UNIVERSITY OF CAPE TOWN

EEE3088F

Initial Design

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GROUP 18

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Git Repository

1. Github

Link to Git Repository: https://gitlab.com/g5168/eee3088f-group-project

See “Initial Design Assignment” for schematics and BOM relevant to this assignment.

Failure Management

2. Power Subsystem Failure Management

I have decided to order extra components and add traces in parallel to where the original components should be but leave it as an open circuit. In the event of trace damage or a component malfunction, I can utilise these traces in parallel. I have chosen multiple components(for each component) that could work if jlcpcb are out of stock at the time of ordering, then I can just use one of the alternatives. If there is an error in my circuit that I only detect post manufacture, I can make use of the parallel traces that I made to alter the values of components or even design a new circuit, I would just have to sever some of the other traces to make this work.

3. Sensing Subsystem Failure Management

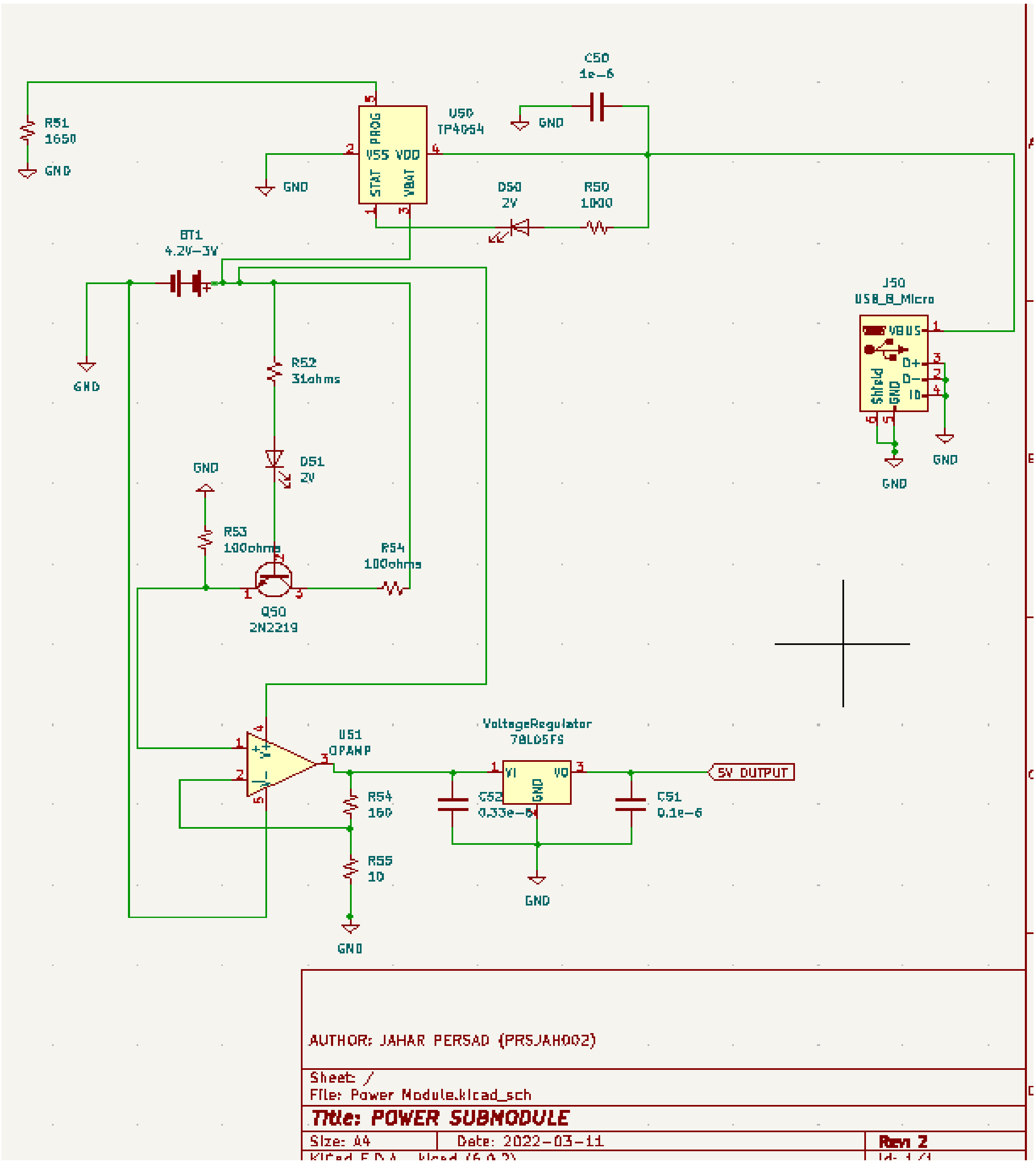
The sensing subsystem will provide additional traces to connect to through-holes that can be used in the case of trace/component destruction. Should a component fail or be destroyed, additional components can be soldered on the through-holes of the pcb. As in the power subsystem, the traces will be connected in parallel to where the original components were set. Additional components will likely be collected from other sources that can replace the ones used in the pcb, so that component replacements can be done when/where necessary. While there are no over-voltage/power preventing mechanisms in the sensing subsystem, the module is powered directly from the discovery board which has power/voltage regulators internally. Providing that the STM is operating properly, the sensing subsystem should be safe from failure.

