Physical Architecture

The physical architecture of the spacecraft (S/C) is comprised by the different subsystems and components, as well as the electrical lines that provide communication between them. A PocketQube architecture is relatively simple compared to bigger spacecrafts, even when compared to CubeSats. The system straightforwardness is given by the use of an individual Microcontroller Unit (MCU). This approach, while necessary due to power and space (size) constraints, centralizes the S/C, and, while it creates a single point of failure to be very careful of, it also minimizes complexity.

A block diagram of the spacecraft (^{Po}Cat 3) physical architecture is provided up next:

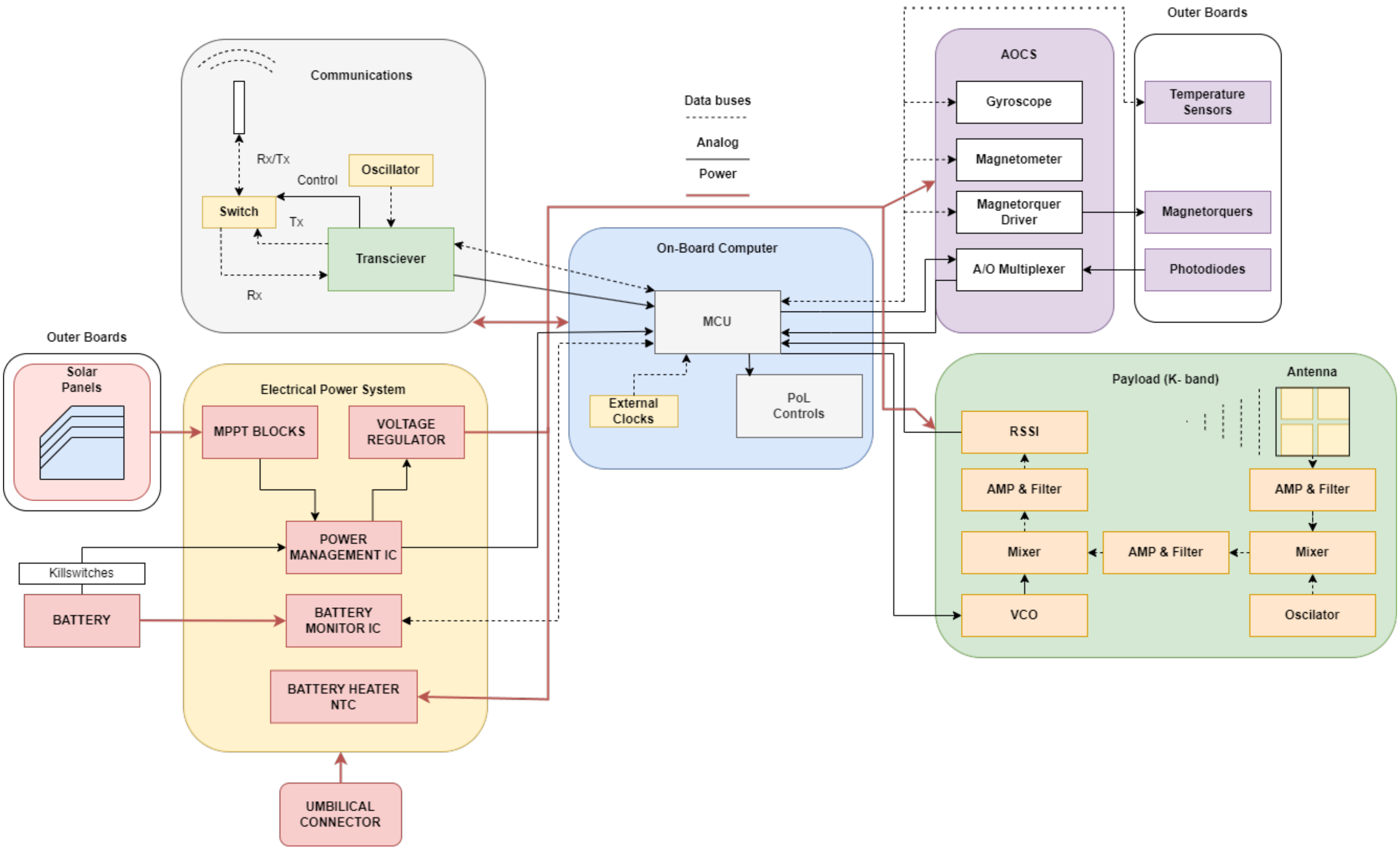

Figure 1.1: ^{Po}Cat 3 Functional Architecture Block Diagram

While it may appear complicated at first sight, this diagram should cause no fear once each subsystem (SS) is properly understood. To get some insight into the later a simple explanation of each SS component:

Communications (COMMS)

The COMMS subsystem main fuctions are to receive and send data through radio frequency (RF) waves. To do so it is provided of a monopole quarter-wavelenght **antenna**, with an approximate lenght of 8.6cm, designed to transmit at 868MHz. The signals to be sent by the spacecraft (telemetry) are generated and modulated by the **transciever** (combination of a radio transmitter and receiver). The signals received are also demodulated at the transciever.

The system is **half-duplex** as radio information (transmission and reception) can not be Tx'd and Rx'd at the same time. This is due to both the transicever capabilities and the use of a **switch**. The later regulates wether information is to be received or transmitted, and is controlled by the transciver itself which is, at the same time, controlled bu the MCU. In fact, all transciver control is done by the MCU through a **Serial Peripheral Interface** (SPI).

Note that the transciever requieres of an **oscillator** that provides a stable reference frequency.

Electrical Power System (EPS) & Power Generation

The EPS subsystem manages power distribution and regulation. Energy is obtained into the system through **solar panels** located at the lateral boards of the PocketQube. This energy is regulated by the **MPPT blocks, one for each panel**, and subministrated to the **battery**. Note that the **killswitches** ensure the satelite can't turn on when in it's rail before being deployed.

