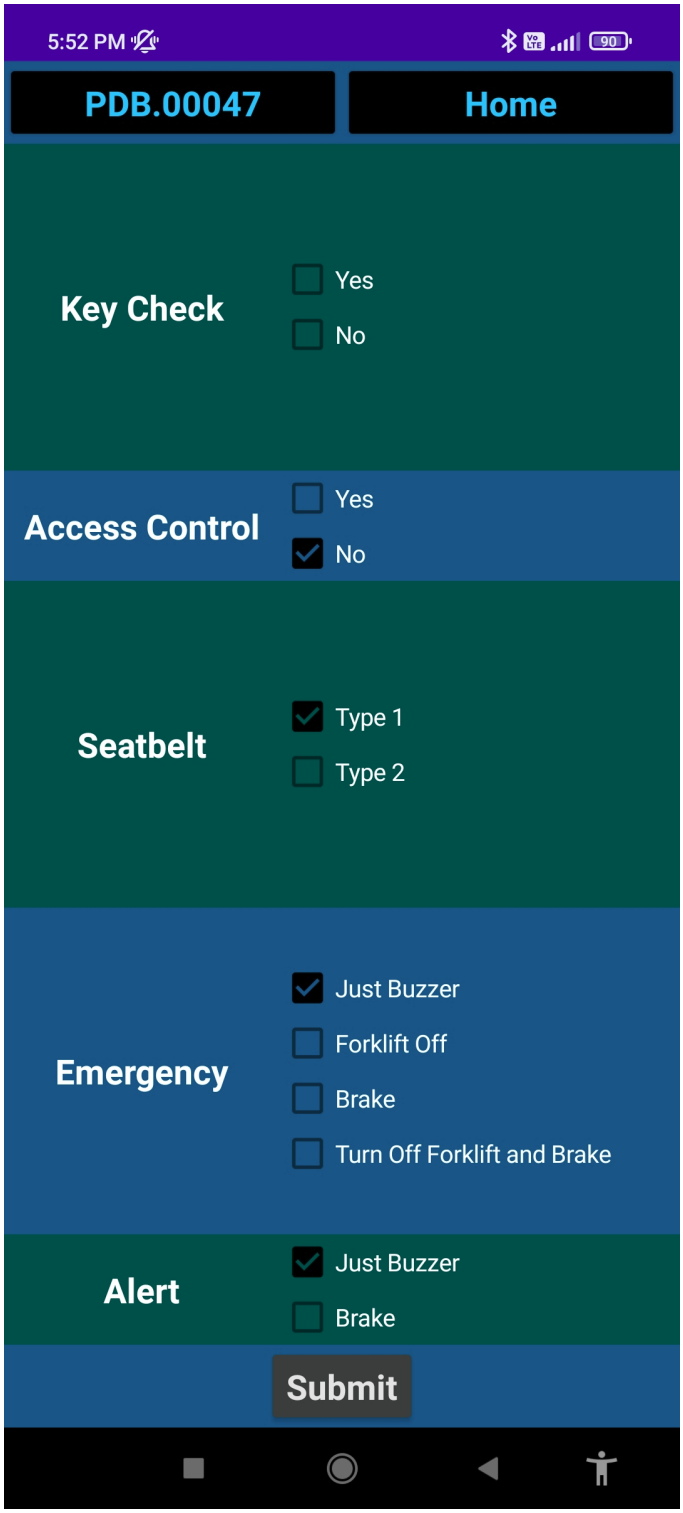


Step 8:If you want to change operator helmet id go to operator helmet settings



- Click operator helmet as YES
- Enter operator helmet id in the format mentioned below:
  If the SAFMET UID is 1144 then enter helmet 1 id as “00001144” and click on the submit button.

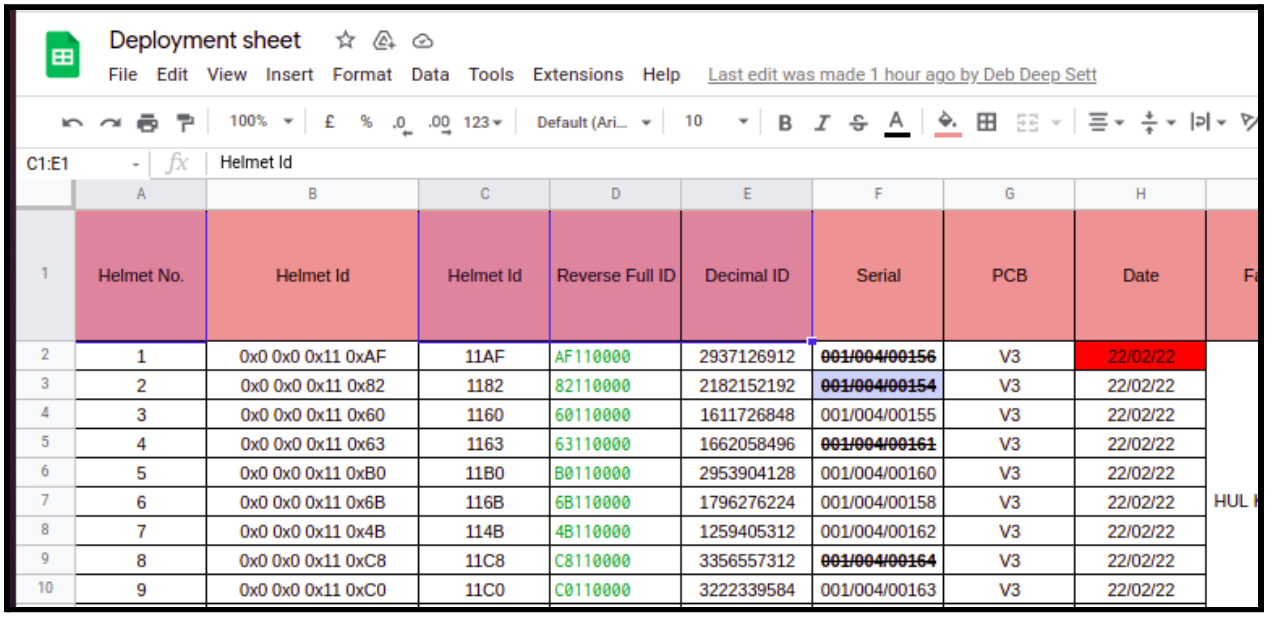
Step 9:If you want to check operator helmet with pdb and casnode setup only then do the following settings and submit.



Note :After each settings update, reset the pdb and then check.

Operator helmet id configuration with PDB by SPIFFS:

Note:Refer operator helmet sheet in deployment sheet for decimal,reverse decimal ids and hexadecimal ids.



Deployment sheet

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C1:E1 | Helmet Id

	A	B	C	D	E	F	G	H
1	Helmet No.	Helmet Id	Helmet Id	Reverse Full ID	Decimal ID	Serial	PCB	Date
2	1	0x0 0x0 0x11 0xAF	11AF	AF110000	2937126912	~~001/004/00156~~	V3	22/02/22
3	2	0x0 0x0 0x11 0x82	1182	82110000	2182152192	~~001/004/00154~~	V3	22/02/22
4	3	0x0 0x0 0x11 0x60	1160	60110000	1611726848	001/004/00155	V3	22/02/22
5	4	0x0 0x0 0x11 0x63	1163	63110000	1662058496	~~001/004/00161~~	V3	22/02/22
6	5	0x0 0x0 0x11 0xB0	11B0	B0110000	2953904128	001/004/00160	V3	22/02/22
7	6	0x0 0x0 0x11 0x6B	116B	6B110000	1796276224	001/004/00158	V3	22/02/22
8	7	0x0 0x0 0x11 0x4B	114B	4B110000	1259405312	001/004/00162	V3	22/02/22
9	8	0x0 0x0 0x11 0xC8	11C8	C8110000	3356557312	~~001/004/00164~~	V3	22/02/22
10	9	0x0 0x0 0x11 0xC0	11C0	C0110000	3222339584	001/004/00163	V3	22/02/22

For example :

```
{
"NAM": "PDB.test2",
"ssid": "HSPLWIFI",
"pass": "HACK@LAB",
"ip": 246,
"HED": 4,
"HAD": 6,
"MED": 4,
"MAD": 6,
"HEL": 2,
"HDS": 3,
"HL1": 2937126912,// for 11AF uid we have reverse the id first to AF110000 then convert this hex id to decimal id “2937126912”
"HL2": 2182152192,//for 1182
"HL3": 1611726848,//for 1160
"KEY":1,
"AC": 1,
"SB": 1,
"ALR": 1,
"EMR": 1,
"HMI": 1,
```

"SLK":3000,
"OTA":0,
"BRK": 5000,
"BYP": 5000,
"DBG": false
}

Note:update the spiffs with these settings in PDB while checking with the setup of casnode and PDB. We can check the operator helmet by activating the touch sensor.

1. Vibration motor should stick
2. Put loctite at charging connector
3. Add o-ring at charging connector
4. Wrap thermal tape to the backside of pcb
5. Check charging connector working or not
6. Put white acrylic glass cut on top of enclosure for led transparency
7. Put sticker id on the top of enclosure
8. Put safmet uid id sticker on top of enclosure and back side of pcb
9. Tick ip5 and li-po battery with marker at top sticker
10. Note down serial number and uid of respected safmet and entered data in deployment sheet

Safmet PCB issues and Possible Checks and its Solutions:

Sr. No.	Faults	Possible Checks and Solutions
1.	Reset is not happening	Check by removing 2N002DW IC. (might be shorting)
2.	Not booting/bootloader failed	Check for presence of crystal oscillator or cable connection of boot loader. Replace atmega if it's damaged . check spi pin continuity mosi(15th pin),miso(16th pin)at atmega ic to ATMEGA_PROG pins on pcb
3.	Constant resetting is happening(for 4 sec periodic alarm)	Check if R16 is fabricated, if yes, take it out and short it out.
4.	Continuous resetting(within 1 sec)(Code issues)	Reupload the code and check. Still not solved, try the blink code with wdt reset and if it works, then try to adjust the code with wdt functions.
5.	Power is being recognised, but VCC not getting 3.3v	C13 might be shorting VCC and GND.
6.	Immediate reset is not happening after taking off power.	Try removing TPS and check.(enable pin of TPS might be floating).
7.	Issues with charging IC	check for shorting, reverse placement or output of the charging IC should be 3.5<O/P<4.2, if more voltage is coming, try changing it. (correct working gives RED and BLUE LEDs).check the voltage at input and output pin of it.
8.	If reset of ATMEGA not happening	Check if reset button is working or not and also check 2N7002DW(If shorting)
9.	If serial prints not getting	Check the shorting between the tx and rx pins of atmega ic to uart usb pins. solder atmega rx and tx pins properly
10.	Decawave not working	Check data coming on IRQ pin(22th

		pin) of decawave and check data coming on mosi(18th pin),miso (19th pin)pins of decawave.
11.	Battery not getting charge	Check battery positive and negative orientation. check the charging connector properly soldered or not
12.	Charging ic 24092 safmet_v3 discharging issue	At atmega we are getting 2.8v at vcc pin soo max809s was resetting atmega because at 2.8 is threshold voltage for that ic.So removed max809s for that.
13.	Pcb was vibrating while plugging to charger	Made vibration motor low in void setup in code
14.	Atmega resetting continuously	Remove both 2n7002dw and max809s.Because max809s voltage supervisor which resetting the atmega through 2n7002dw n channel mosfet.
15.	Showing low battery at 3.5v	Comment tone buzzer and no tone buzzer in code,BAT_LOW_ALERT set at 0.846
16.	Voltage not getting at output of charging ic	Check r9 resistor value is 560 ohm or not replace charging ic with working one r40 and r41 should properly soldered
17.	Safmet resetting at above 3.4v,after pressed reset also still same on reset state	The decawave might be stuck and the decawave will not reset till the battery is fully discharged. Short decawave vcc and ground pin then its working fine. soldered tps on pcb bypass r16
18.	Power supply issues	Check the voltage at LDO input and output it should be 3.2. Check voltage at atmega vcc pin(4th pin) it should be 3.2v. Check voltage at decawave vcc pin(6th pin) it should be 3.2v
19.	RGB led not getting on	Check the rgb led orientation. Check charging ic working properly by checking its input and output voltages.

