IOT Development platform
User manual

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Contents

1 Abstract

This the documentation for an Open-Source IOT development platform that is modular in nature. It is built to have one essential part and two parts that are flexible in nature. The essential part is the Power Supply board which uses a 3.7V LIPO battery to power the whole system through a vertical pin bus. The Power supply board can also charge the battery and has a Buck-Boost converter to get an additional 5V voltage line out of the 3.3V voltage line that is already regulated.

Then as of now there is the Microcontroller board which has a Feather Wi-Fi development platform from Adafruit and a 2 row 90° angled header that functions as a breakout for all of the pins of the Microcontroller as well as the 5V and 3.3V power supplies with some current limiting.

And finally there is the top most board which has an OLED that is controlled via I2C, three pushbuttons and a rotary encoder with a momentary switch. This is all connected to the Feather Microcontroller.

In the following document you will find the schematics, BOM's and important tips for assembling the platform.

2 Tips for assembling

Take great care when soldering the small components labeled 'U', they have to be oriented correctly. There is a small dot on the component which should line up with the dot on the silkscreen. If you cannot see it then use a magnifying glass

There are a couple things to be aware of when assembling this platform, mainly because of the Vertical Bus system that it has. It's simply some 2.54mm pitch header pins that connect the boards together, but soldering those pins correctly so that the boards fit together can be a bit tricky. The best way that I have found is to simply put all of the headers on the boards without soldering, screwing them all together(or atleast the first two boards) with the hex-standoffs, make sure that the headers are flush with their respected PCB and then solder the headers while the whole assembly is screwed together. Then you will get a perfectly vertical alignment of all the header pins.

But before that you naturally have to solder the components, it is best to do it from the lowest component in size; Resistors, non-polarized capacitors, components labeled 'U' then finally the USB connector and polarized capacitors.

To secure the battery I used some simple double sided tape. So far this has secured it pretty well. Be also aware that you need to solder two pads on the OLED screen before soldering it to the board because we are using it in I2C mode, see the picture below.

If you want to use the frontpanel as is depicted in the section pictures for the HID Board. then it's best to solder the header pins to the OLED, put the OLED in the PCB but DON'T SOLDER, then mount the frontpanel, put the device on it's front(frontpanel downwards), check if the OLED is straight and THEN you solder it to the PCB. The pins might be short so they might not go to the other side but just solder the pins on the other side of the PCB. You can see how I did it in the pictures for the HID Board.

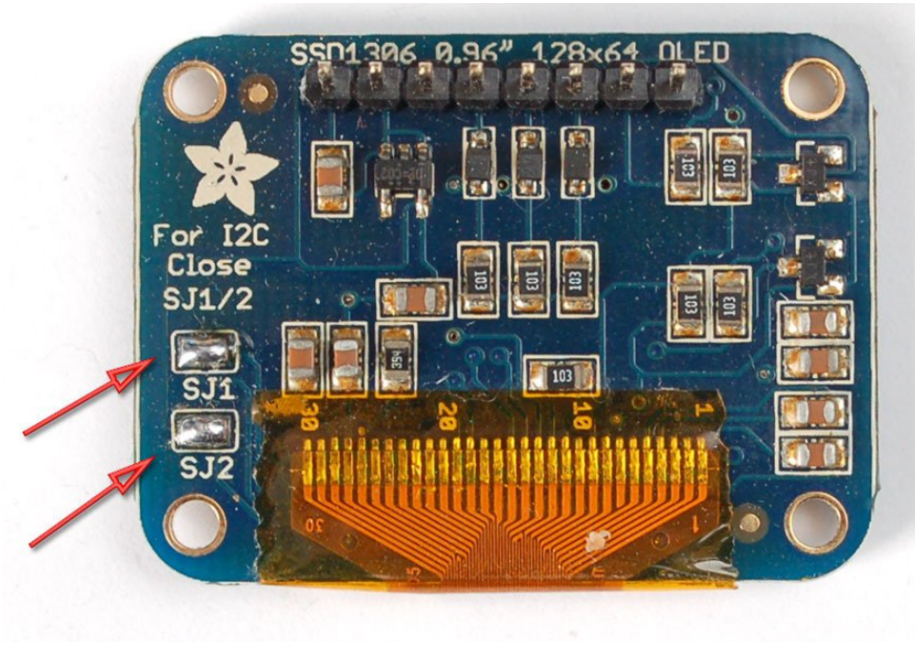

Figure 1: I2C config for OLED

3 Vertical Bus

Here is a simple depiction of the vertical bus with the current versions of the Microcontroller board and HID board.

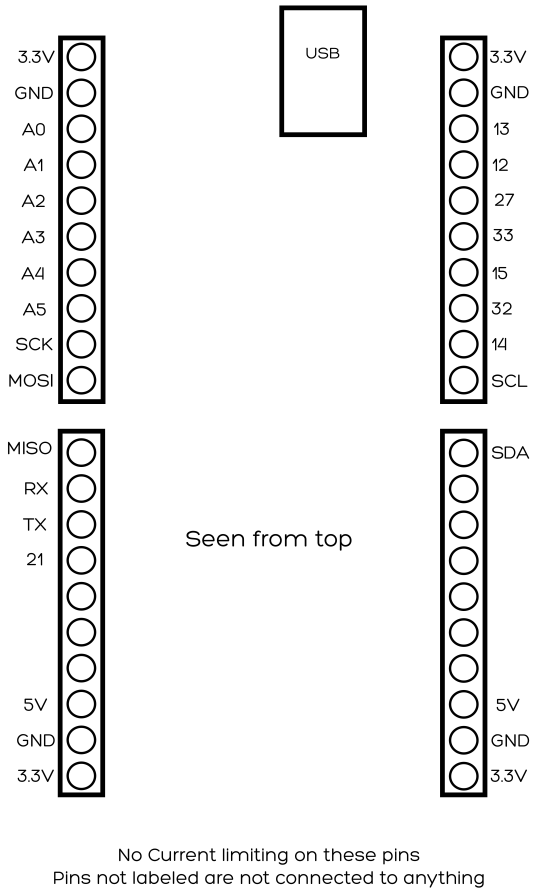

Figure 2: Pinout for Vertical bus-board

4 Battery/PSU PCB

This is the most important PCB since it powers the whole system and charges the battery. A Green LED indicates that power is ON and a red LED indicates that the battery is charging. The battery can charge while you use the system because there is a simple mosfet circuit that will disconnect the battery to the rest of the circuit except the battery charging part.

