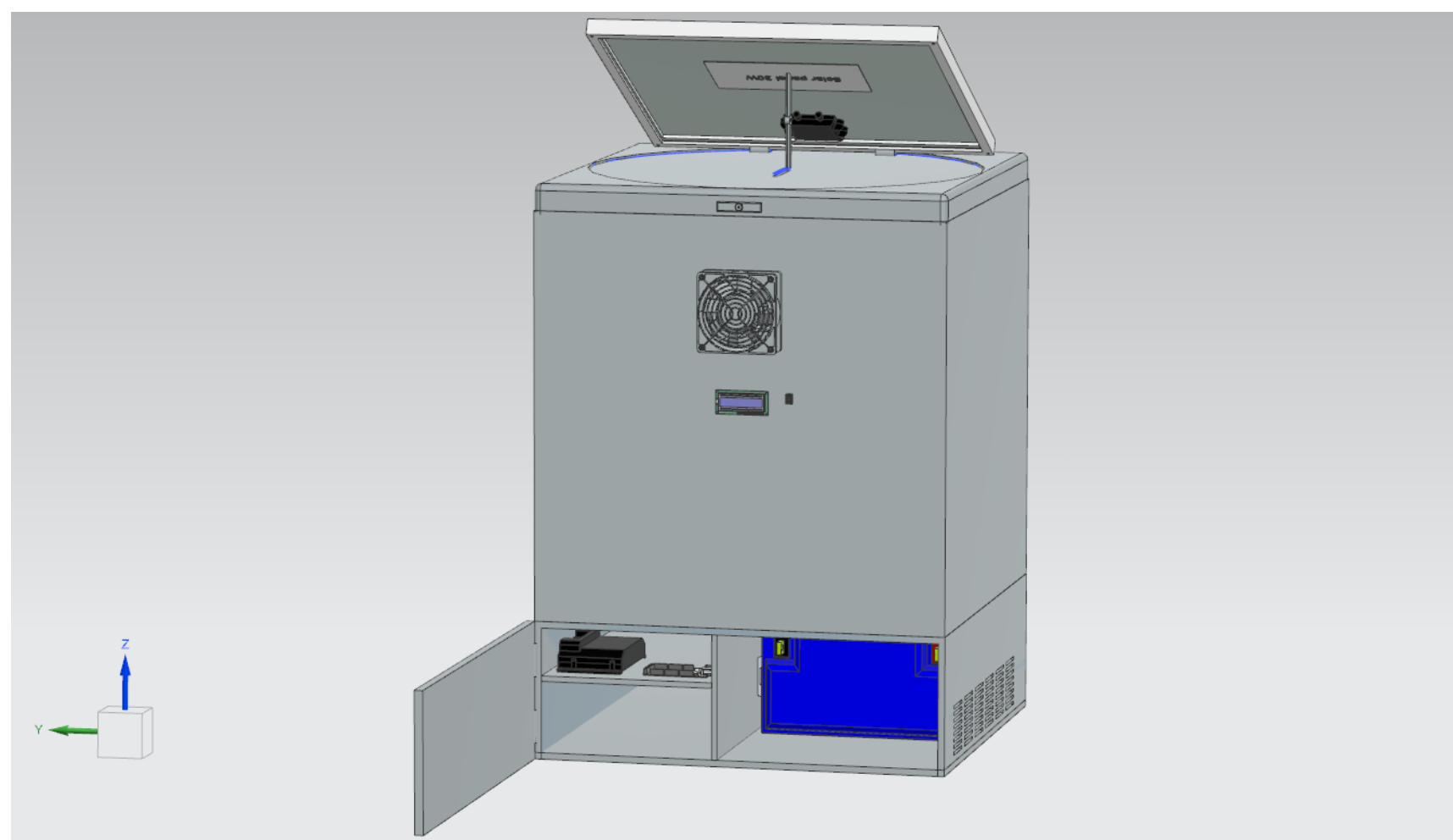


Priority Topic Area: Food, Health and Well-being

1 – Revolutionising Vaccine Delivery

EcoMed tackles the urgent challenge of vaccine storage and transport in off-grid, resource-limited regions like Kano, Nigeria. Many vaccines, including RTS-S for malaria, require strict temperature control (2-8°C), but unreliable electricity and poor cold chain infrastructure lead to high vaccine wastage. EcoMed is a solar-powered, thermoelectric refrigerator with PCM (paraffin phase change material), designed to provide stable, energy-efficient cooling without harmful refrigerants. By combining renewable energy, thermoelectric cooling, and thermal energy storage, EcoMed ensures sustainable, low-maintenance vaccine storage, reducing reliance on diesel generators and improving last-mile vaccine delivery.