4. Microcontroller Interfacing Failure Management

A diode is used to prevent surging to the USB mount from any external source the USB is connected to. Further, alternative EEPROM and FTDI chips have been considered and researched to ensure that in the event that the original component choices are unavailable at the time of PCB assembly, the schematics and gerbers can be updated for manufacturing. In the event that the AT24C256C-SSHL-T EEPROM is not available, there are M24C02-WMN6TP chips available which have the same amount of storage space and are also cheaper and will fit into the budget. In the case that the CH340C FTDI chip is unavailable, it is likely that the CH340G will be available. However, this chip would also require the addition of a clock as it has no integrated clock. There is also a decoupling capacitor to the input of the FTDI pin.

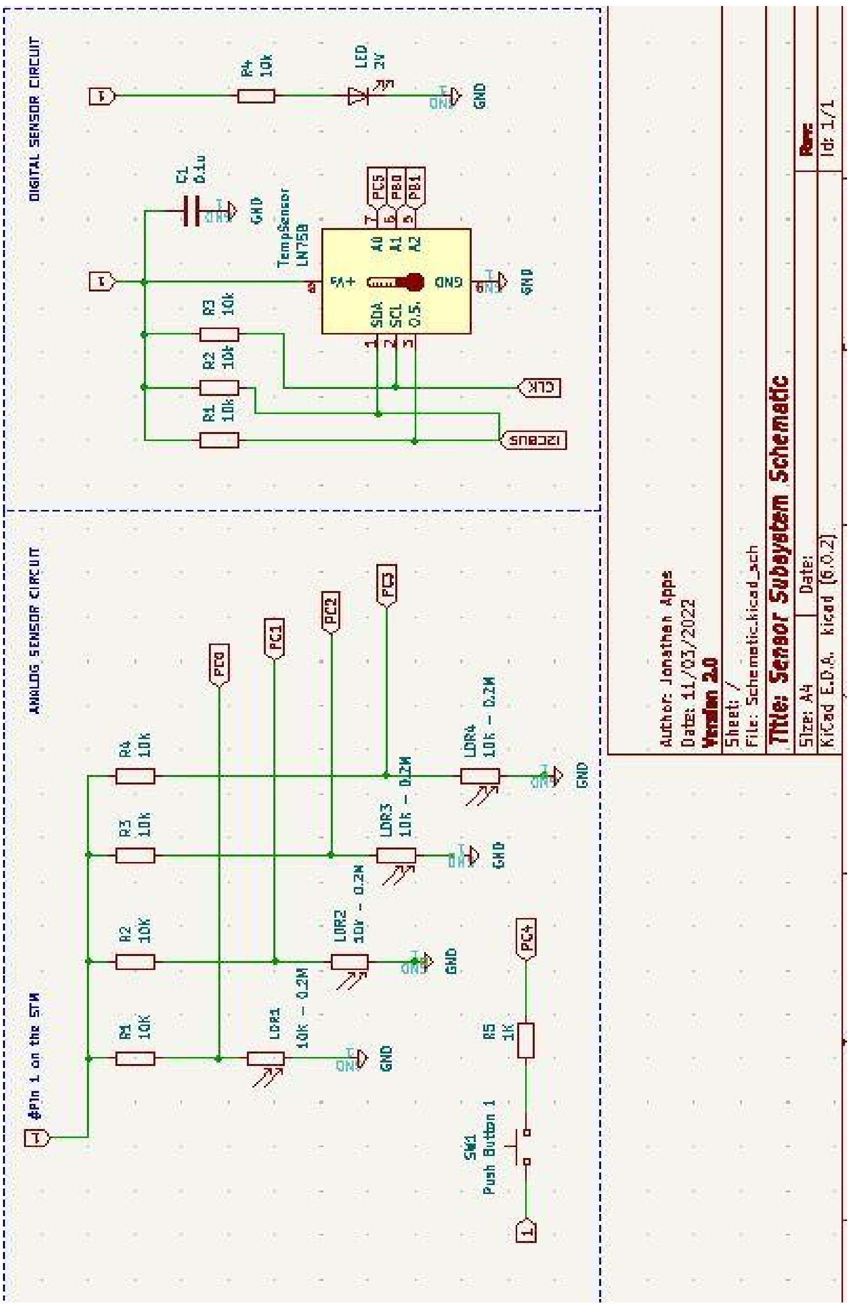
Schematics

5. Power Subsystem Schematic

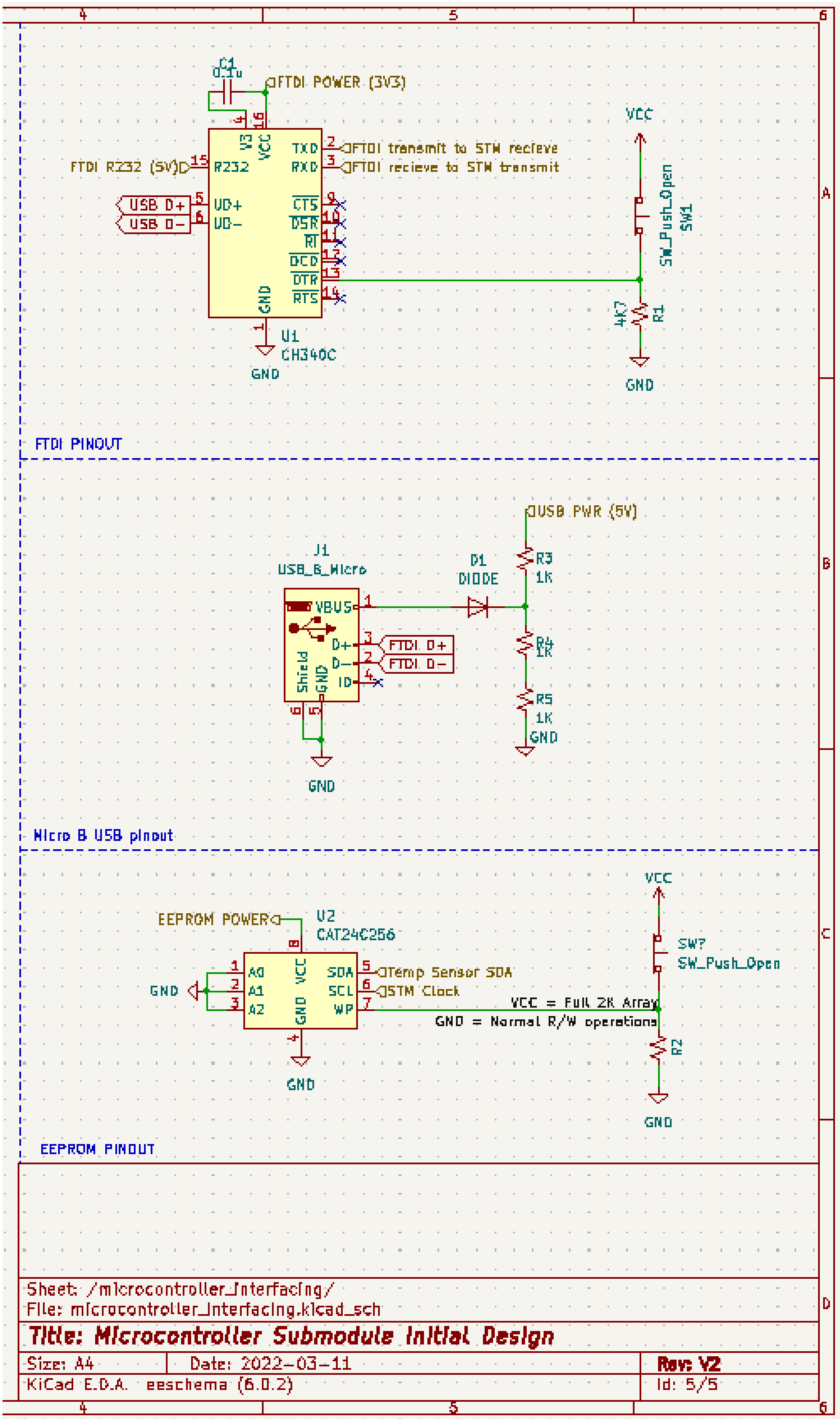