The circuit also has a 3.3V to 5V buck-boost converter to be able to have 5V for prototyping purposes or for anything that requires 5V in the system. As of now everything runs on the 3.3V power supply.
Please take note that the Buck-Boost converter chip can only supply 100mA MAX. If you go above that or near it you might risk damage to the chip.

4.1 BOM

Power Supply			
Part	**Value**	**Type**	**Package**
C1	10μ	Electrolytic Capacitor	0810
C2	10μ	Electrolytic Capacitor	0810
C3	10μ	Electrolytic Capacitor	0810
C4	100n	Capacitor	1206
C5	10μ	Electrolytic Capacitor	0810
C6	100n	Capacitor	1206
C7	10μ	Electrolytic Capacitor	0810
C8	10μ	Electrolytic Capacitor	0810
D1	MBRS130LT3	Schottky Diode	SMB
L1	10μ	Inductor	L3216C
LED1	RED	LED	3mm
LED2	GREEN	LED	3mm
Q1	FDN360P	Transistor	SSOT-3
R1	1k	Resistor	1206
R2	100k	Resistor	1206
R3	1k	Resistor	1206
R4	100k	Resistor	1206
R5	1k	Resistor	1206
R6	220k	Resistor	1206
R7	1M	Resistor	1206
R8	100k	Resistor	1206
R9	309k	Resistor	1206
S1	EG1213	E-Switch	EG1213
U1	AP2112K-3.3TRG1	CMOS LDO	SOT-25-5
U2	MCP73831	LIPO Charger	SOT-23
U3	MAX1834	Buck-Boost Converter	SOT-23-6
X1	PN61729-S	USB-B connector	PN61729-S
SV1	10 pin	Female header	2.54mm Pitch
SV2	10 pin	Female header	2.54mm Pitch
SV3	10 pin	Female header	2.54mm Pitch
SV4	10 pin	Female header	2.54mm Pitch
CN1	JST-2pin	2 Pin connector	Adafruit
Bat	1200mA 3.7V	LIPO battery	Adafruit(see links section)

