Wk5 PCB Design - Group 24

Q1 Github [1]

https://gitlab.com/Lloyd01/eee3088-group-24-hat-project/-/tree/main

Q2 Power Subsystem Failure Management [5]

Fuses have been added to protect the power system and the other subsystem circuitry against any damage. The chosen power supply comes with surge and short circuit protection which also helps the safety of the board and components.

Test points have been added at important locations and will help with testing, monitoring and debugging for when we have problems or general use.

I have made sure that the parts on JLC I've chosen have a huge stock and have backup parts planned if any stock shortages occur.

Multiple boards are being ordered (5 to be specific) this allows us to have backups in case of any damage or malfunction occurs.

A Schottky Diode has been added to prevent voltage entering the 5V rail when operating on battery power. A P-channel MOSFET has been added for reverse polarity protection and as a switch for charging off 5V or using battery power.

Q3 Sensing Subsystem Failure Management [2]

Within the sensing subcircuit I've added test points at various locations and ground. This will allow us to test the voltage at points in the circuit which will greatly increase our failure safety by testing, debugging, and monitoring the sensors and its components.

I've connected 0Ω resistors along the connections to the microcontroller. These help us in several ways. Such as, help reduce noise and signal distortion. If there are any errors found post manufacture it is much easier and safer to desolder the resistor to change the circuit configuration if necessary than dealing with the copper traces. As well as, providing some component safety by acting as a fuse and stopping the connection if over-currented.

A fuse has been connected to protect each circuit/sensor against any surges from the power supply.

Our digital humidity sensor can also be used as a temperature sensor if failure of the analogue temperature sensor occurs.

I've made sure that for each component there is a substitution plan on JLC in case of any stock shortages.

We will also be ordering 5 boards for use and prototyping so there are back-ups to any damage or malfunction.

Q4 Microcontroller interfacing Failure Management [2]

For failure management I have added two test points on the EEPROM - one connected between the A pins (A0, A1 and A2) and VCC. While the other is connected between WP and GND. These test points will have their voltages monitored in order to detect any abnormal or unexpected voltages/ change in voltage due to component failure , trace damages and various other potential iss. This will allow failure to be quickly noticed.

The EEPROM and STM32F051C6 will be on dip sockets - in case of a failure the component can be removed, replaced with a new component easily. Rather than trying to desolder the component and solder a replacement.

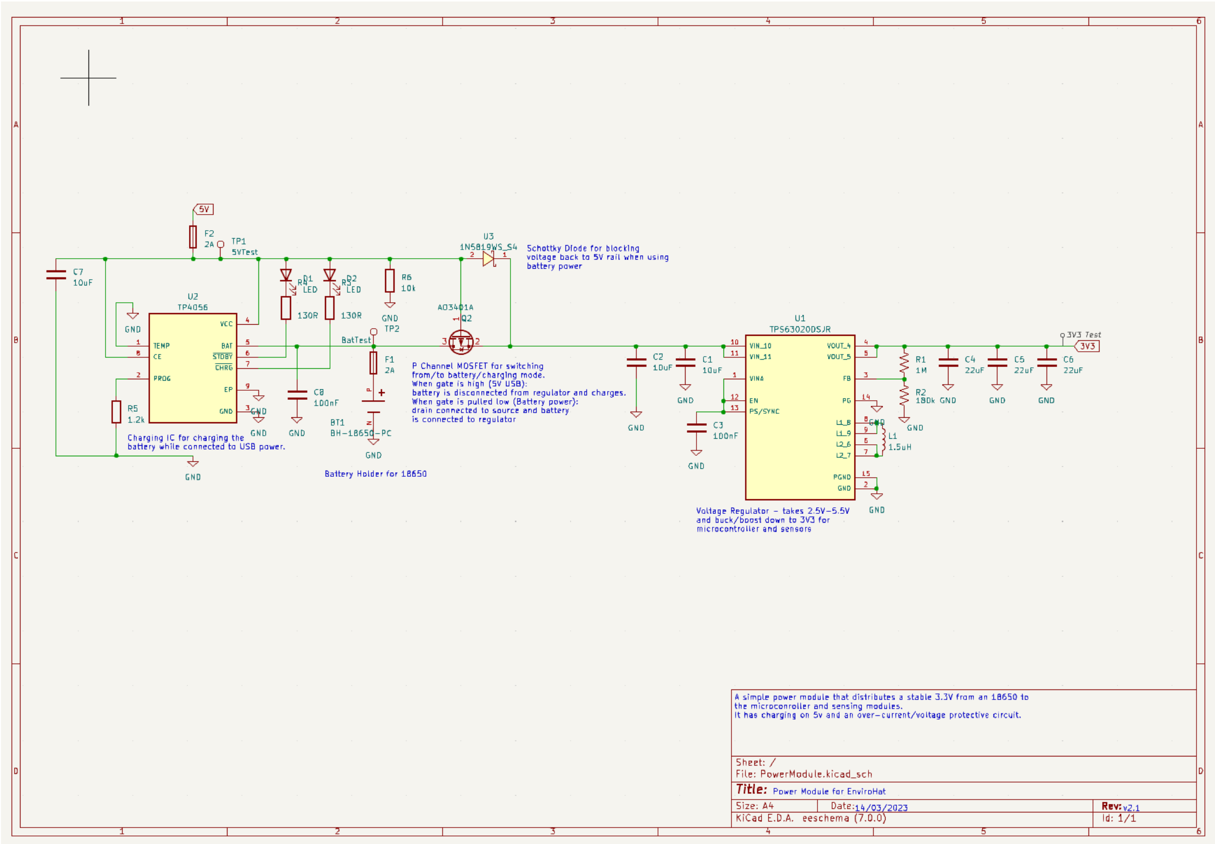
No fuse was used in this module as the component is very expensive and better utilised by the other modules.