Power is distributed to the rest of the system after passing through the **voltage regulator**. Note that a **battery heater** is located in this board. The heater ensures that the battery temperature is constrained to higher than it's lowest operating temperature.

Finally, power can also be provided through the **umbilical connector**, still passing through the killswitches. The umbilical connector also provides code flashing into the MCU.

On-Board Computer (OBC)

The OBC subsystem's main component is the **microcontroller unit** (MCU). The MCU is in control of all data handling and on-board processing, acting as the brain of the spacecraft. Almost all information goes to or comes from the MCU and it is all stored there, either in its flash memory or in its random access memory (RAM).

Physically, on the OBC board will also be located the COMMS subsystem as well as **point of load (PoL) controls** and **external clocks** to ensure the proper timing of the MCU.

Attitude Determination and Control (ADCS)

The ADCS subsystem is the responsible for, as the name indicates, attitude determination and control. To do so it is equipped with a **gyroscope**, to measure it's angular velocity, a **magnetometer** to measure the local magnetic field, the **magnetorquer driver**, which controls the intensity that circulates through the **magnetorquers**, square, plain coils located at the lateral boards that provide torque via electromagnetic interactions, as well as an **A/O Multiplexer** that provides information on sun position.

Temperature sensors are also placed on the lateral boards in order to provide insight for future missions, as a tumbling mode to avoid heat is not possible with the current architecture.

Payload/K-Band (P/L)

The payload on ^{Po}Cat 3 measures RFI interference on the K-Band. To do so it is equiped with a **patch antenna**, several **amplifiers and filters** as well as **mixers**, one regulated by an **oscilator** and the other by a **voltage controlled oscilator** (VCO).

As mentioned several times, the architecture of this specific subsystem is completely dependant on the P/L. Note: RSSI means **received signal strenght indicator**.

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