4.2 Placement

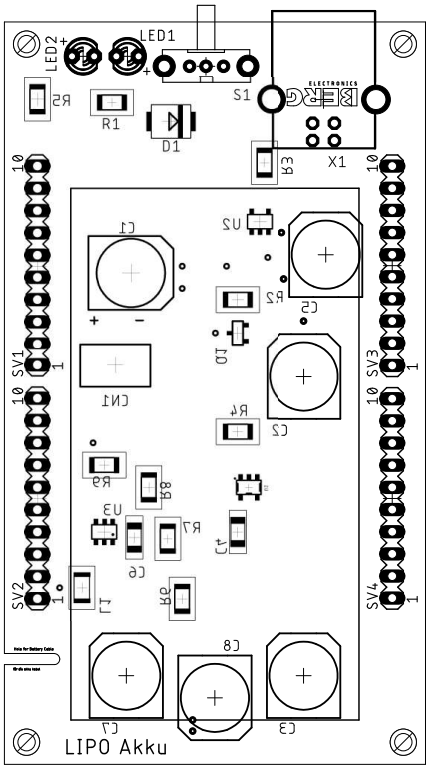

Figure 3: Placement for PSU board

4.3 Schematic

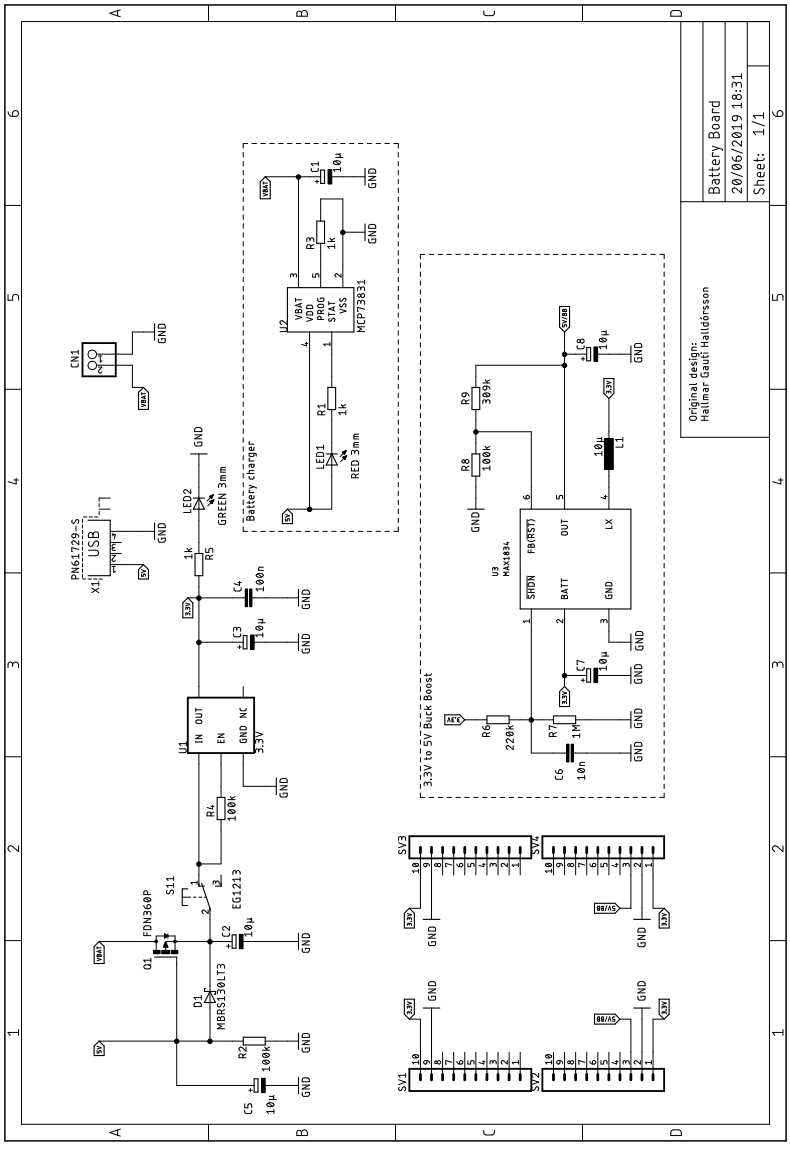

Figure 4: Schematic for PSU board

4.4 Pictures

As can be seen on the picture there is an extra capacitor soldered where the arrow is pointing. This is C8, in this prototype I forgot to put it there which resulted in the 5V to only have an RMS value of around 4.3V. With this C8 the 4.3V jumped up to 5V, as it should be.

