For my 3rd year Individual Research Project, I designed a solar-powered e-reader specifically for deployment in Sub-Saharan Africa to address the acute shortage of educational and medical resources, as well as overcoming the access to electricity. The e-reader, designed to be cost-effective and self-sustaining, uses Reflective LCD (RLCD) technology to enhance visibility and reduce power consumption as well as an MPPT controlled solar panel.

The project began with a thorough research phase where the feasibility of using solar power and RLCD technology was assessed, considering the high solar irradiance and challenging environmental conditions of the target region. The design process involved extensive use of Autodesk Fusion 360 for pre-visualising the device and MATLAB for component selection through trade-off analysis. This analysis was capable of receiving large databases from websites such as Mouser and Digi-key, and automatically sort them based on chosen parameters. The model could compare up to 4 different parameters of each component area.

A critical part of the development was the design of a printed circuit board that incorporated a Raspberry Pi Pico as the base microcontroller. The PCB design included detailed schematic preparation and voltage regulation to accommodate the solar power setup. Simulink was utilised to simulate the maximum power point tracking algorithm, an essential component for optimising the solar panel's efficiency.

Software development was tailored to the device's specific needs, using MicroPython for ease of programming given the constraints of the hardware. The software was designed to be simple yet functional, capable of handling basic e-reader operations and supporting an extensive digital library through an SD card system.

This project not only exemplified innovative engineering solutions to real-world problems but also highlighted the importance of interdisciplinary skills, including digital design, cost management, and sustainable engineering principles. The project culminated in a detailed evaluation of the design, manufacturing feasibility, and operational testing, setting the stage for potential future deployment and real-world impact.

Skills used:

Fusion 360

Eagle CAD

Matlab

Database creation

Database extraction model

Graphing modelling

Critical research techniques

Electrical Engineering

Simulink