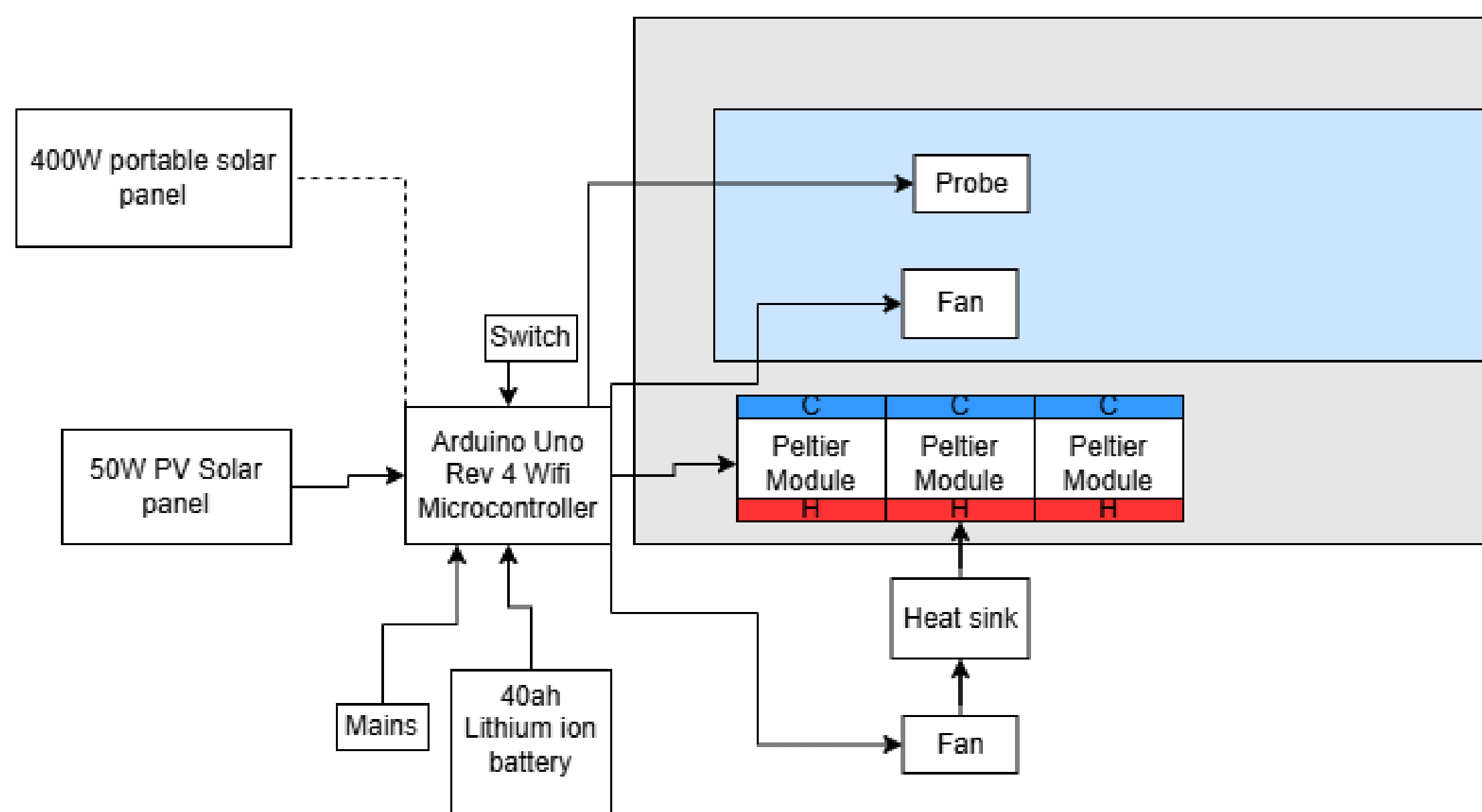


2 – Innovative Cooling Technology

EcoMed integrates three core technologies: thermoelectric cooling via Peltier modules, paraffin phase change material (PCM), and solar power. The Peltier devices create temperature differential when powered by electricity, cooling the vaccine chamber. PCM stabilises temperature by absorbing heat above 8°C and releasing cooling energy below 2°C. An Arduino Uno Rev4 WiFi microcontroller manages temperature regulation (through PID control), optimises solar charging (via MPPT algorithms), and enables remote monitoring. The aluminium outer casing with polyurethane insulation protects internal components, while the lithium-ion battery provides power during low sunlight periods.

3 – Reimagining the Cold Chain

- **Temperature Stability:** Maintains 2-8°C storage, even during solar unavailability with 125l capacity to store ~8000 vaccines.
- **Energy Efficiency:** Consumes ~5.5 kWh/day, powered entirely by solar (850W capacity) and a 100Ah lithium-ion battery.
- **Off-Grid Feasibility:** Functions independently from unreliable power grids, reducing reliance on diesel generators.
- **Sustainability:** Eliminates harmful HFC refrigerants, reducing carbon footprint and promoting clean energy adoption.
- **Cold Chain Impact:** Could reduce vaccine spoilage by up to 50%, ensuring more effective malaria immunisation campaigns.
- **Scalability & Adaptability:** Suitable for vaccine storage, blood banking, and food preservation, enhancing rural healthcare.
- **Security & Usability:** Designed to be lightweight, compact, and transportable via standard vehicles, addressing last-mile delivery challenges in remote regions.



4 – Transforming Healthcare Access

EcoMed improves healthcare accessibility by ensuring stable vaccine storage in remote areas, directly supporting malaria eradication efforts in Kano (where malaria prevalence is 32.4%). By reducing vaccine wastage, it enhances immunisation efficiency, strengthens public health infrastructure, and supports United Nations Sustainable Development Goals (SDGs) for health and climate action. The solar-powered design eliminates fossil fuel dependence, reducing environmental impact while providing affordable, sustainable refrigeration for vulnerable communities.

5 – Engineering Hope

Beyond technical refinements, our vision is to transform EcoMed from a prototype into a lifeline for communities battling malaria. We'll collaborate with local healthcare workers in Kano to ensure our solution meets their needs. By partnering with Nigerian health authorities, we aim to integrate EcoMed into national immunisation strategies, creating sustainable impact. We are not just designing a product; we are engineering hope—bringing life-saving vaccines to children (aged 1-6) who need them most and demonstrating how innovative engineering can address humanity's greatest challenges.