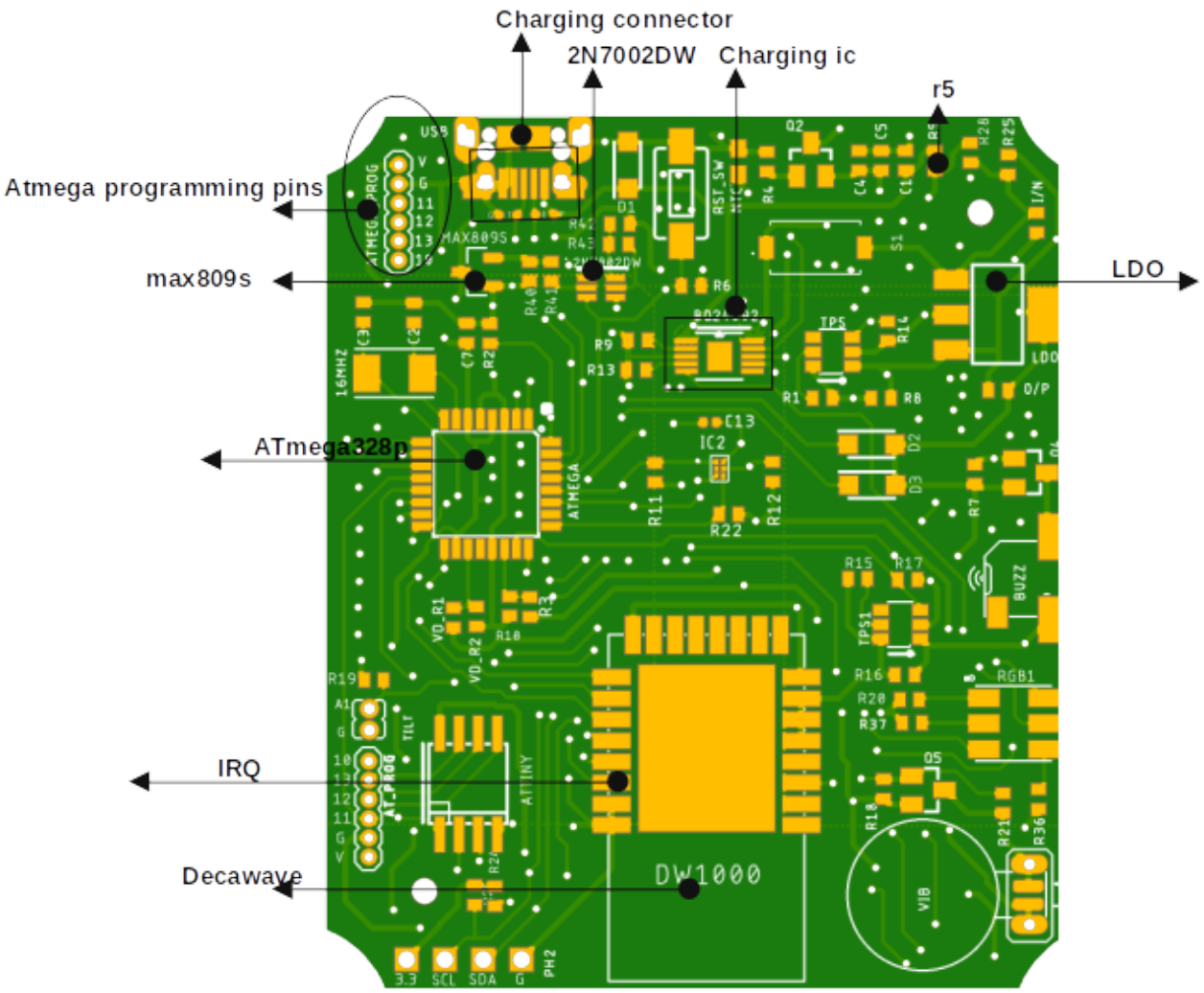
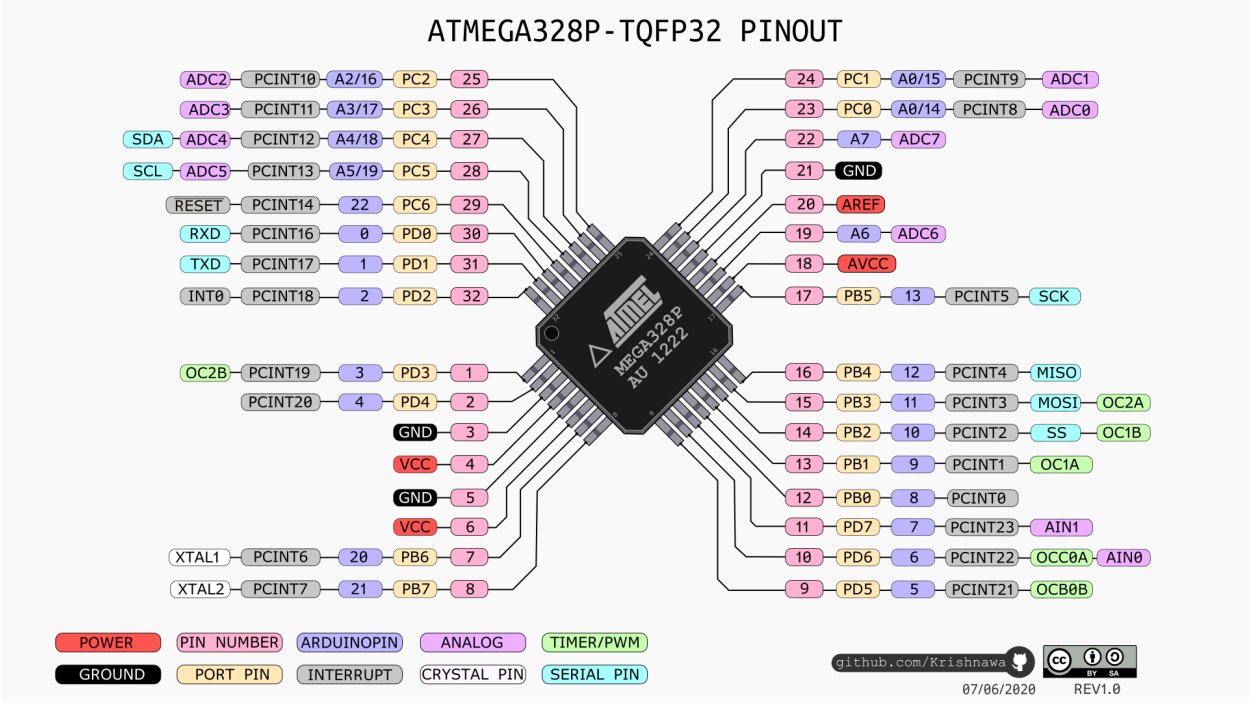


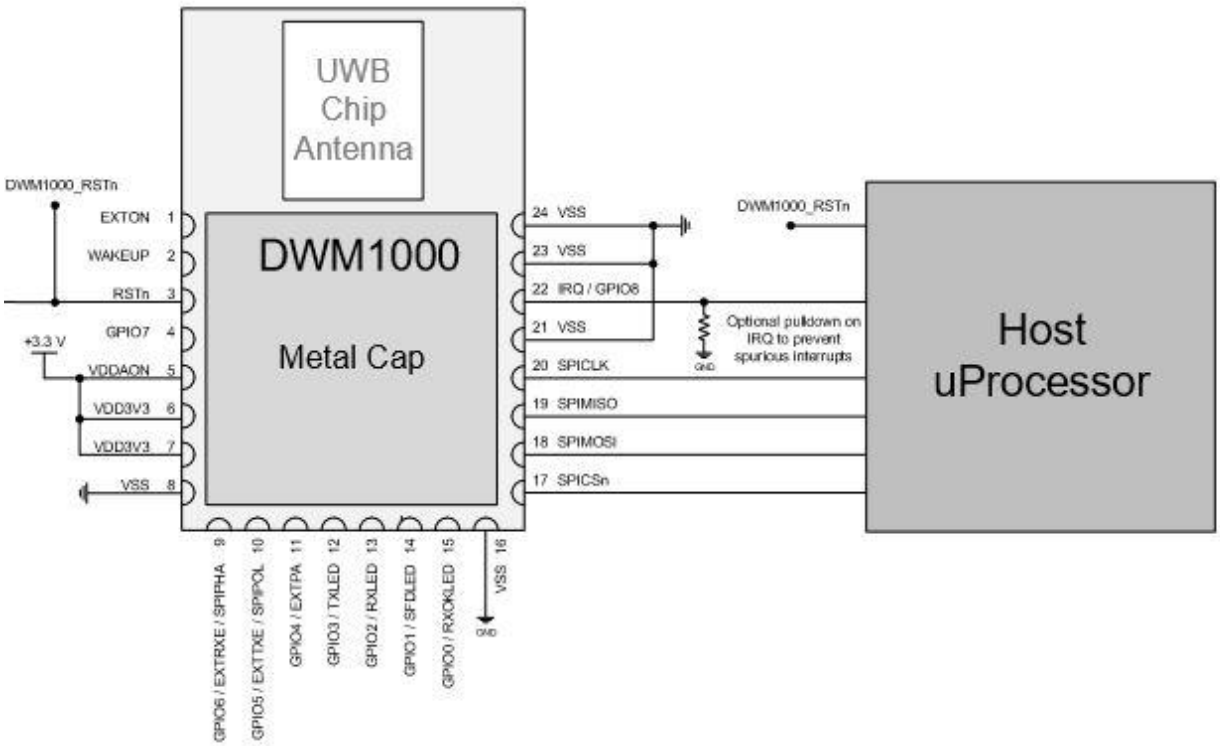
fig 1:Pin descriptions for CasNode PCB

Note:For detailed description of pinouts of atmega ic ,decawave and charging ic please refer below pinout diagrams.