As you may have noticed, the power submodule circuit for this assignment is different from the last. This is because the last circuit did not have a method of charging the battery. I also changed the configuration of the voltage regulator as I decided to use a different part (voltage regulator part). The input to the power module also changed, it is now getting power from a usb input. The polarity protection is covered by the LED which only allows current to flow in one direction, And no current will flow if the battery voltage drops below 3V (which is the recommended discharge maximum), since the voltage at the base of the transistor will be equal to or less than 0.7V, therefore the voltage at the emitter will be 0V, so the output will be zero. In that way undervoltage lockout is also dealt with.

6. Sensing Subsystem Schematic



7. Microcontroller Interfacing Schematic



8. Planned ERCs

We plan to use KiCad's internal ERC feature. There are additional Spice ERCs that could be useful, and thus these will be considered as well.

9. Updated BOM

A table of the BOM is included below for ease of reference and the generated version from KiCad is available in the git repository under the directory "Initial Design Assignment" in the zipfile 'main'.

Unit	Description	Multiplier	Cost per unit ($)	Total Cost ($)	Notes
C404969	Surface Mount Micro-B SMD USB Connector	2	0,048	0,096	
CH340C	FTDI USB-to-UART chip	1	0,7311	0,7311	
M24128-BRMN6TP	EEPROM	1	0,2052	0,2052	
STM32F051	Microcontroller chip & discovery kit	1	0	0	(retained from EEE2046F)
USB to microB cable	USB to microB cable	2	0	0	(retained from EEE2046F)
LM75BD	Temperature Sensor	1	0,5734	0,5734	
BL-HUE35A-AV-TRE	Red LED	1	0,0234	0,0234	
RCT02300RFLF	300Ω Resistor	1	0,0028	0,0028	

CT41G-0402-2X1-16V-0.1μF-K(N)	0.1uF Capacitor	1	0,0034	0,0034
RCT0310KJLF	10KΩ Resistor	7	0,0016	0,0112
GL48516	Photoresistor	4	0,0527	0,2108
C13828	Push Button	2	0,0382	0,0764
	Resistors	7	0,0007	0,0049
BL-HUE35A-TRB	LED	2	0,1305	0,261
TP4054	Charger IC	1	0,2523	0,2523
2n2222A	NPN transistor	1	0,1736	0,1736
78L05FS	Voltage regulator	1	0,21	0,21
Tlv316	Opamp	1	0,2	0,2
	Capacitors	3	0,001	0,003
TOTAL (PER BOARD)				**3,0385**
TOTAL (5 BOARDS)				**15,1925**