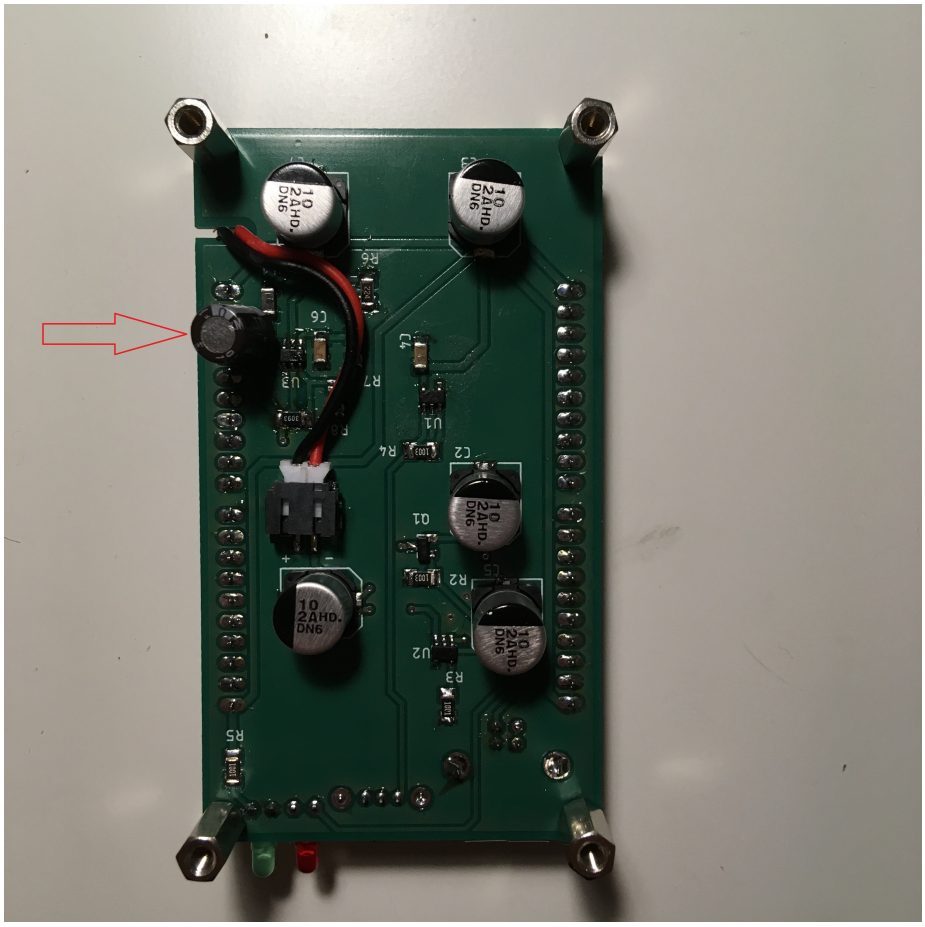

Figure 5: Photo of the prototype PCB

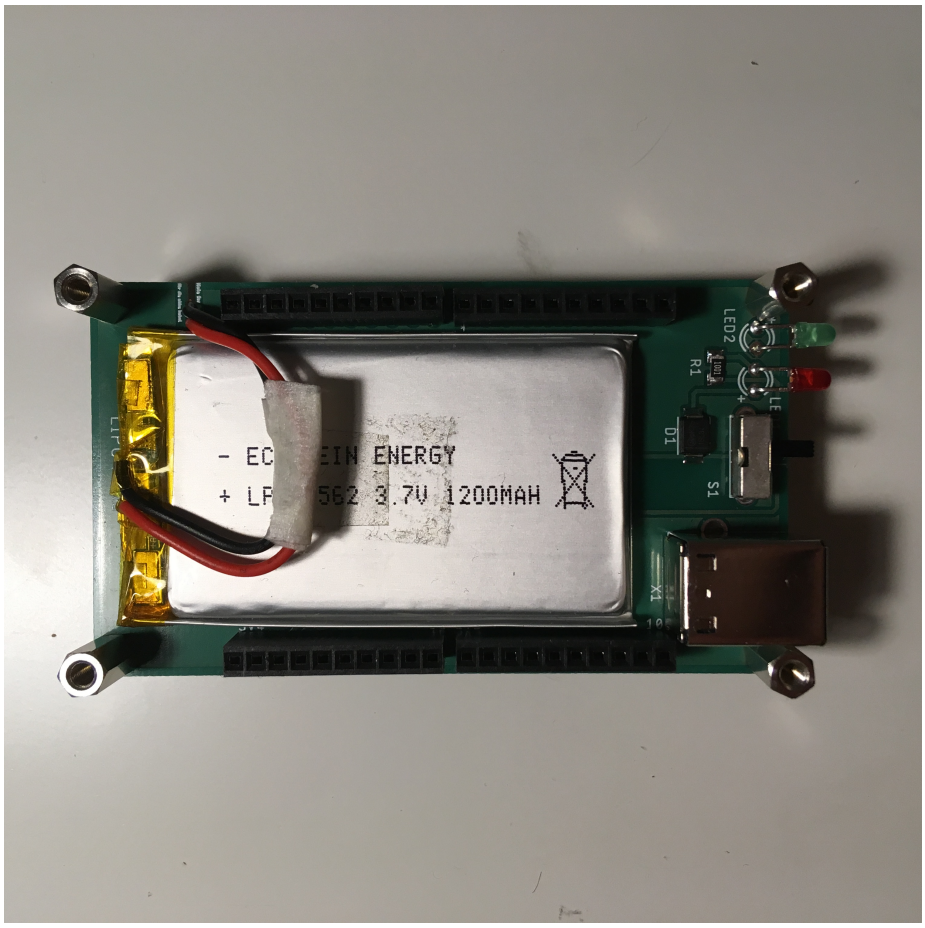

Figure 6: Photo of the prototype PCB

5 Microcontroller PCB

This is the heart of the whole system, here is the Microcontroller that handles everything. This board also has a prototype header that can be connected to a breadboard for prototyping all sorts of stuff. This header has +5V and +3.3V that are limited to 100mA and 150mA respectively.

5.1 BOM

Microcontroller			
Part	**Value**	**Type**	**Package**
R1	1k	Resistor	1206
R2	1.5k	Resistor	1206
U1	ESP32-Feather	Microcontroller	-
U2	MIC2009A	Current limiter	SOT-23-6
U3	MIC2009A	Current limiter	SOT-23-6
SV1	10 pin	Stackable header	Sparkfun: PRT-11376
SV2	10 pin	Stackable header	Sparkfun: PRT-11376
SV3	10 pin	Stackable header	Sparkfun: PRT-11376
SV4	10 pin	Stackable header	Sparkfun: PRT-11376
JP3	24 pin	2 row 90° female header	2.54mm Pitch