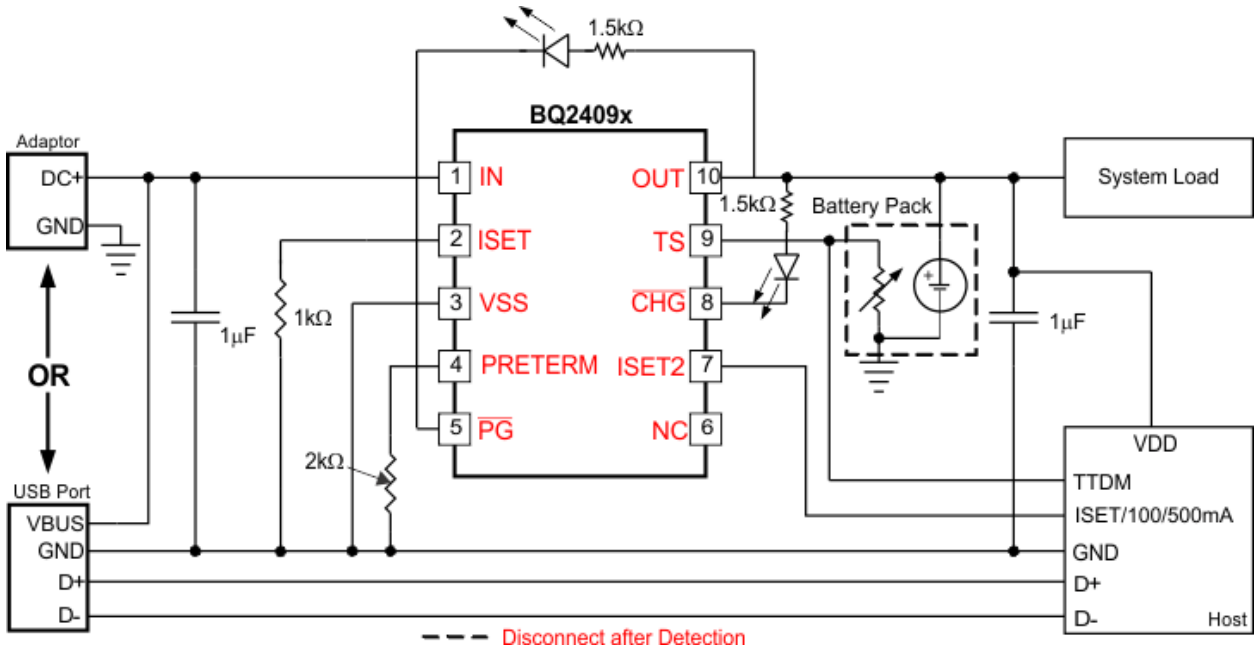
Atmega328p IC Pinout Diagram:



Decawave dw1000 Pinout Diagram:



Charging IC Pinout Diagram:



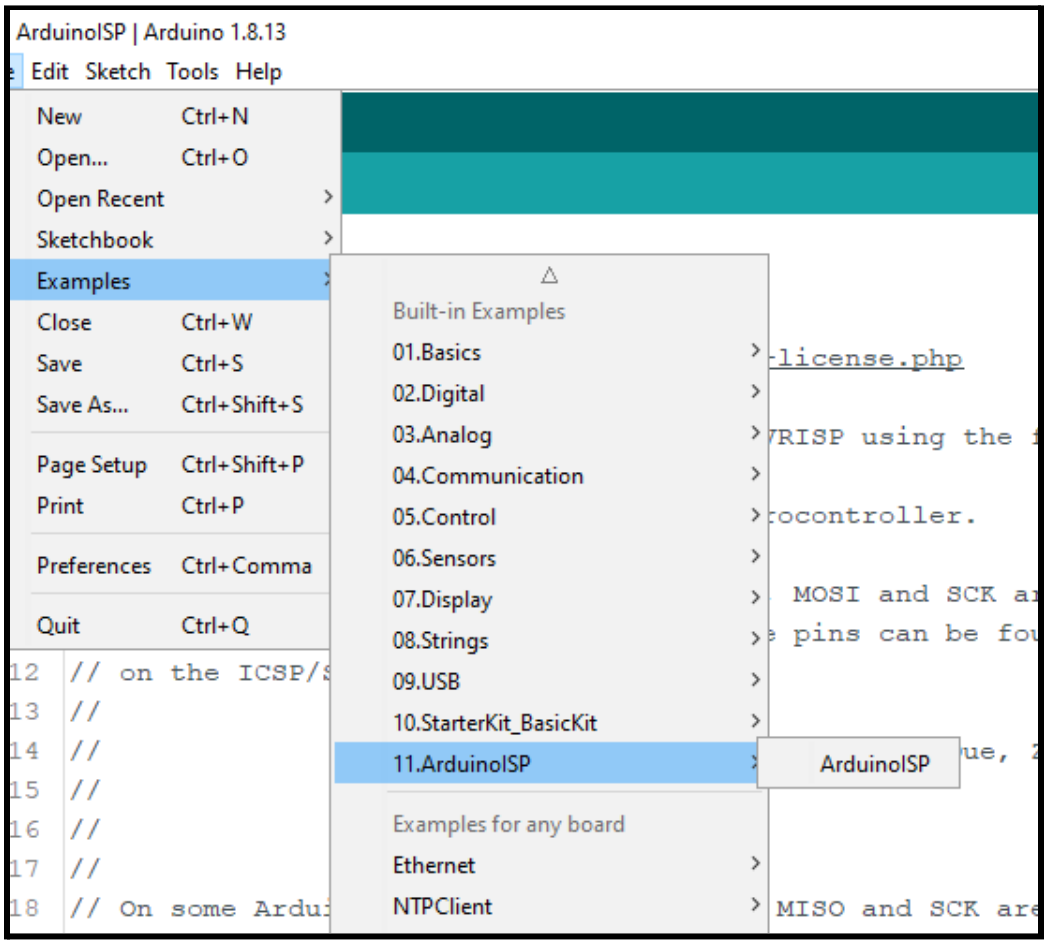
Safmet Programming Guide :

Programming for Atmega328p :

The following are the 3 steps needed to upload code in any **Atmega328p** .

Step 1

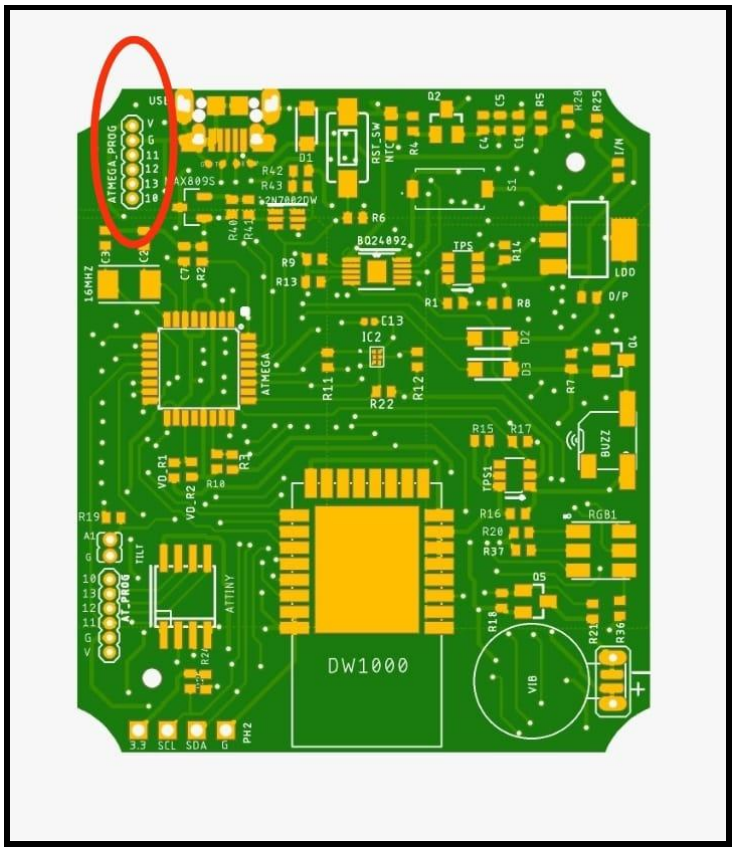
A. The nano programmer first programmed an atmega328p ic with an ArduinoISP code.



B. Connect capacitor 220uf 16v between RST and GND pin of arduino nano .
C. Connect spi pins from nano to 6pin molex connector

Step 2

A. First connect Arduino Nano Programmer to ATMEGA_PROG on SafmetPCB
B. The nano programmer red wire vcc pin should connect to V pin at ATMEGA_PROG on Safmet PCB

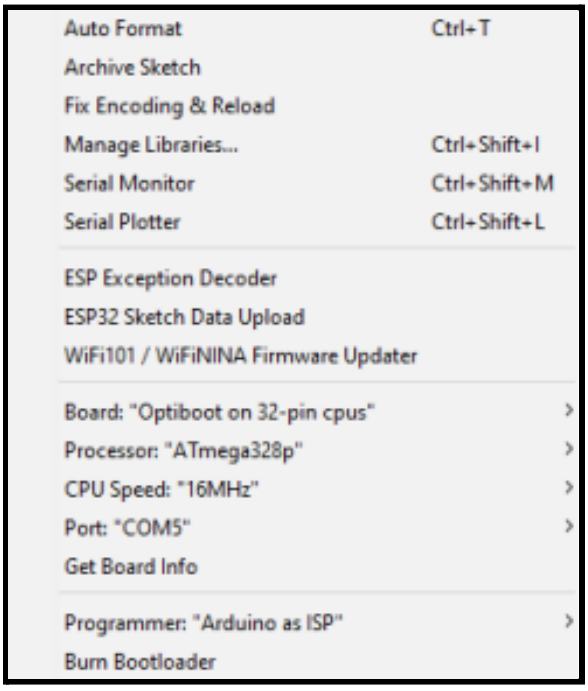


Step 3

a. Burn Bootloader with the following settings

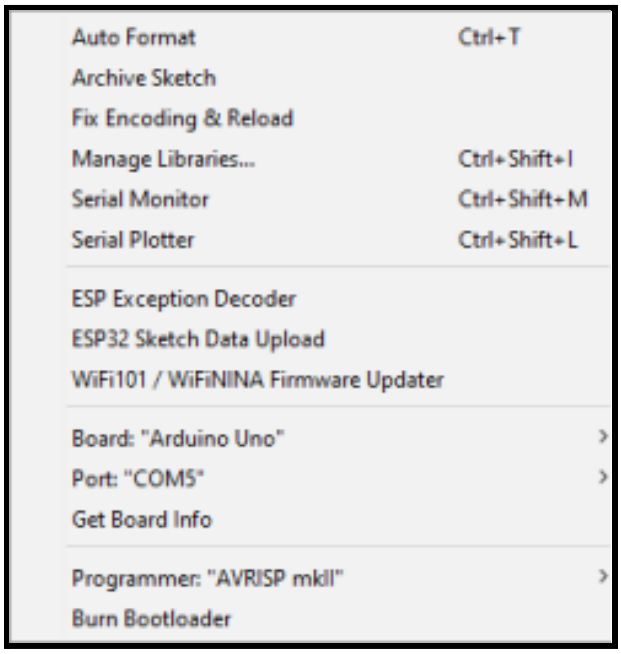
To bootload the atmega328p with the Arduino IDE, first, we need to add the optiboot Support to the Arduino IDE. For that, go to ***File > Preferences*** and add the below link in the Additional Boards Manager URLs and click 'OK.'

https://github.com/Optiboot/optiboot/releases/download/v8.0/package_optiboot_optiboot-additional_index.json



To burn Optiboot onto an Arduino board
1. Select board type
2. Connect the board to an ISP programmer
My programmer is nano programmer
3. Choose Optiboot board type to upload a sketch-here using "Optiboot on 32-pins cpus"
4. Menu Tools - Burn Bootloader

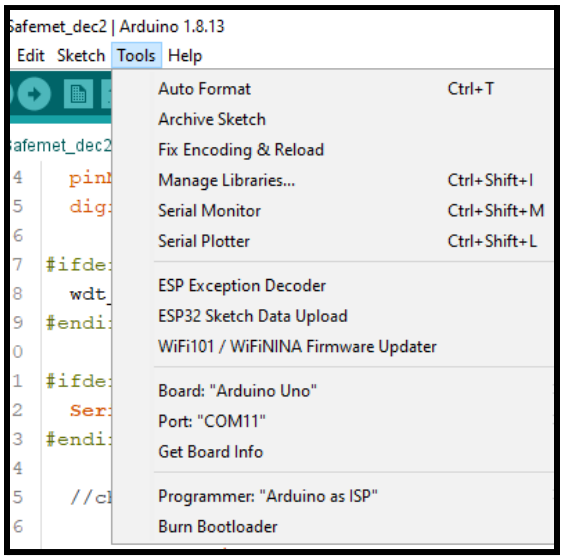
b. If successful, go to the next step,else check wiring
c. Now remove the nano programmer, connect USB - TTL with the USB connector to the PCB. If the battery is not charged, R5 should be bypassed and provided with a power supply from USB. In case the battery is charged, don't power the PCB from USB and desolder R5.
d. Then program with the following settings



e. Then upload the code and while uploading press reset twice.