I have ensured that for each component - there is an alternative in case of stock shortage. The components I chose all have very high stock counts on JLC to reduce the chance of facing stock issues.

The use of multiple boards - 5 in this case is to reduce the risk of failure by having alternative boards and components in case of failure.

0 Ohm resistors were added to the circuit aswell as more test points. The 0 ohm resistors help us in several ways. Such as, help reduce noise and signal distortion. If there are any errors found post manufacture it is much easier and safer to desolder the resistor to change the circuit configuration if necessary than dealing with the copper traces. As well as, providing some component safety by acting as a fuse and stopping the connection if over-currented.

Q5 Power Subsystem Schematic [2]

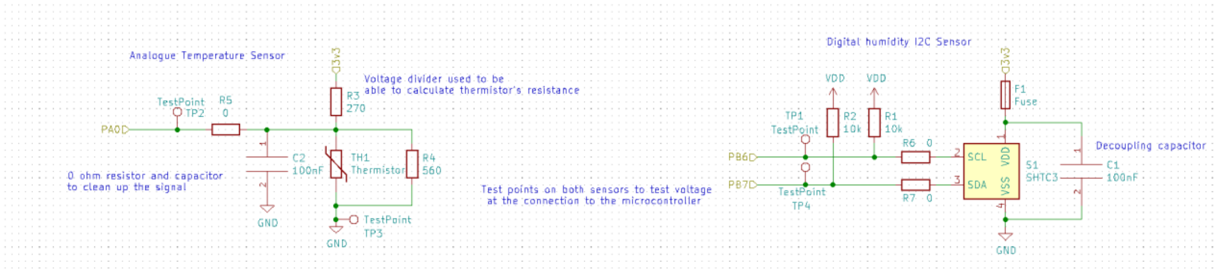


Changes to schematic:

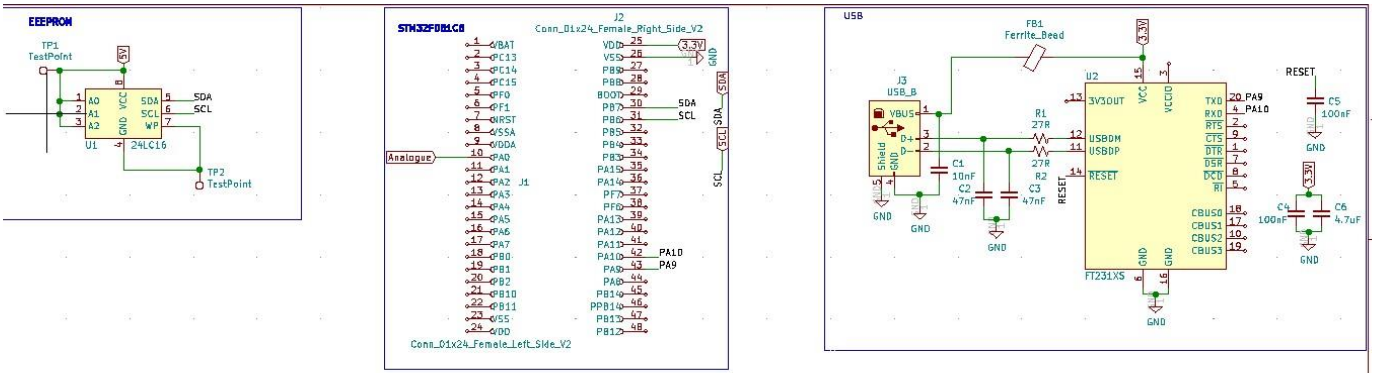
- Added Schottky diode for reverse polarity protection and to prevent feedback to the charging circuit.
- Added P-channel MOSFET to switch between charging and discharging states - when charging, circuit is powered by 5V USB.

