# Subsystem Description

## 1. Functional Architecture

The EPS is responsible for managing the energy throughout the satellite, including charging the battery and distributing power to the various subsystems. It is divided into two main blocks: the **Energy Harvest Block**, which is in charge of collecting energy from the solar cells and maximizing power generation, and the **Battery Charger Block**, which efficiently and safely charges the LiPo battery while distributing power to the different subsystems.

It is made use of a total of **5 solar cells**: 4 on the sides and 1 on the bottom. These are high-efficiency GaAs triple junction solar cells with an efficiency rate of 30%. The solar cells on the sides are arranged in parallel (+Z with -Z and +X with -X). This configuration allows one of the two faces to always be illuminated, enabling the use of one **MPPT** (Maximum Power Point Tracker) for each pair of solar cells. The bottom cell is managed individually with its own MPPT.

The MPPTs are responsible for maximizing the power generated by the solar cells. After the MPPT output, with a reverse-blocking diode, the power management system will handle the energy distribution.

The **Power Management IC** is the core component that manages energy at all times, deciding the actions based on the available energy and the requirements of the other subsystems. Depending on the battery’s charge state, the Power Management IC will take advantage of the opportunity to charge it, ensuring that energy is always available.

Simultaneously, energy is constantly sent through a **power regulator**, reducing the voltage to 3.3V, which is used by the other subsystems. The Power Management IC will decide whether to power the system directly from the solar cells, depending on the power consumption, or from the battery when necessary.

The EPS also includes a **battery sensor** capable of measuring various battery parameters such as voltage, current and temperature. This sensor communicates with the OBC via I2C. Additionally, the battery is equipped with an NTC temperature sensor that the Power Management IC can read to ensure the battery does not overheat or drop below a certain threshold. If the OBC detects that the battery temperature approaches a critical level, it will activate a **battery heater** to maintain the temperature within safe operating limits

Moreover, the Power Management IC, through digital control pins, will notify the OBC of its status, including notifications such as charge completed or battery error, among others.

To the other subsystems, the EPS appears as a single power source, capable of providing the necessary energy at all times while also supplying real-time battery data.

A block diagram of the EPS is provided up next:

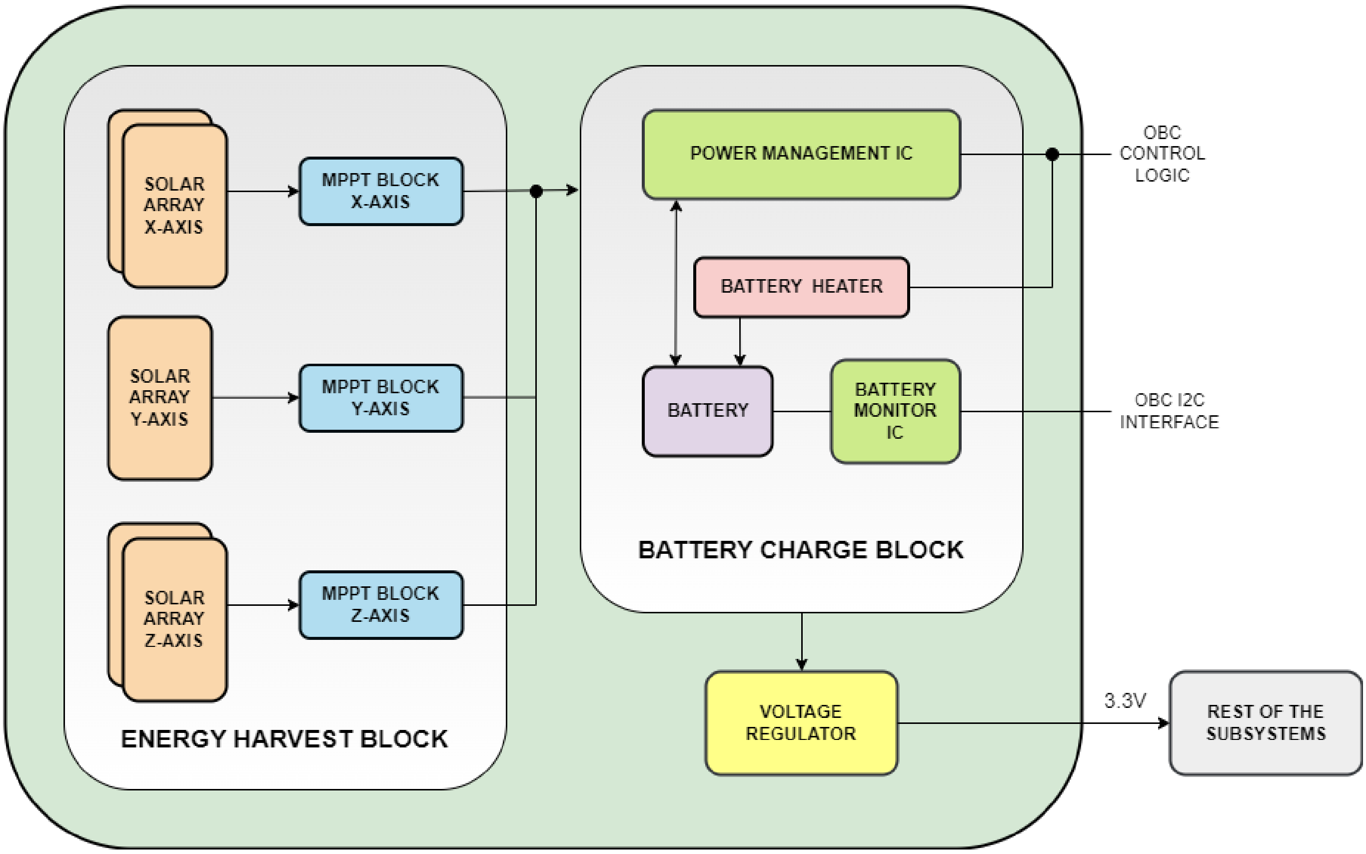


Figure 1: EPS Block Diagram

# 2. Requirements

The EPS is designed and schedulled tu fulfill the following requirements established by the necessitities of the spacecraft and the mission itself.

| SS | SS - Number | DESCRIPTION |
|---|---|---|
| EPS | EPS-0000 | The EPS is capable of providing the requisite current for the other subsystems to function correctly. |
| EPS | EPS-0010 | The battery shall remain within safe temperature ranges. |
| EPS | EPS-0020 | The EPS shall provide an output of 3.3V ±5% at its output to power the other subsystems |
| EPS | EPS-0030 | The battery shall be able to charge via the umbilical port. |

| SS | SS - Number | DESCRIPTION |
|---|---|---|
| EPS | EPS-0040 | The satellite's battery shall be decoupled from the rest of the system during launch using mechanically controlled kill switches. |
| EPS | EPS-0050 | The EPS shall charge the battery automatically using the solar cells. |
| EPS | EPS-0060 | The EPS shall include protections to prevent battery damage |
| EPS | EPS-0070 | The MPPTs shall produce sufficient power to charge the battery |

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