Note: If USB - TTL is not working then program with nano programmer only by selecting below options and then upload the code(Safmet.ino) by option upload using a programmer.

Step 1



Programming for ATtiny :

The following are the steps needed to upload code in **Attiny**.

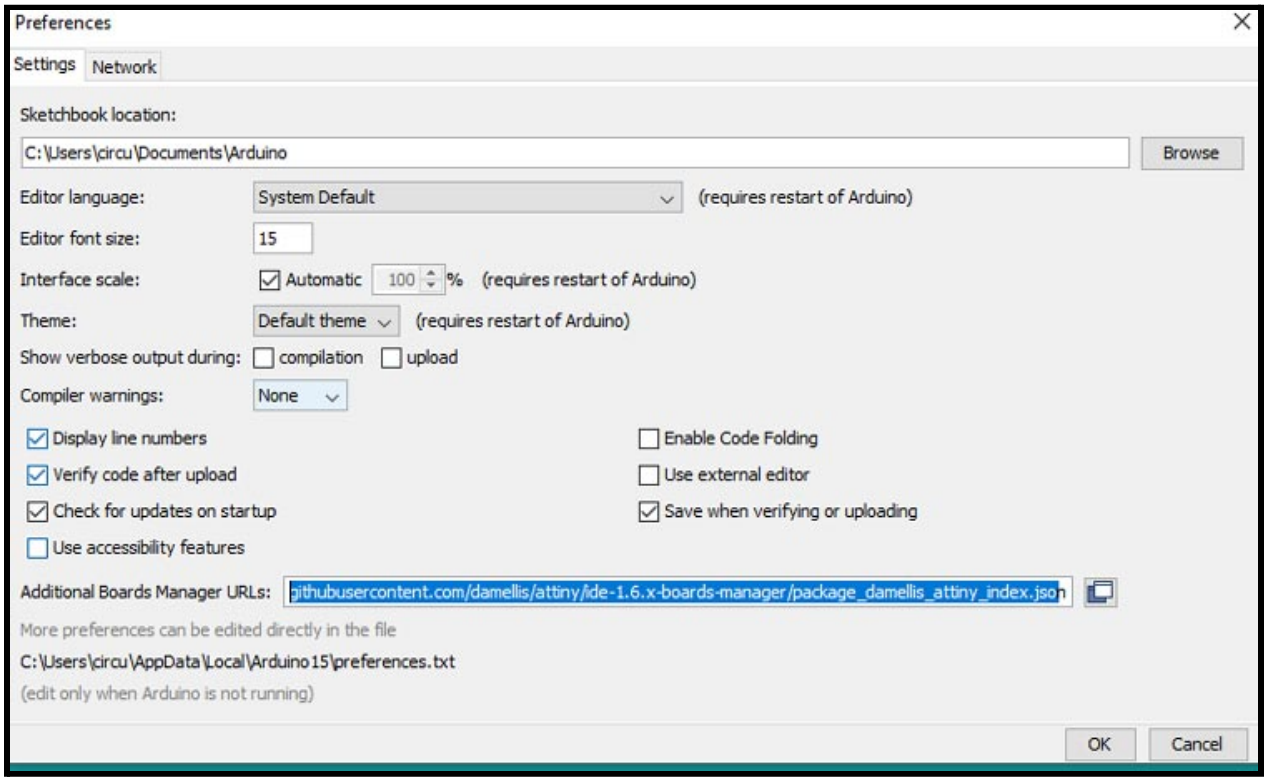
1. **For ATtiny85**

Step 1 :

Install hardware package for ATtiny85

To program the ATtiny85 with Arduino IDE, first, we need to add the ATtiny85 Support to Arduino IDE. For that, go to ***File > Preferences*** and add the below link in the Additional Boards Manager URLs and click 'OK.'

https://raw.githubusercontent.com/damellis/attiny/ide-1.6.x-boards-manager/package_damellis_attiny_index.json



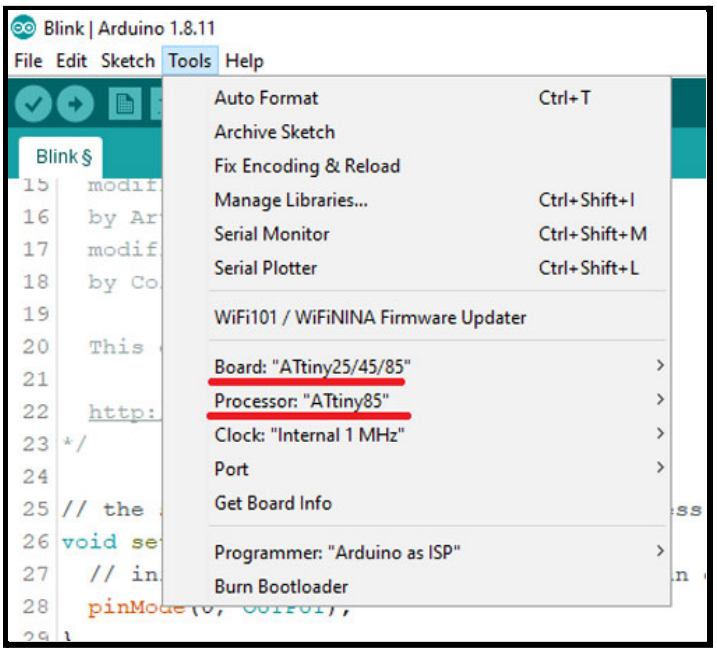
Step 2

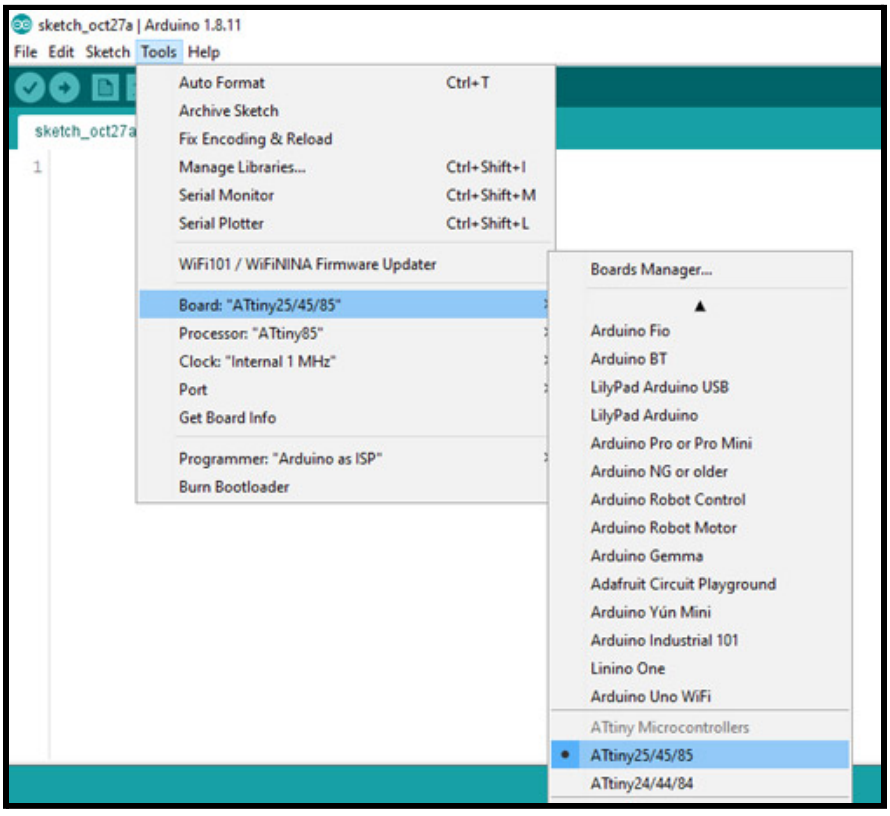
After that, go to ***Tools > Board > Board Manager*** and search for 'attiny' and install the latest version.

Step 3

After installing it, now you would be able to see a new entry in the Board menu titled **'Attiny25/45/85'**.

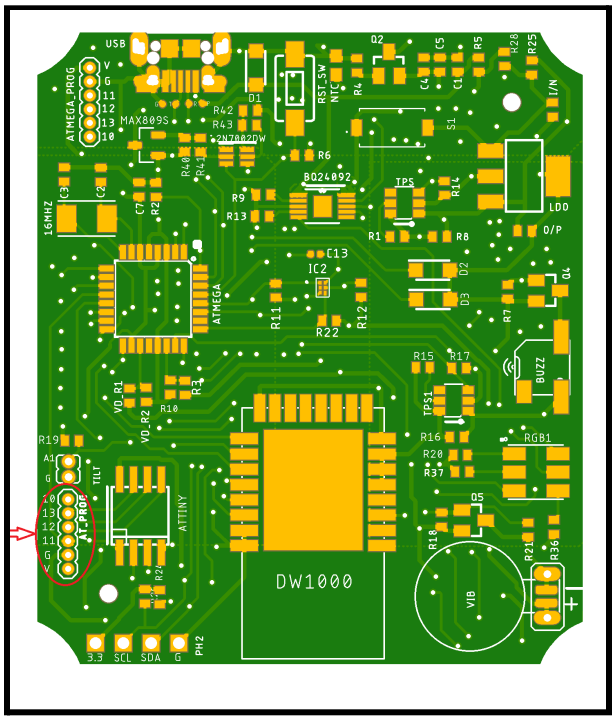
Now go to **Tools -> Board** and select “Attiny25/45/85”, then select **ATtiny85** under **Tools > Processor**.





Step 4

- First connect Arduino Nano Programmer to AT_PROG on Safmet PCB
- The nano programmer red wire vcc pin should connect to V pin at AT_PROG on Safmet PCB.