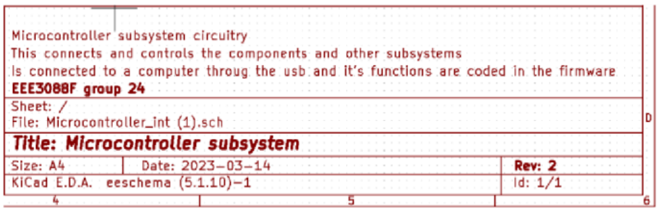
Added detail explaining major components function to schematic.

Q6 Sensing Subsystem Schematics [2]



Q7 Microcontroller interfacing Schematic [2]

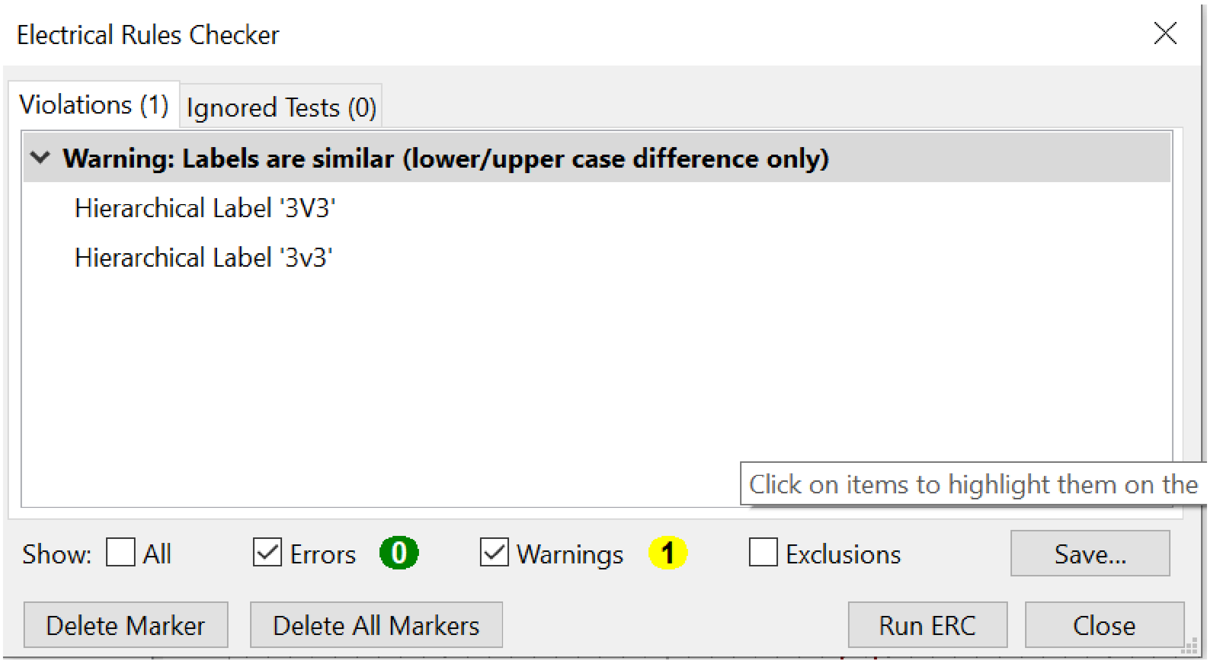




0 Ohm resistors were added to the circuit aswell as more test points. Some corrections were made such as the missing GND in the EEPROM and the signal lines from the EEPROM were moved as they were clashing with the signals from the digital sensor. The point on the FTDI was changed to 5V from 3.3V and the supply voltage on the EEPROM was changed to 3.3V as this would be much easier than attempting to run 5V when on "battery power"

