# Week 1 Report

1. Project Objectives

The project aims to leverage **supercapacitors** as a technical support solution for electrical applications and project requirements, such as providing power supply in **robotic competitions** where the power demand exceeds 40W (competition requirement).

Since there is already support in hardware, our task is mainly to provide software and modeling assistance.

2. Basic understanding of supercapacitor

Supercapacitors (SCs) are advanced energy storage devices that can store and release energy rapidly, and they have high power density, quick charge–discharge time, low input resistance, extended lifetime, and they are environmentally friendly.
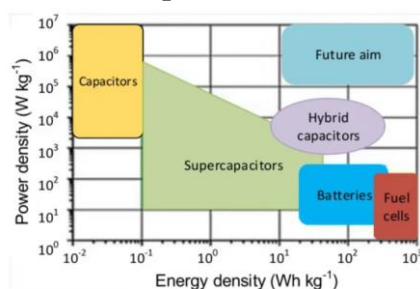
Energy storage mechanisms:

(1) electrochemical double layer capacitors (EDLC) use the pure electric charge that accumulates at the electrode interface

(2) pseudo-capacitance (PC) develops from quick and reversible surface redox processes.

(3) hybrid capacitors take advantage of both mechanisms.

In our project, with the hardware already available, our primary focus is on modeling, analysis, and control using MATLAB. Through MATLAB, we can simulate the behavior of supercapacitors under various conditions, optimize their performance, and develop control strategies to ensure they meet the power demands efficiently

3. References

[1] W. Raza *et al.*, "Recent advancements in supercapacitor technology," *Nano Energy,* vol. 52,

pp. 441-473, 2018/10/01/ 2018, doi: https://doi.org/10.1016/j.nanoen.2018.08.013.

[2] M. E. Şahin, F. Blaabjerg, and A. Sangwongwanich, "A Comprehensive Review on Supercapacitor Applications and Developments," *Energies,* vol. 15, no. 3, p. 674, 2022. [Online]. Available: https://www.mdpi.com/1996-1073/15/3/674.