Step 5

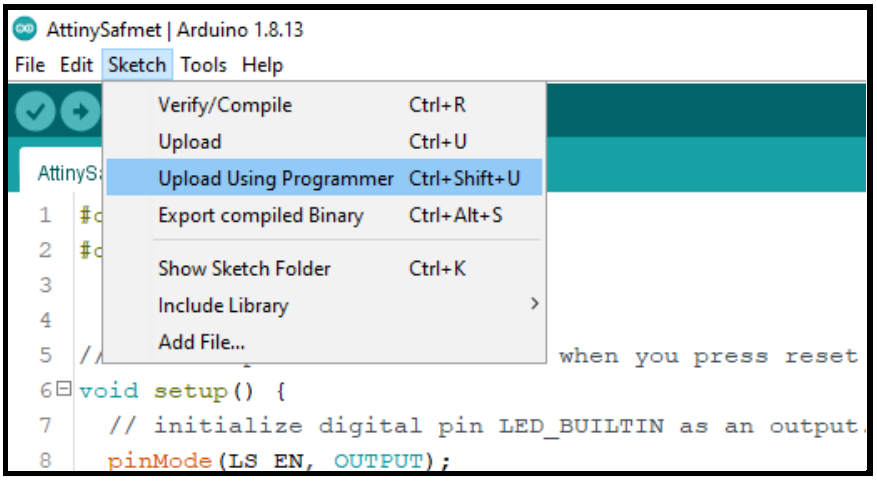
Burn Bootloader

(You only need to do this once per chip)

Go to Arduino IDE -> Tools -> Burn Bootloader

Step 6

Then program with a nano programmer only by selecting the above options and then upload the code(AttinySafmet.ino) by option upload using a programmer

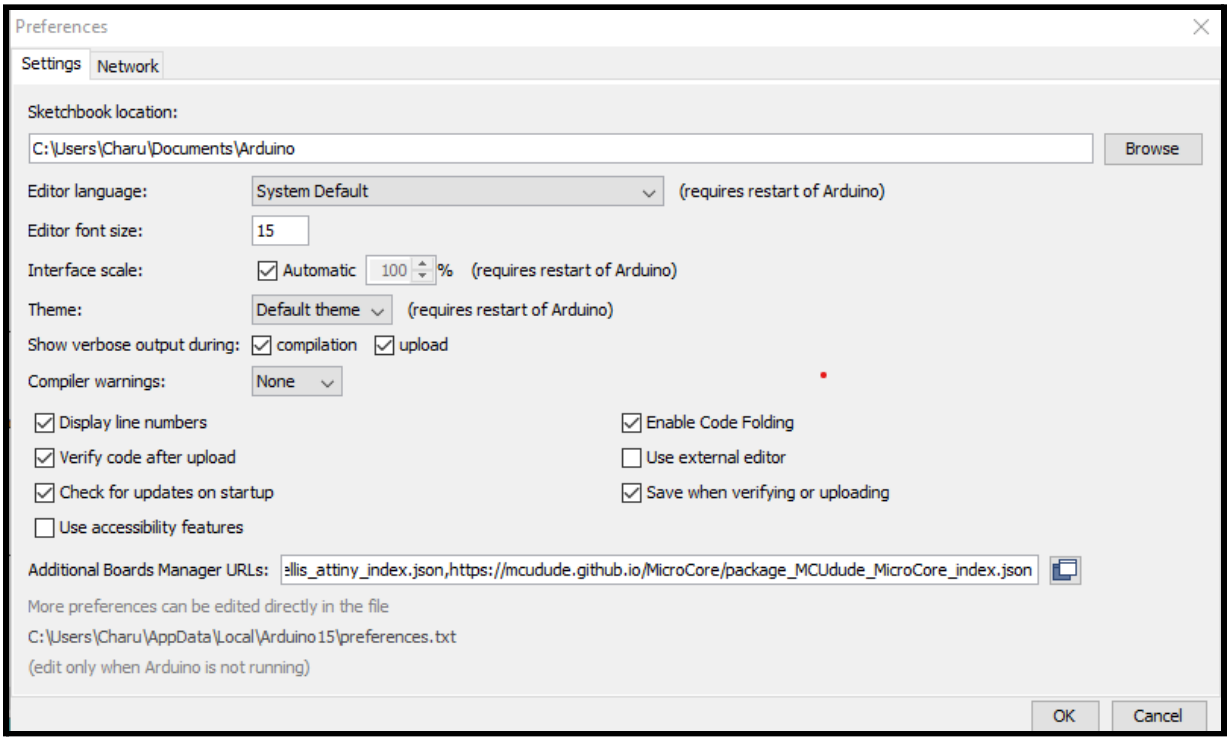


2. For ATtiny13A

Step 1

Install hardware package for ATtiny13A

To program the ATtiny85 with Arduino IDE, first, we need to add the ATtiny85 Support to Arduino IDE. For that, go to ***File > Preferences*** and add the below link in the Additional Boards

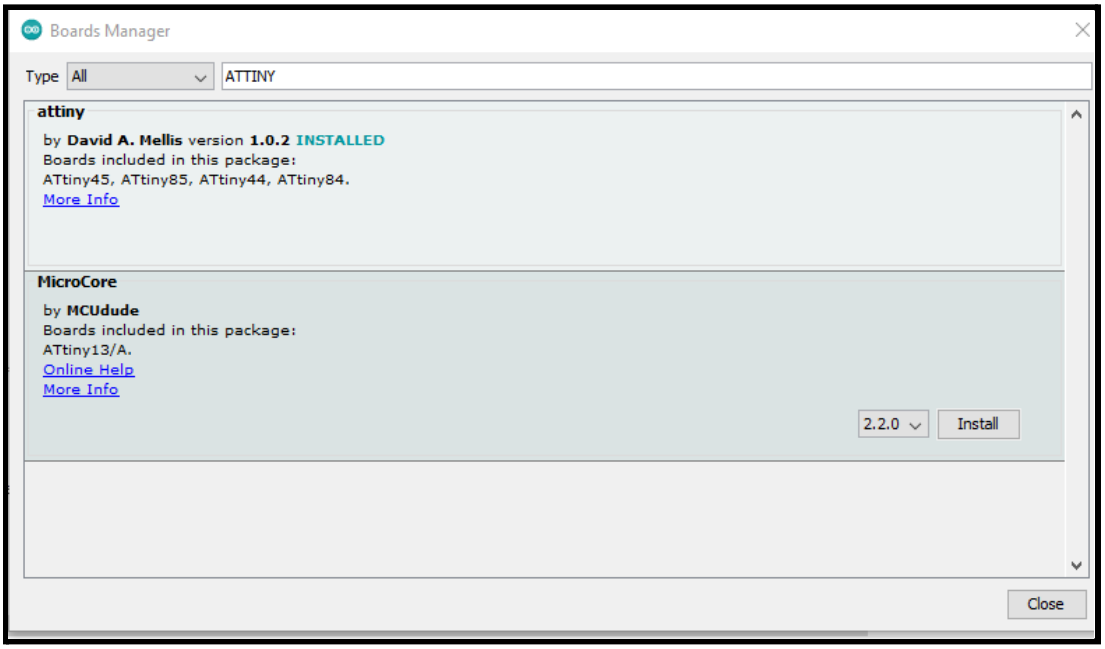


Manager URLs and click 'OK.'

https://mcudude.github.io/MicroCore/package_MCUdude_MicroCore_index.json

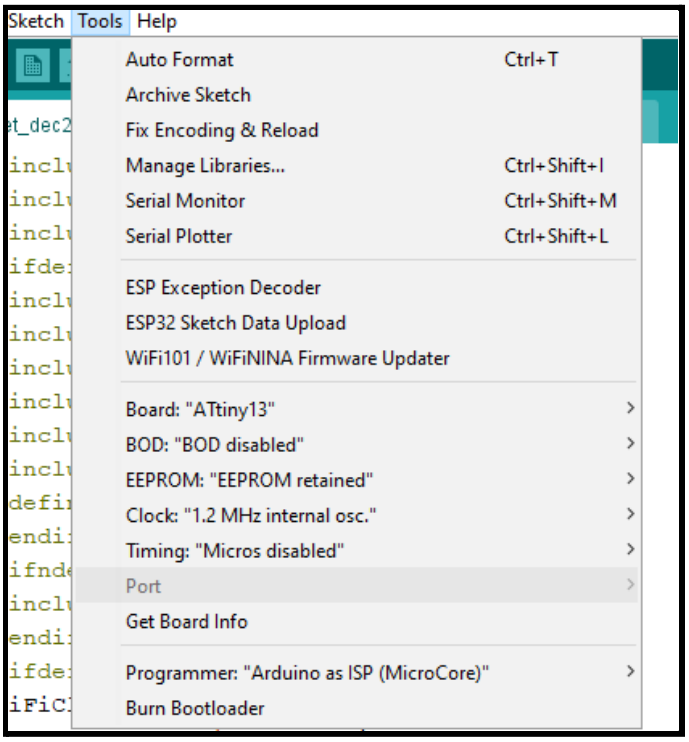
Step 2

Open Arduino IDE -> Tools -> Board -> Boards manager. Find MicroCore and click Install.



Step 3

Go to Arduino IDE -> Tools and select the options below:



Step 4

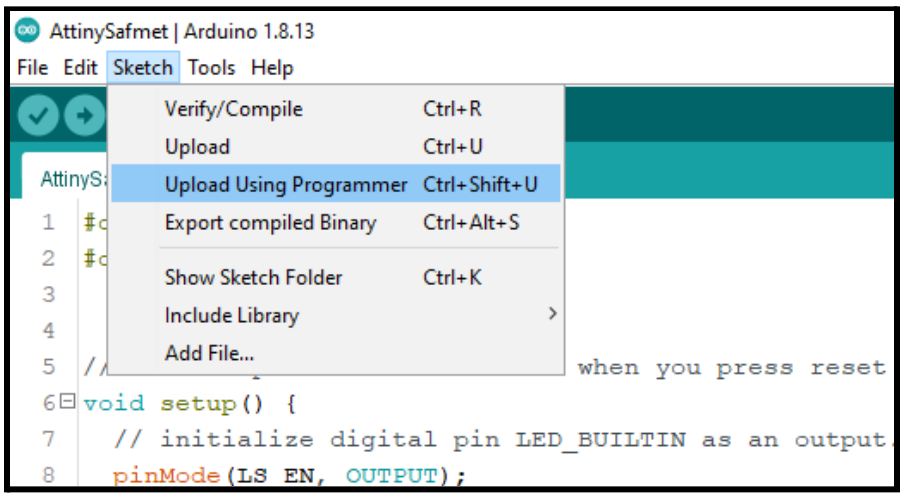
Burn Bootloader

(You only need to do this once per chip)

Go to Arduino IDE -> Tools -> Burn Bootloader

Step 5

Then program with a nano programmer only by selecting the above options and then upload the code(AttinySafmet.ino) by option upload using a programmer.



Voltages check points:

1. ***Check all the voltages-***

    A. First connect the charger(5volt) to the charging connector.Then check the power is getting at the pwr pin of the connector.It should be more than 4volt.
    B. Then check the voltage at charging ic input pin.It should be more than 4volt then check voltage at charging ic output pin it should be more than 3 volt
    C. Check at Q4 we are getting input voltage
    D. Then check the voltage at LDO at input pin it should be same as input voltage like more than 3volt and output pin it should be 3.2volt
    E. Then check the voltage at tps input pin it should be 3.2 volt and at output pin it should be 3.2volt
    F. Check the atmega328p vcc pin should get the 3.2 volt
    G. Check the attiny input pin voltage is 3.2volt and at output pin the voltage should be 2.8volt
    H. Check the dwm vcc pin getting 3.2 volt

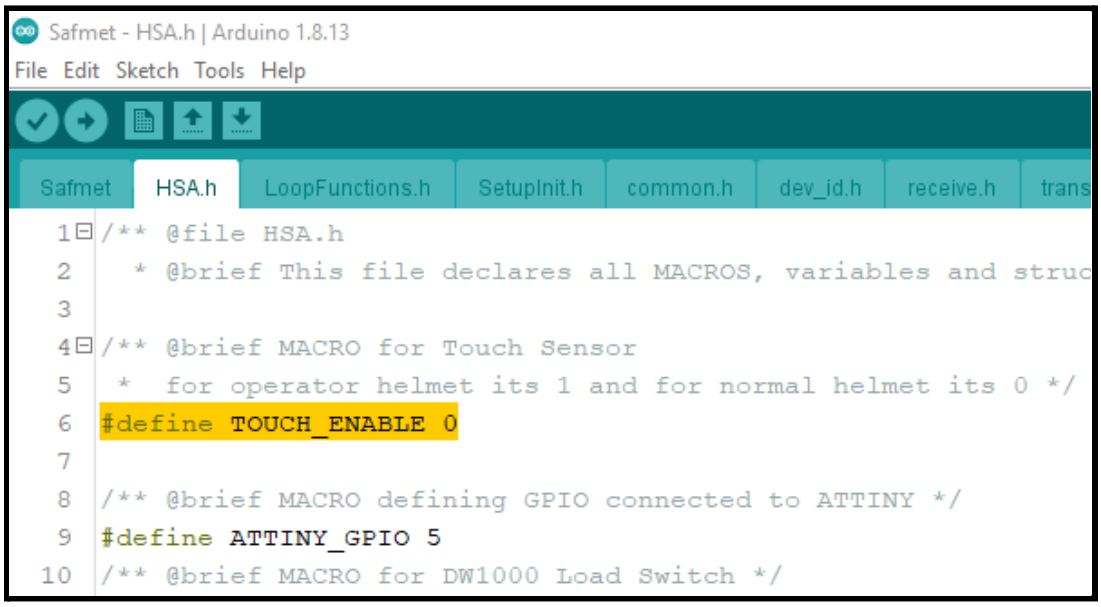
2. ***If above testing falls the respected solution is as follows-***