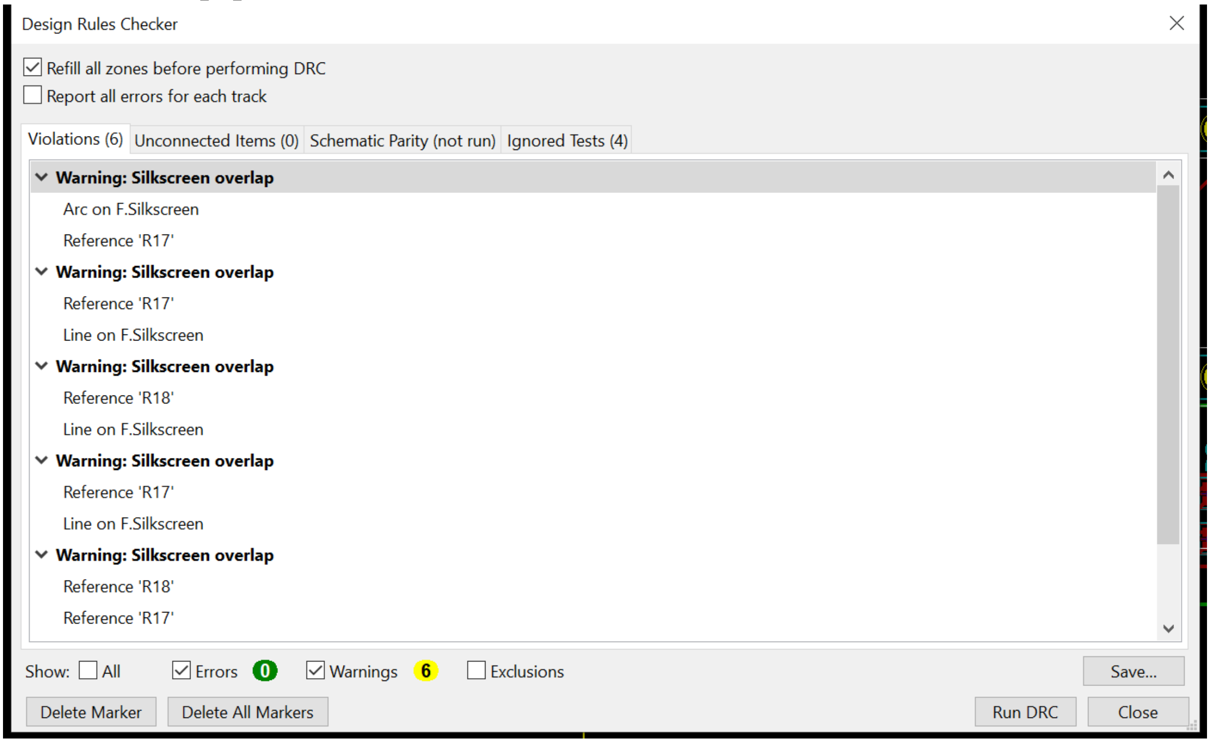
Q8 Updated ERCs [2]

KiCAD's ERC was used



(Issue with deleted/hidden label – has been updated)

Q9 DRCs [2]

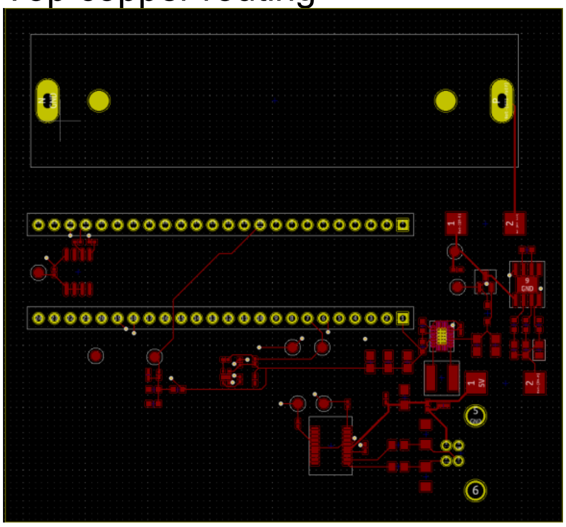


Q10 Updated BOM [4]

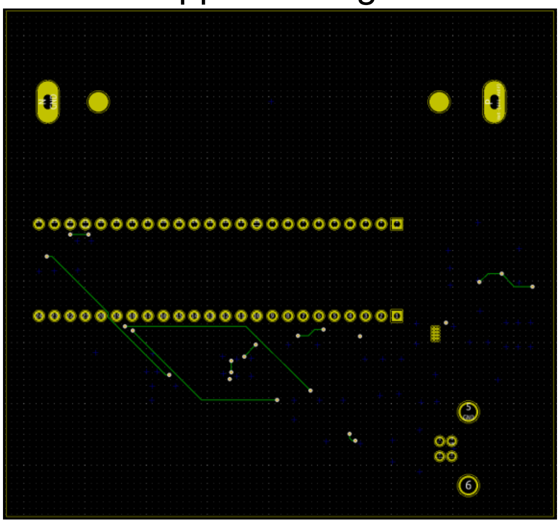
https://gitlab.com/Lloyd01/eee3088-group-24-hat-project/-/blob/main/Documents/All_BOM.xlsx