5.2 Placement

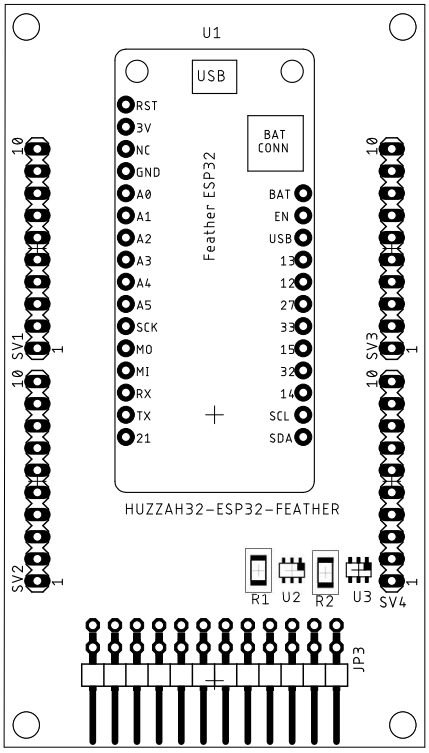

Figure 7: Placement for Microcontroller board

5.3 Schematic

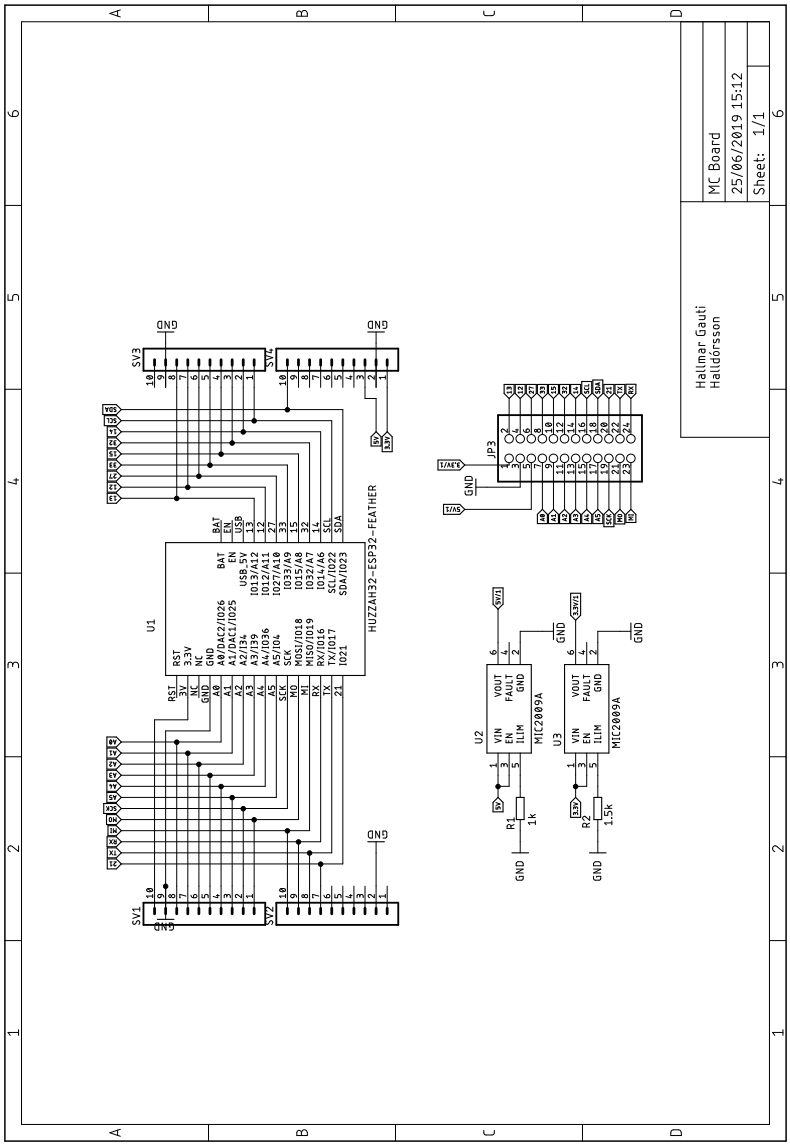

Figure 8: Schematic for Microcontroller board

5.4 Pictures

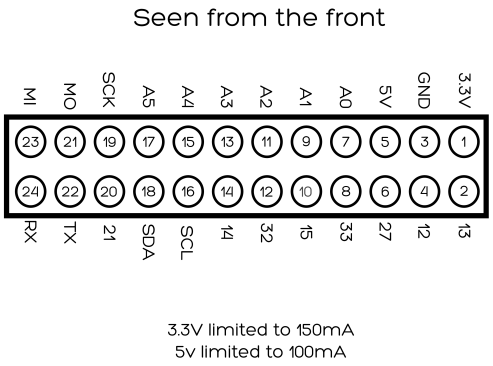

Figure 9: Pinout for Prototyping header

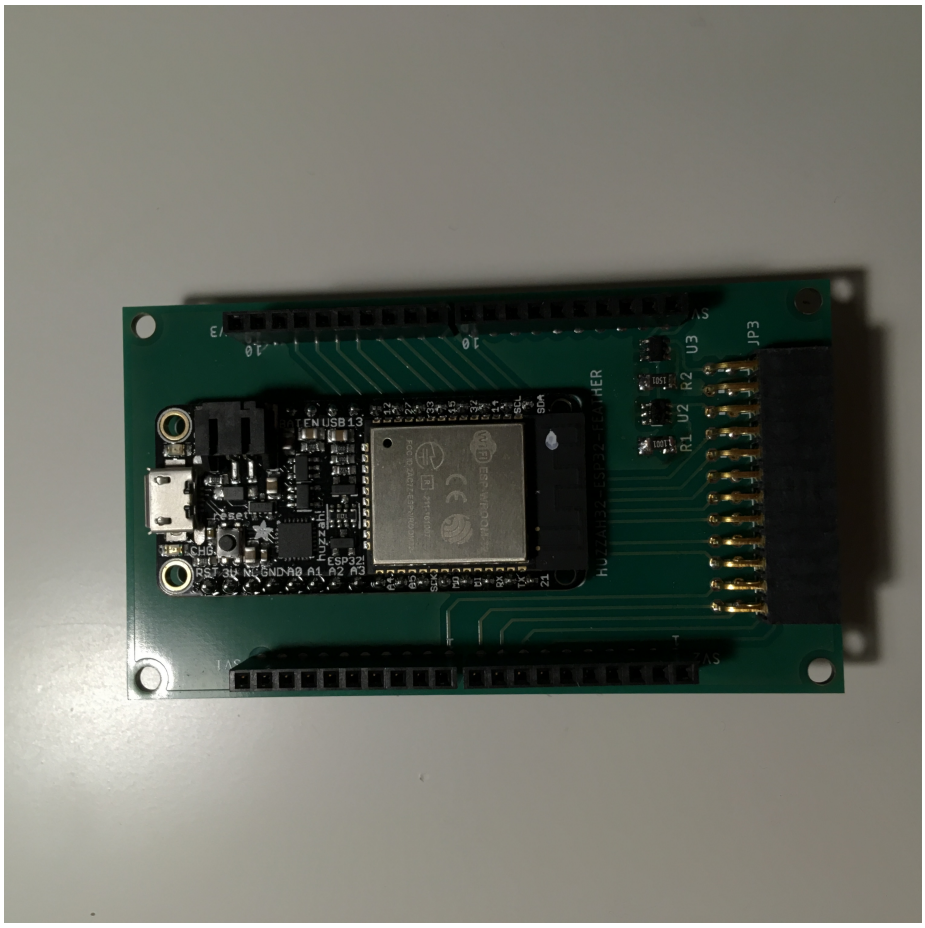

Figure 10: PCB prototype

6 HID PCB

This is the Human Interface Device PCB which has 3 switches, a rotary encoder(with a switch) and an OLED. This is all connected to the Microcontroller board. You can see to what pins each component is connected to by looking at the schematic.

