

# PCB Design– Week 3

Embedded Hardware/Software  
Design



# Example

- Let's design an activity tracker
- What are the requirements?
  - It has to be small
  - Low power
  - It needs an IMU
  - The MCU has to be powerful enough to process IMU data (timeseries)
  - Low cost of course!
  - Activity recognition is a machine learning application that requires us to collect labeled data!



# Components - Power

- Power components
  - Battery
    - Capacity/size
    - System's lifetime
  - Battery charger
    - Charging rate
    - Cost/size
  - Voltage regulator (buck converter)
    - Efficiency
    - Cost/size
  - Schottky barrier diodes
    - Efficiency
    - Cost/size



# Power Component Options

- Buck converters
- Batteries
- LiPo chargers
- Schottky diodes



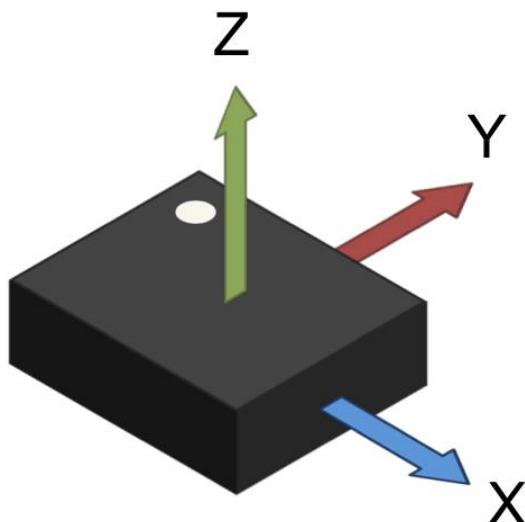
# Components – Sensor

- IMU
  - Power consumption
  - Working voltage
  - Range
  - Degree of freedom
  - Connectivity interface
  - Cost/Size
  - Interrupt capability



# Why IMU?

- Accelerometer: measures linear acceleration ( $\text{m/s}^2$  or  $\text{g}$ ) along X/Y/Z
  - includes gravity, so it can estimate tilt/orientation and detect motion/vibration.
- Gyroscope: measures angular velocity ( $^\circ/\text{s}$  or  $\text{rad/s}$ ) around X/Y/Z — captures rotation/turning and fast orientation changes.



# Sensor Options

- LSM6DSOX
- ADXL345
- ...



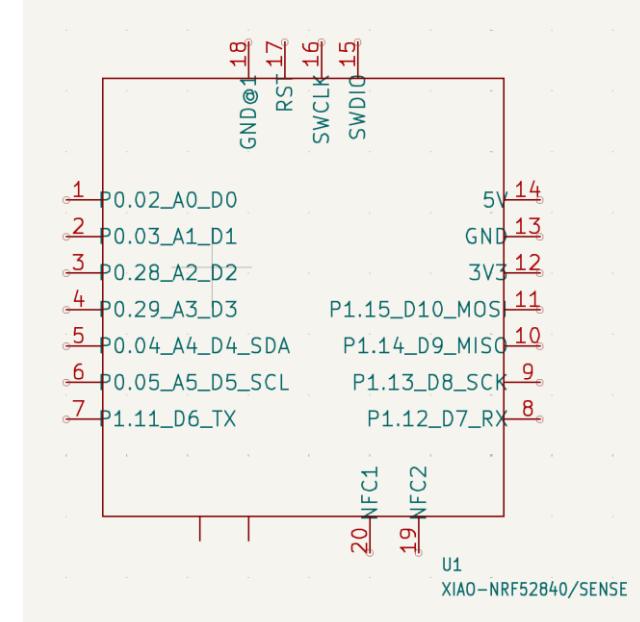
# Step 0

- Download and Install [KiCad](#)
- Create accounts on JLCPCB and SnapMagic.



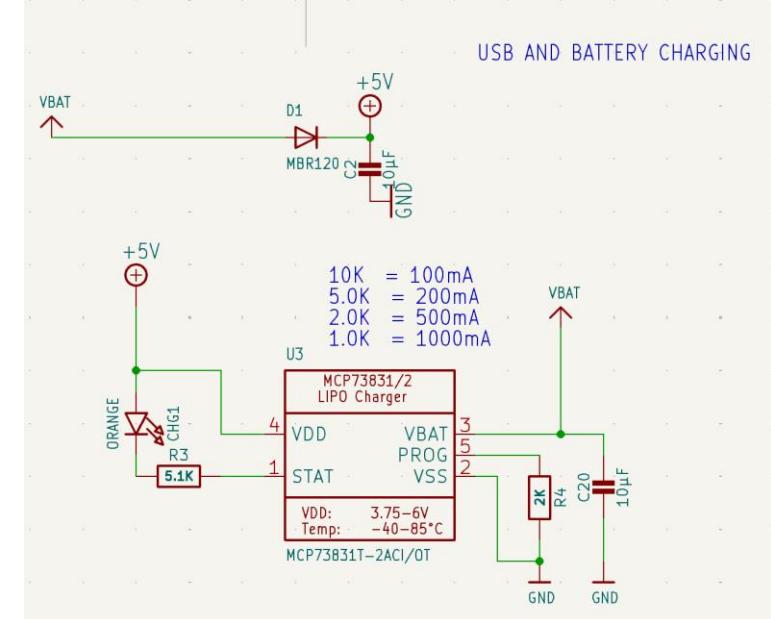
# Step 1

- Let's start by adding the MCU
  - Please go [this webpage](#) and download Seeed Studio XIAO Series Library repository.
  - Then follow [this tutorial](#) to import symbols and footprints.
  - Add your Xiao board to the schematic editor.



# Step 2

- Let's take care of the power related components
  - We will use MCP73831T-2ACI/OT to charge our LiPo battery.
    - Navigate to [SnapMagic](#) webpage and download symbol and footprint.
  - We will also use MBR120 diode to switch between USB and Battery. You will find this diode in default libraries.
  - Select R\_0603\_1608Metric for resistor's package.
  - Select C\_0805\_2012Metric for capacitor's package.
  - You can also download [this project](#) into your KiCad.



# Step 3

- Let's add the sensor and MicroSD card slot.
- There are 3 possible ways to get this done
  - Using existing projects
  - Finding symbols and footprints from SnapMagic and reviewing datasheet.
  - [IMU Example Project.](#)
  - [MicroSD Card Example Project.](#)

# Step 4

- Routing on PCB Editor