Q11 PCB [15]

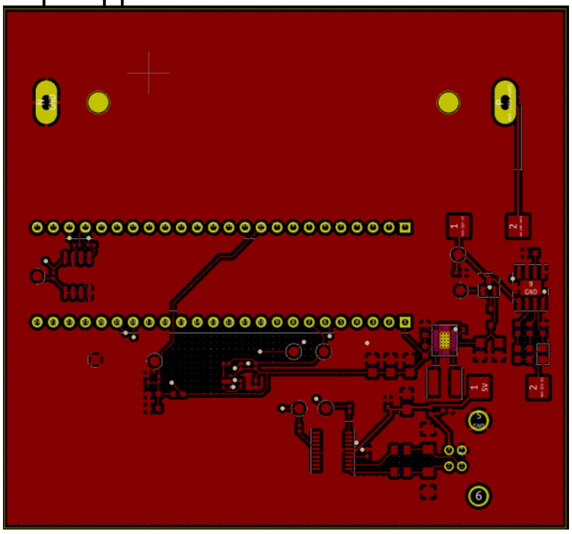
Top copper routing



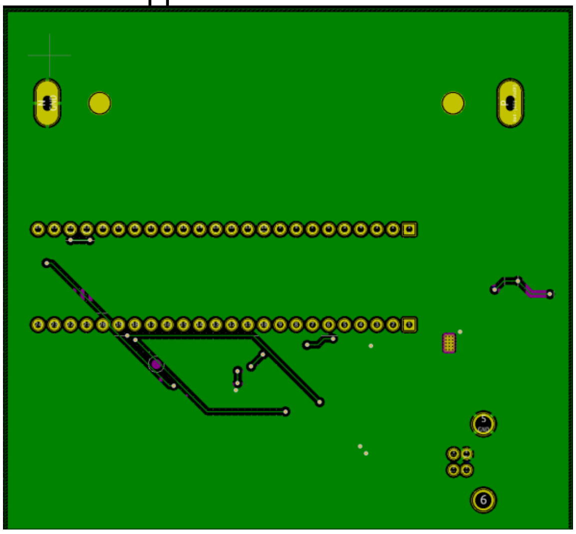
Bottom copper routing



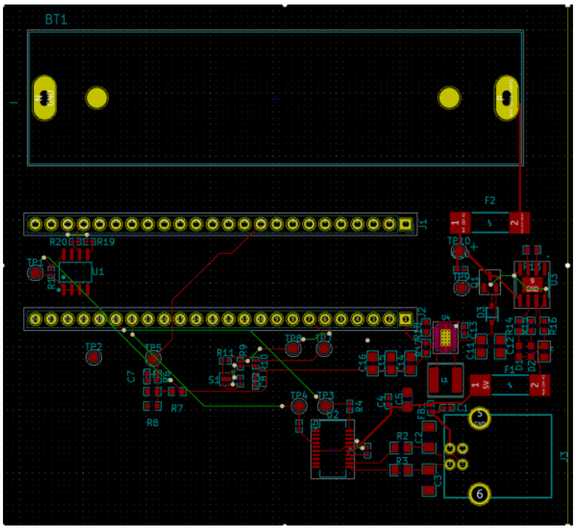
Top copper fill



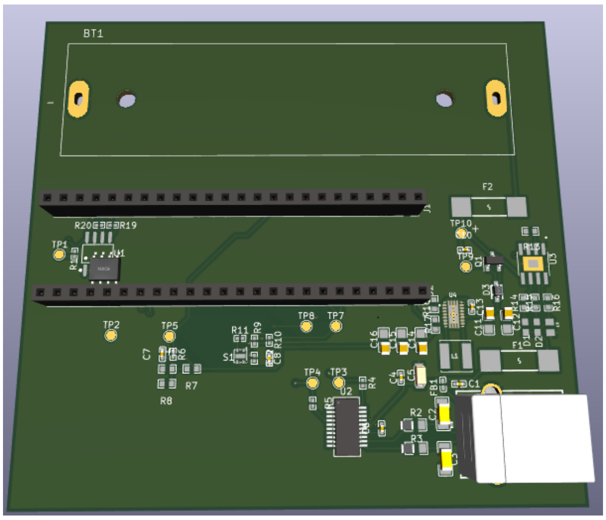
Bottom copper fill



PCB silkscreen



3D Model View



The gerber files are on the git repository:
https://gitlab.com/Lloyd01/eee3088-group-24-hat-project/-/tree/main/PCB/Gerbers