6.1 BOM

HID			
Part	**Value**	**Type**	**Package**
C1	10n	Capacitor	1206
C2	10n	Capacitor	1206
R1	10k	Resistor	1206
R2	10k	Resistor	1206
R3	10k	Resistor	1206
R4	10k	Resistor	1206
R5	10k	Resistor	1206
R6	10k	Resistor	1206
R7	10k	Resistor	1206
R8	10k	Resistor	1206
S1	TL1105SPF250Q	Tactile Switch	-
S2	TL1105SPF250Q	Tactile Switch	-
S3	TL1105SPF250Q	Tactile Switch	-
SW1	PEC11R-4215F-S0024	Rotary Ecnoder	-
U$1	Adafruit: 938	OLED screen	-
SV1	10 pin	Male header	2.54mm Pitch
SV2	10 pin	Male header	2.54mm Pitch
SV3	10 pin	Male header	2.54mm Pitch
SV4	10 pin	Male header	2.54mm Pitch
JP3	24 pin	2 row 90° female header	2.54mm Pitch

6.2 Placement

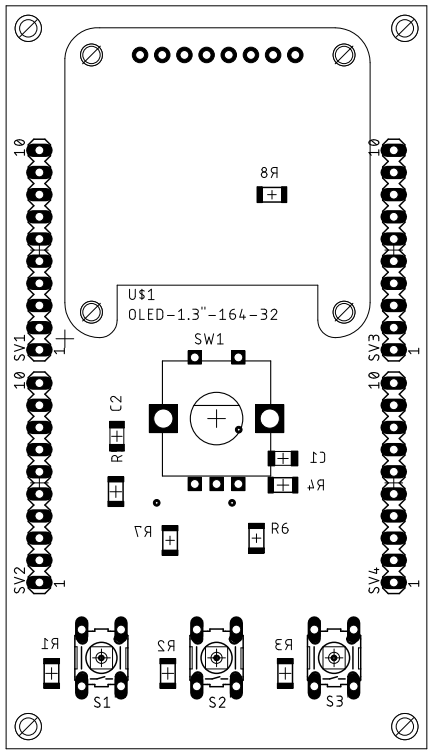

Figure 11: Placement for HID board

6.3 Schematic

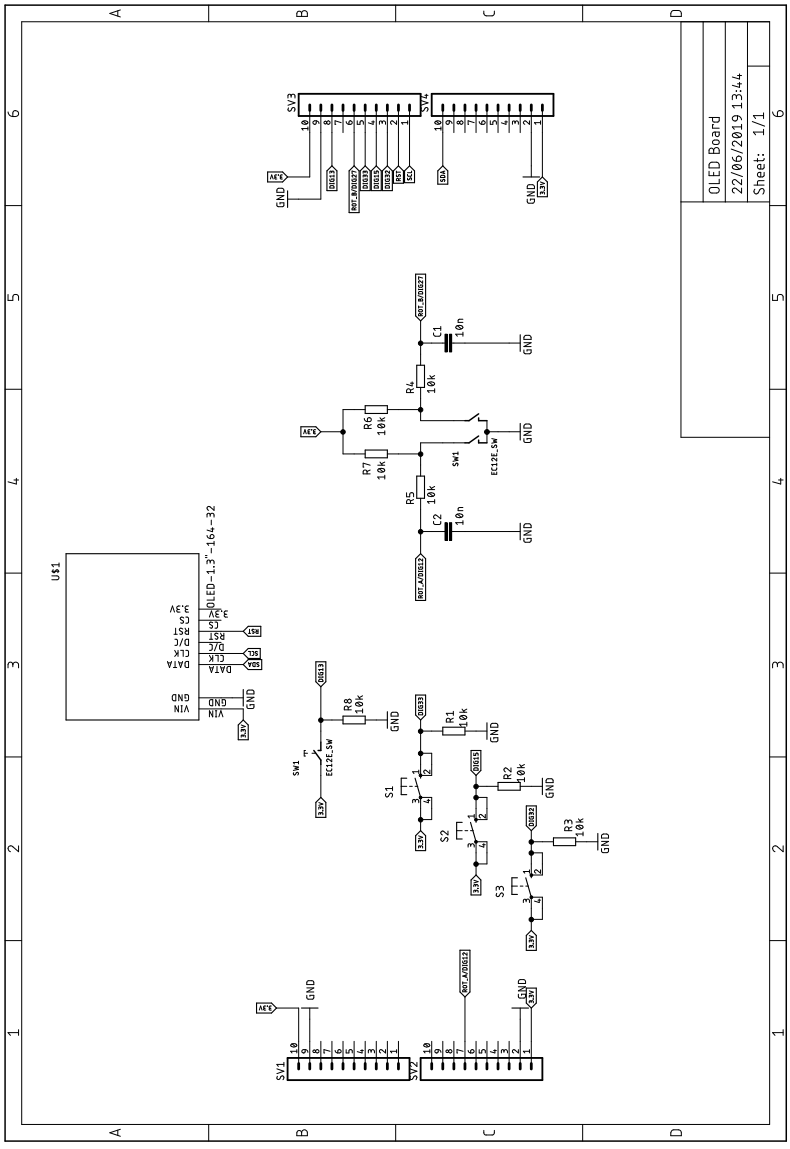

Figure 12: Schematic for HID board

6.4 Pictures

Figure 13: Photo of the prototype PCB

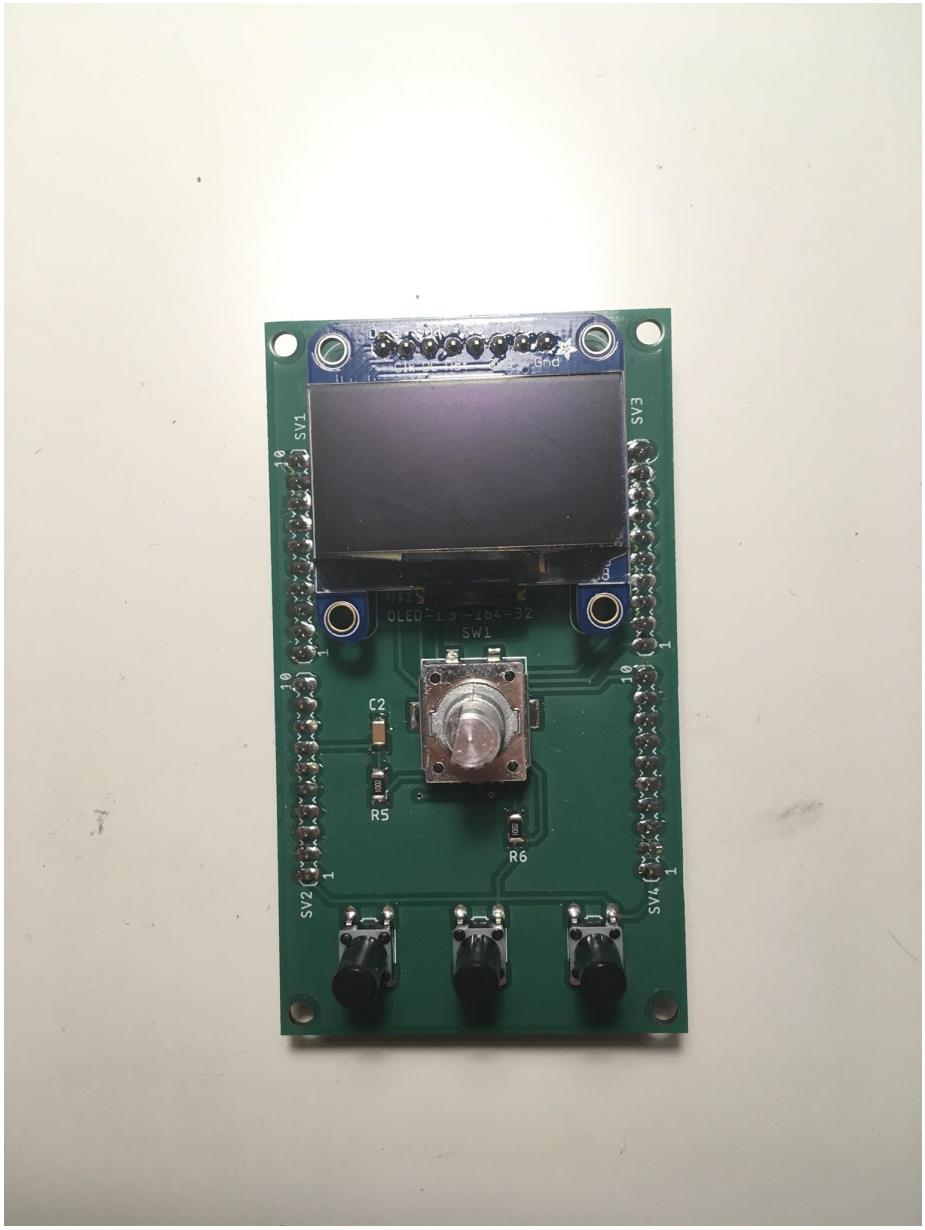

Figure 14: Photo of the prototype PCB

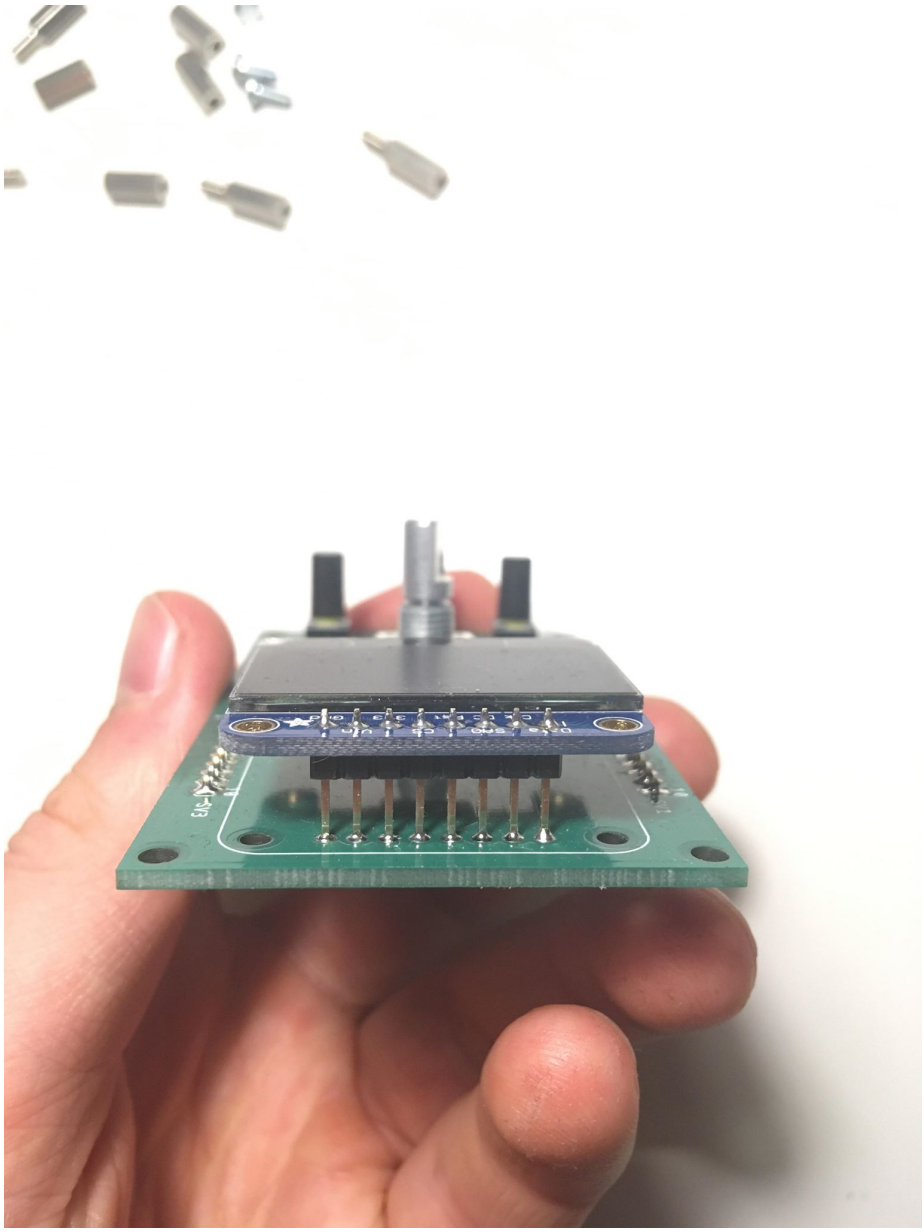

Figure 15: Photo of the prototype PCB

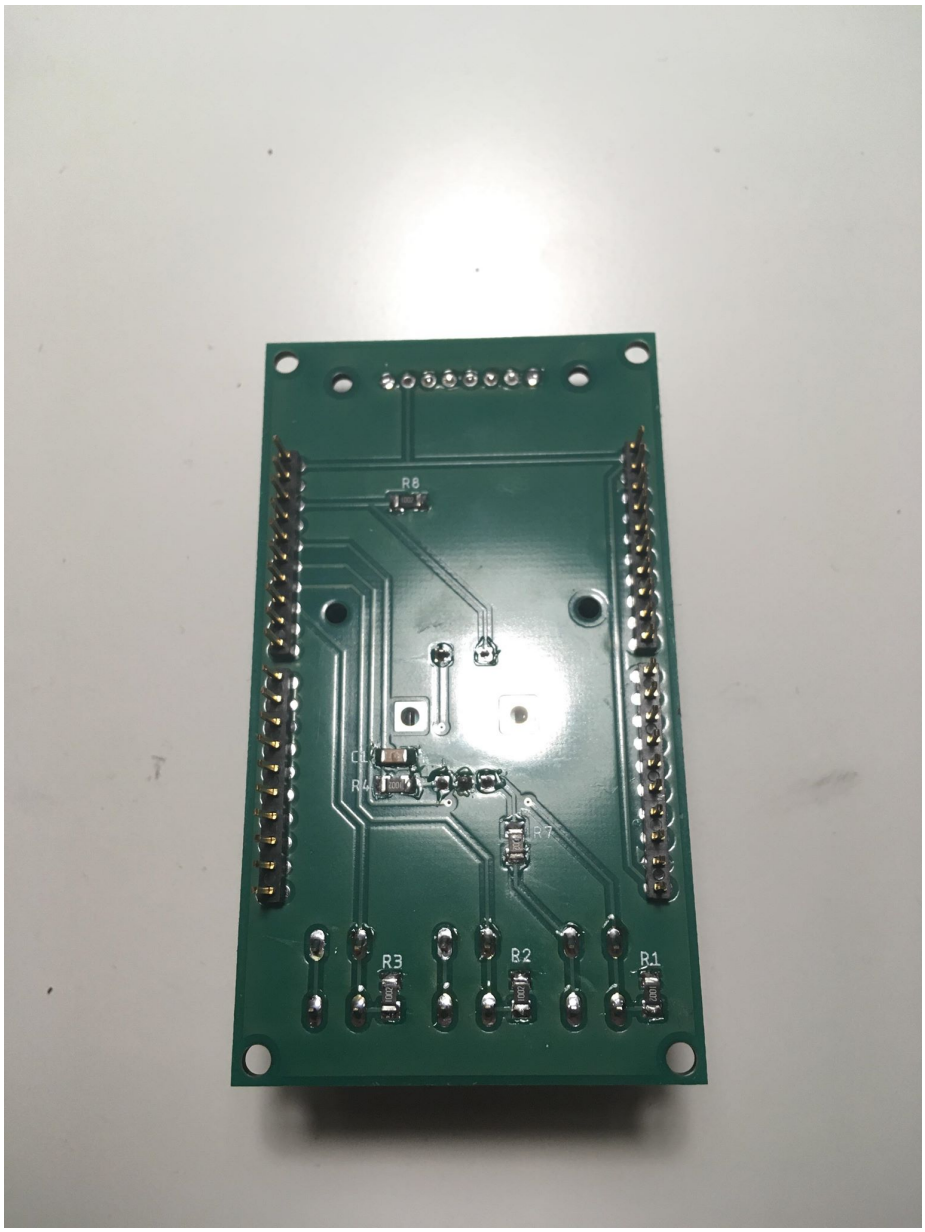

Figure 16: Photo of the prototype PCB

7 Peripherals BOM

Here is a BOM for the peripheral stuff you need, such as screws, standoffs and switch caps.

Peripherals			
Amount	**Value**	**Type**	**Mouser. No**
3	1RBLK	Cap for switches	1RBLK
8	M3 Screw 6mm	Screw	534-29311
12	11mm HEX standoff M/F	Standoff	855-R30-3001102
4	11mm HEX standoff F/F	Standoff	855-R30-1001102

8 Links

Here are some useful (clickable) links for purchasing of the LIPO battery since it cannot be purchased from mouser and some other useful links for the Microcontroller, OLED, some libraries and ect.

- OLED Display
- ESP32 Feather platform Information
- Using ESP32 Feather with Arduino IDE
- Access Point Tutorial for ESP32
- Web server Tutorial for ESP32
- Library for Adafruit OLED
- Library for Adafruit OLED(GFX)
- LIPO battery on Adafruit
- Purchase LIPO Battery in Europe
- Mouser Cart