A. Solder connector properly avoids shorting between each pin of the connector.check charger also is giving output voltage.
B. If charging is getting input but not output voltage:
    a. then check if the battery thermistor is working properly or not for that first remove the white wire at the battery and solder the 10k resistor to the NTC at pcb.
    b. if it is still not working, change the battery and check it once.
    c. Check charging ic pins should be properly soldered,avoid shoring between each pin.
    d. Check the r9 and r13 resistor values should be proper.
    e. If still its not working then change charging ic
C. Check Q4 shorted properly
D. Check LDO pins shorting.if we are not getting output voltage at ldo Replace LDO and check once
E. Check tps pins shorting.check which tps we are usingTPS22917 or TPS22918 upload code according because for both logic is reversed.if still types not working change tps with new one
F. Tps output should be 3.2 volt then only at atmega at vcc pin we will get 3.2volt
G. Check attiny pins should not short.voltages if not getting proper check with tps
H. Check shorting of dwm1000

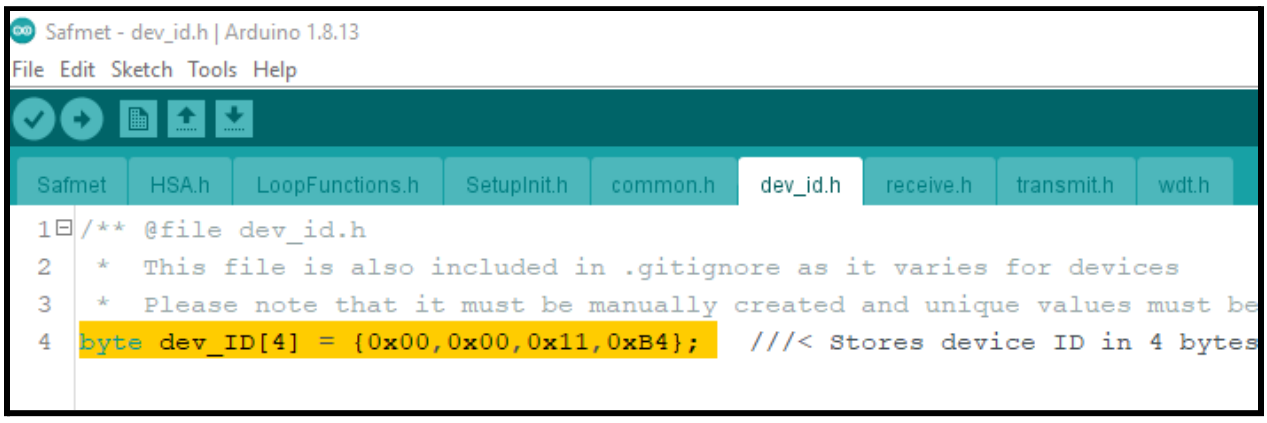
Firmware edits:

1. Normal helmet:

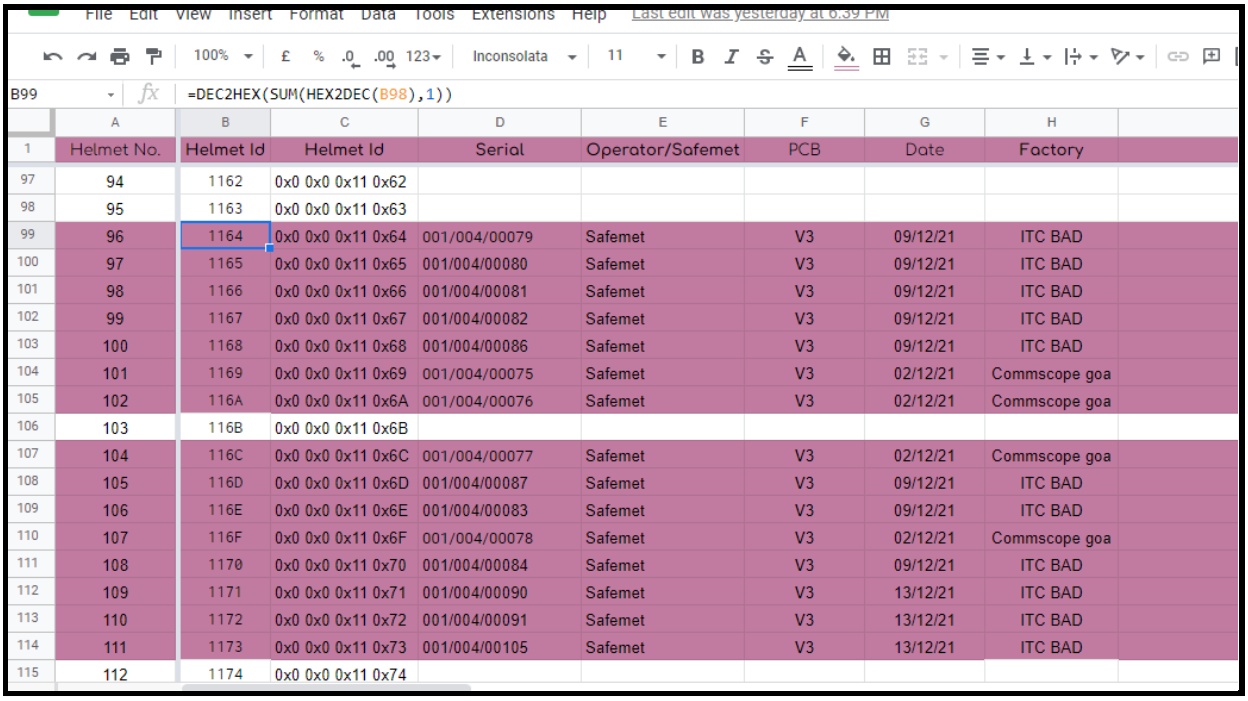
a. Change the TOUCH_ENABLE value in HSA.h file
for normal helmet its 0
#define TOUCH_ENABLE 0



b. Change Safmet UID in dev_id.h file



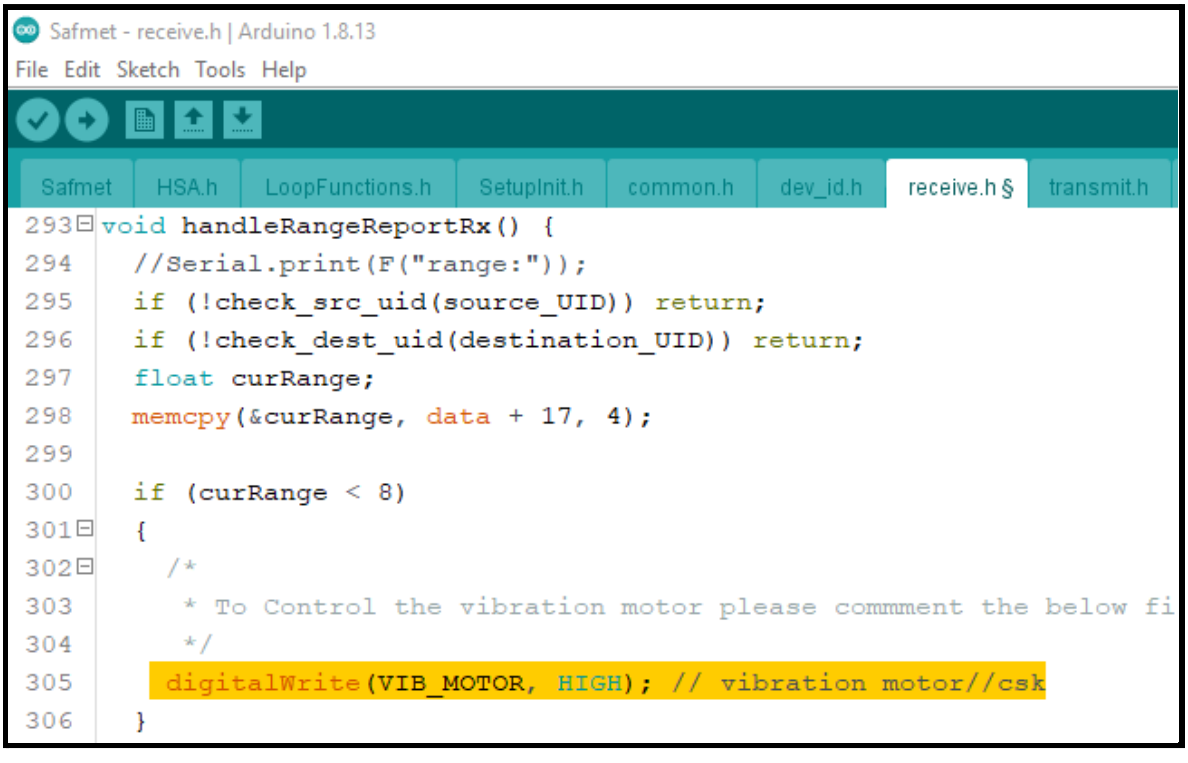
Note: Take Safmet UID's from deployment sheet



=DEC2HEX(SUM(HEX2DEC(B98),1))

	A	B	C	D	E	F	G	H
1	Helmet No.	Helmet Id	Helmet Id	Serial	Operator/Safemet	PCB	Date	Factory
97	94	1162	0x0 0x0 0x11 0x62					
98	95	1163	0x0 0x0 0x11 0x63					
99	96	1164	0x0 0x0 0x11 0x64	001/004/00079	Safemet	V3	09/12/21	ITC BAD
100	97	1165	0x0 0x0 0x11 0x65	001/004/00080	Safemet	V3	09/12/21	ITC BAD
101	98	1166	0x0 0x0 0x11 0x66	001/004/00081	Safemet	V3	09/12/21	ITC BAD
102	99	1167	0x0 0x0 0x11 0x67	001/004/00082	Safemet	V3	09/12/21	ITC BAD
103	100	1168	0x0 0x0 0x11 0x68	001/004/00086	Safemet	V3	09/12/21	ITC BAD
104	101	1169	0x0 0x0 0x11 0x69	001/004/00075	Safemet	V3	02/12/21	Commscope goa
105	102	116A	0x0 0x0 0x11 0x6A	001/004/00076	Safemet	V3	02/12/21	Commscope goa
106	103	116B	0x0 0x0 0x11 0x6B					
107	104	116C	0x0 0x0 0x11 0x6C	001/004/00077	Safemet	V3	02/12/21	Commscope goa
108	105	116D	0x0 0x0 0x11 0x6D	001/004/00087	Safemet	V3	09/12/21	ITC BAD
109	106	116E	0x0 0x0 0x11 0x6E	001/004/00083	Safemet	V3	09/12/21	ITC BAD
110	107	116F	0x0 0x0 0x11 0x6F	001/004/00078	Safemet	V3	02/12/21	Commscope goa
111	108	1170	0x0 0x0 0x11 0x70	001/004/00084	Safemet	V3	09/12/21	ITC BAD
112	109	1171	0x0 0x0 0x11 0x71	001/004/00090	Safemet	V3	13/12/21	ITC BAD
113	110	1172	0x0 0x0 0x11 0x72	001/004/00091	Safemet	V3	13/12/21	ITC BAD
114	111	1173	0x0 0x0 0x11 0x73	001/004/00105	Safemet	V3	13/12/21	ITC BAD
115	112	1174	0x0 0x0 0x11 0x74					

c. To make the vibration motor ON/OFF do uncomment/comment respectively below the line in the receive.h file.
For normal helmets, the vibration motor is ON(you can OFF also as per client requirements).



Safmet - receive.h | Arduino 1.8.13

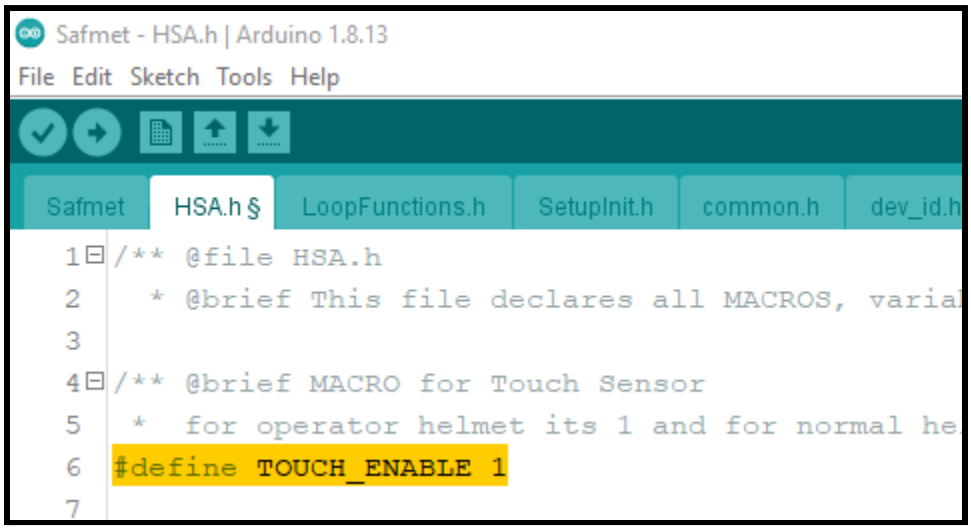
File Edit Sketch Tools Help

Safmet | HSA.h | LoopFunctions.h | SetupInit.h | common.h | dev_id.h | receive.h § | transmit.h

```
293 void handleRangeReportRx() {
294   //Serial.print(F("range:"));
295   if (!check_src_uid(source_UID)) return;
296   if (!check_dest_uid(destination_UID)) return;
297   float curRange;
298   memcpy(&curRange, data + 17, 4);
299
300   if (curRange < 8)
301   {
302     /*
303      * To Control the vibration motor please commment the below fi
304      */
305     digitalWrite(VIB_MOTOR, HIGH); // vibration motor//csk
306   }
```

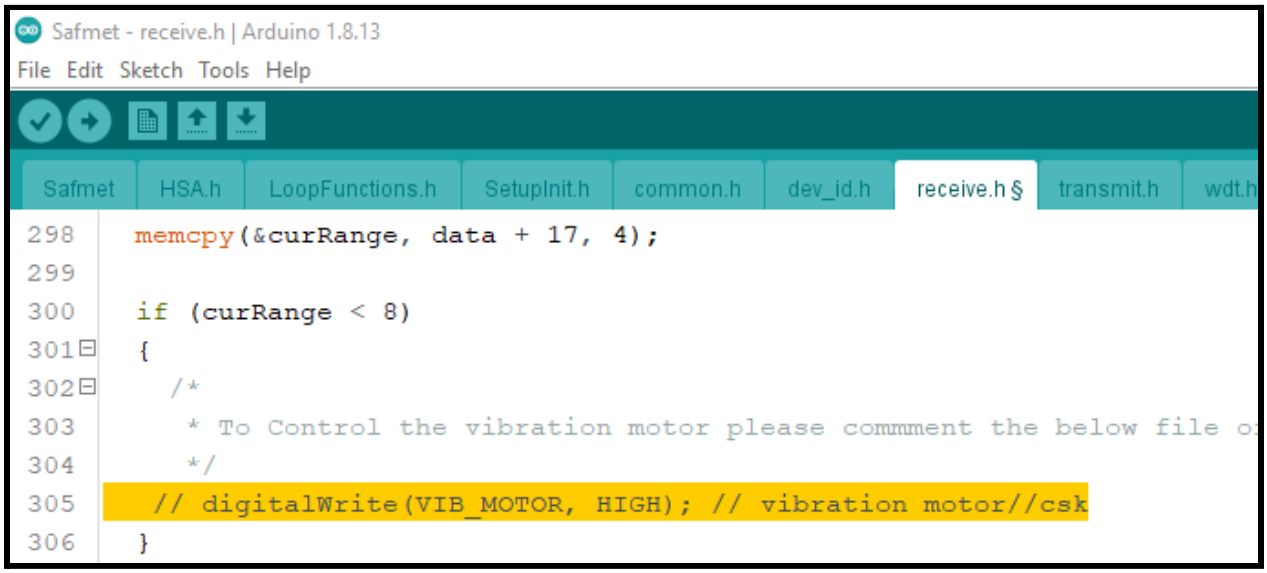
2. *Operator helmet:*

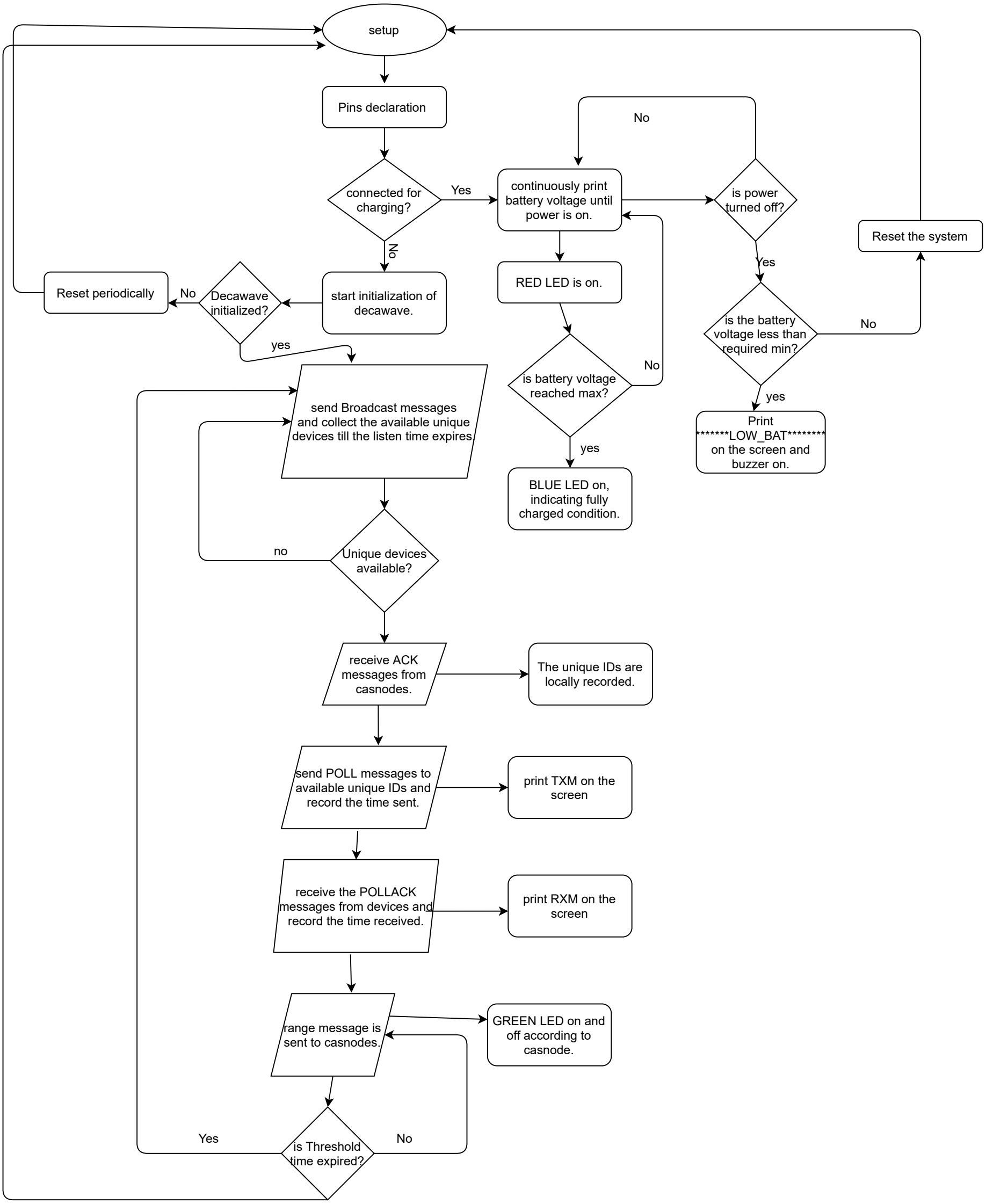
a. Change the TOUCH_ENABLE value in HSA.h file
For a Operator helmet its 1
#define TOUCH_ENABLE 1



b. Same as mentioned in normal helmets.

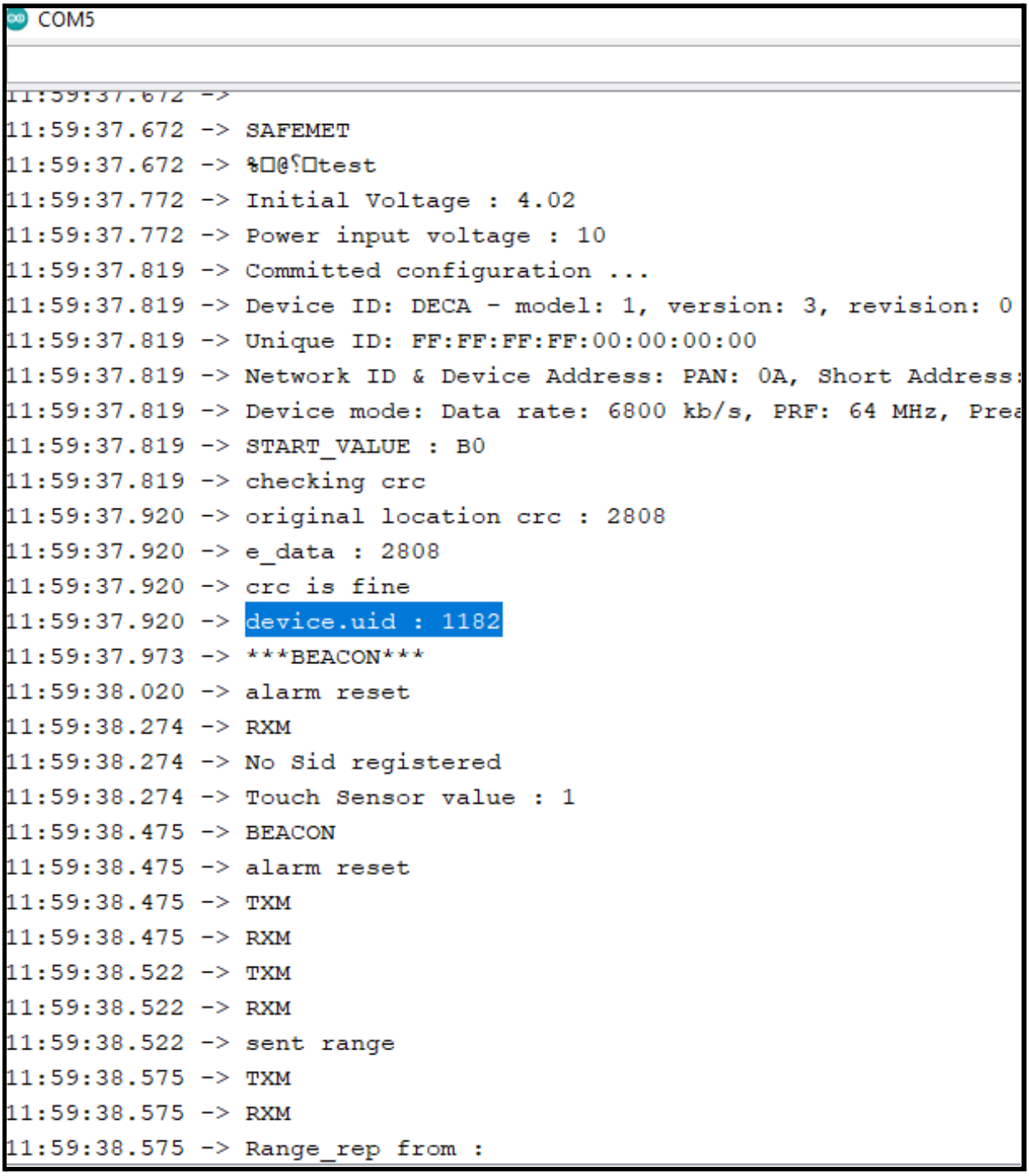
c. To make the vibration motor ON/OFF do uncomment/comment respectively below the line in the receive.h file.
for operator helmets, make the vibration motor OFF.



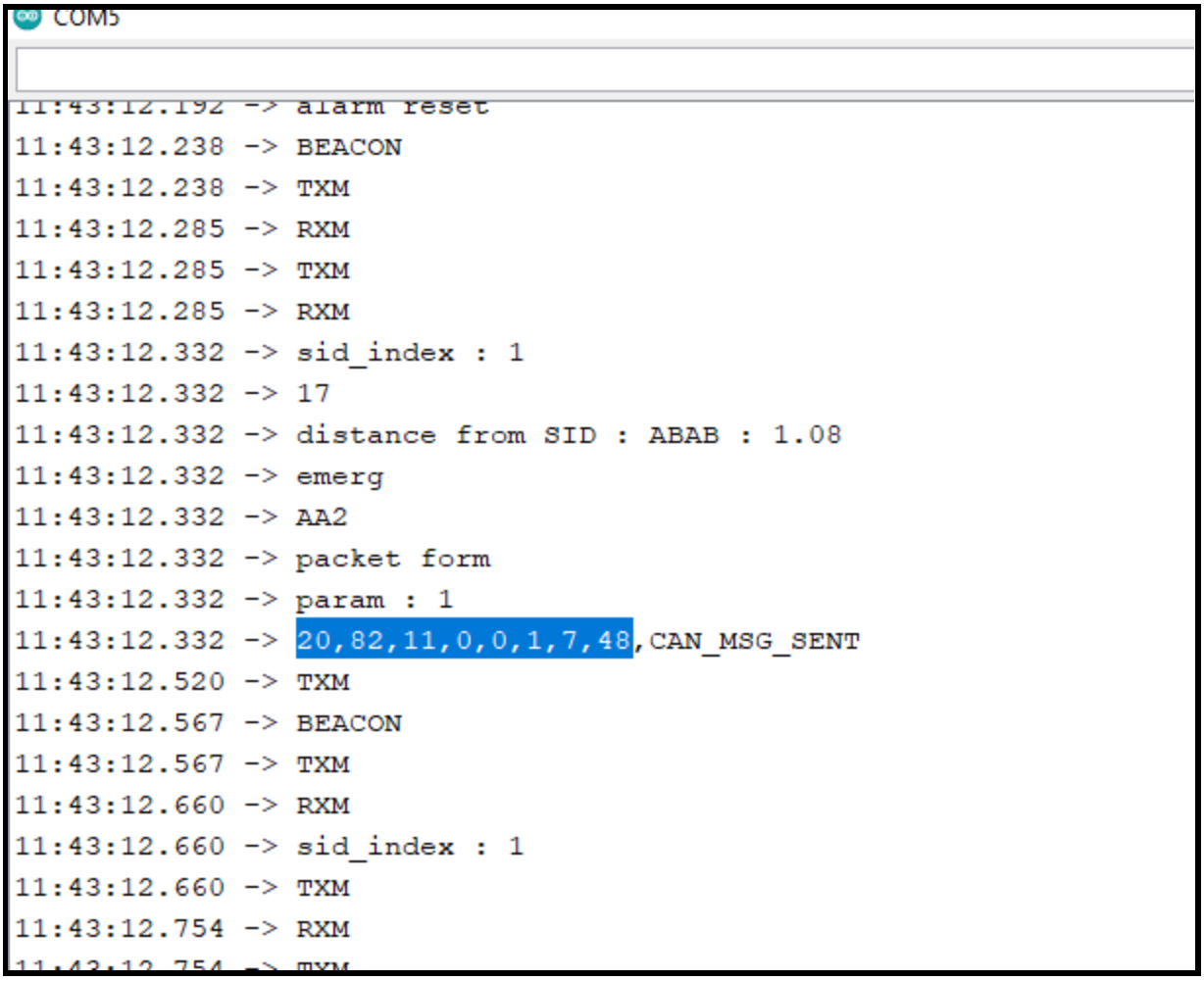

setup
Pins declaration
connected for charging?
Yes
No
continuously print battery voltage until power is on.
No
is power turned off?
Reset the system
Yes
RED LED is on.
is the battery voltage less than required min?
No
yes
Print *******LOW_BAT******** on the screen and buzzer on.
is battery voltage reached max?
No
yes
BLUE LED on, indicating fully charged condition.
start initialization of decawave.
Decawave initialized?
No
Reset periodically
yes
send Broadcast messages and collect the available unique devices till the listen time expires
Unique devices available?
no
receive ACK messages from casnodes.
The unique IDs are locally recorded.
send POLL messages to available unique IDs and record the time sent.
print TXM on the screen
receive the POLLACK messages from devices and record the time received.
print RXM on the screen
range message is sent to casnodes.
GREEN LED on and off according to casnode.
Yes
is Threshold time expired?
No

Let's take the safmet UID as 1182

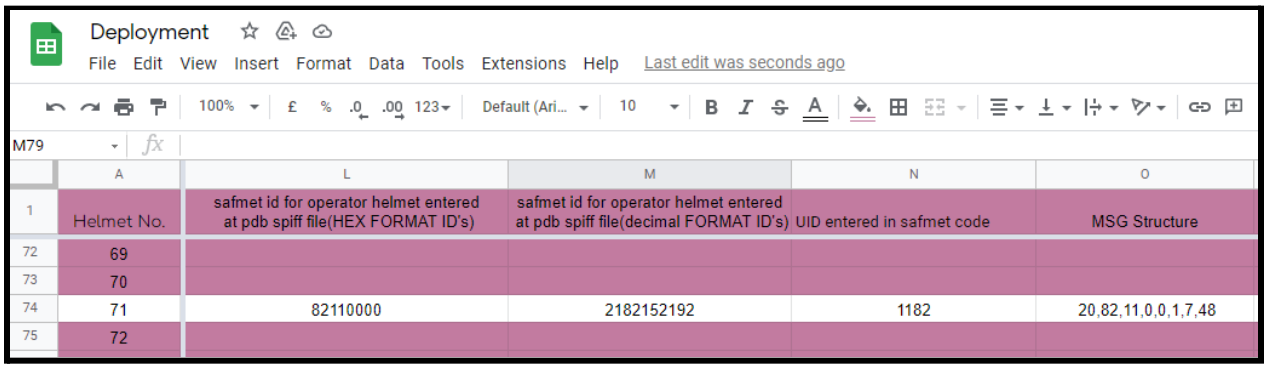
1. Checking safmet uid at its serial print



2. Checking safmet uid at CASnode serial print



3. Checking safmet uid at pdb serial print



	A	L	M	N	O
1	Helmet No.	safmet id for operator helmet entered at pdb spiff file(HEX FORMAT ID's)	safmet id for operator helmet entered at pdb spiff file(decimal FORMAT ID's)	UID entered in safmet code	MSG Structure
72	69				
73	70				
74	71	82110000	2182152192	1182	20,82,11,0,0,1,7,48
75	72				

- Enter id in reverse format in decimal format in pdb spiff to detect it as operator helmet

```
{
"NAM": "PDB.Deb",

"ssid": "SAFFR_UP",
"pass": "HACK@LAB",
"ip": 246,

"HED": 4,
"HAD": 6,
"MED": 4,
"MAD": 6,

"HEL": 1,
"HDS": 3,
"HL1": 2182152192,
"HL2": 1796276224,
"HL3": 1259405312,


"KEY":1,
"AC": 1,
"SB": 1,
"ALR": 1,
"EMR": 1,
"HMI": 1,
"SLK":5000,
"OTA":0,
"BRK": 5000,
"BYP": 5000,
"DBG": false
}
```

- Serial print for normal helmet at pdb side for safmet uid 1182

```
17:56:58.399 -> #%1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> &1
17:56:58.399 -> *
17:56:58.499 -> ed : 20, 82, 11, 0, 0, 2, 5, 48,
17:56:58.499 -> 0x10
17:56:58.499 -> CAS - EMR 1 SENT on 46
17:56:58.499 -> Emergency from 20 --> HLMT $1182 @2.50m
17:56:58.598 -> ed : 22, 46, 45, 0, 0, E0, 40, 0,
```

- Serial print for operator helmet at pdb side for safmet uid 1182

```
17:55:46.381 -> #%1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> &1
17:55:46.381 -> *
17:55:46.448 -> ed : 23, 82, 11, 0, 0, 2, 3, 48,
17:55:46.448 -> 0x10
17:55:46.448 -> CAS - Helmet :: 821100
17:55:46.448 -> **PPE on**
```

The following changes were made to the Safmet_V3.0.2 pcb:

Touch 3pin connector added(1-GND,2-TX(touch data pin,I/O),3-T_PWR(touch supply pin,VCC))
At USB Connector TX and T_PWR pin using for touch data and supply pin respectively.
At atmega328p ic pin PC3(ADC3)using for T_PWR.
Tilt sensor removed from schematic because for low battery led we required one gpio pin.
Q1 FDN360P MOSFET added across TPS (due to unavaibility of TPS we can use this mosfet.

The following changes were made to the Safmet_P3.0.2 pcb:
Q2 mosfet placed between battery and circuit.
Resistors value replaced -r13(4.7k), r20(1.5k), and r37(1.5k).
led added(LED,PC1/ADC1) for low battery status.
Touch 3pin connector added(1-GND,2-TX(touch data pin,I/O),3-T_PWR(touch supply pin,VCC))
At USB Connector TX and T_PWR pin using for touch data and supply pin respectively.
At atmega328p ic pin PC3(ADC3)using for T_PWR.
Tilt sensor removed from schematic because for low battery led we required one gpio pin.
Q1 FDN360P MOSFET added across TPS (due to unavaibility of TPS we can use this mosfet.