



Design and development of an educative platform based on the PocketQube60 Specification

3rd PocketQube Workshop

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Agenda

- Objectives
- Research group at University of Zacatecas
- PocketQube modules
- Workshops
- Lessons Learned

Objectives

- Develop an educative platform to promote **STEM education** in the state of **Zacatecas, Mexico**.
- The platform should satisfy the **PocketQube 60** specification.
- The modules integrating the platform should be designed at home using **COTS** components.
- Look forward for gender equality among the participants.

Zacatecas



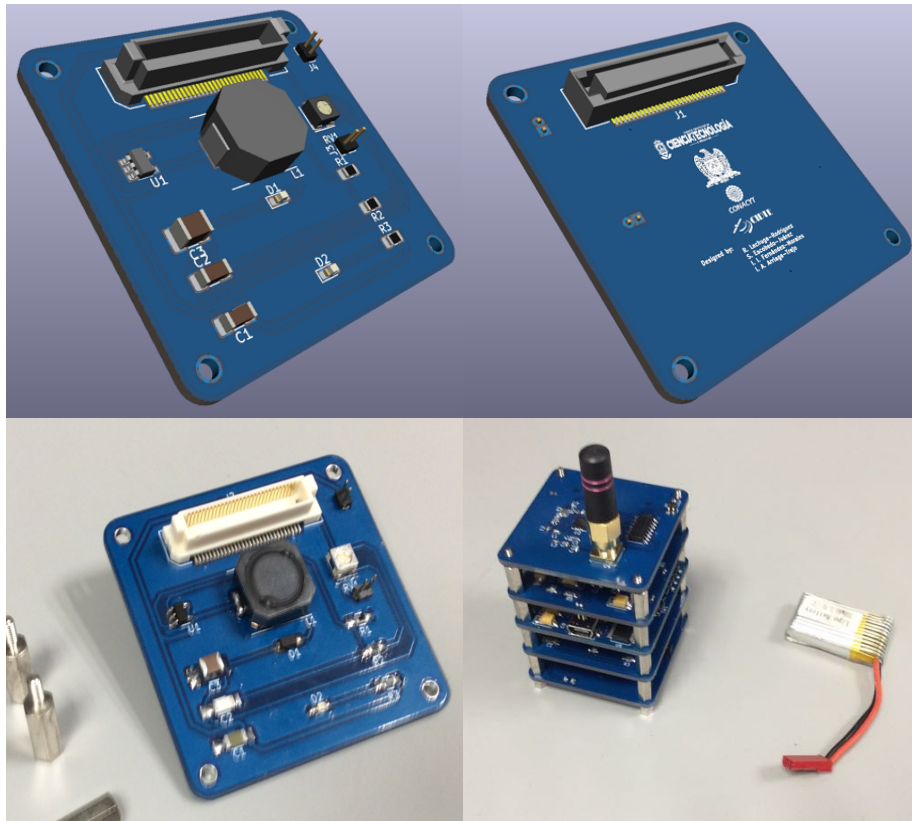
- Located in the center-north part of Mexico.
- **World Heritage Site** by UNESCO in 1993.
- Population of 1.5 million settlers (2015).
- Research center devoted to Telecommunications.

Funding

- Project supported and funded by **COZCYT**.
- Grant of **\$6,000 USD**.
- Should be completed in **6 months**.
- The **compromises**: workshops **free of charges** to high school students in the state of **Zacatecas**.



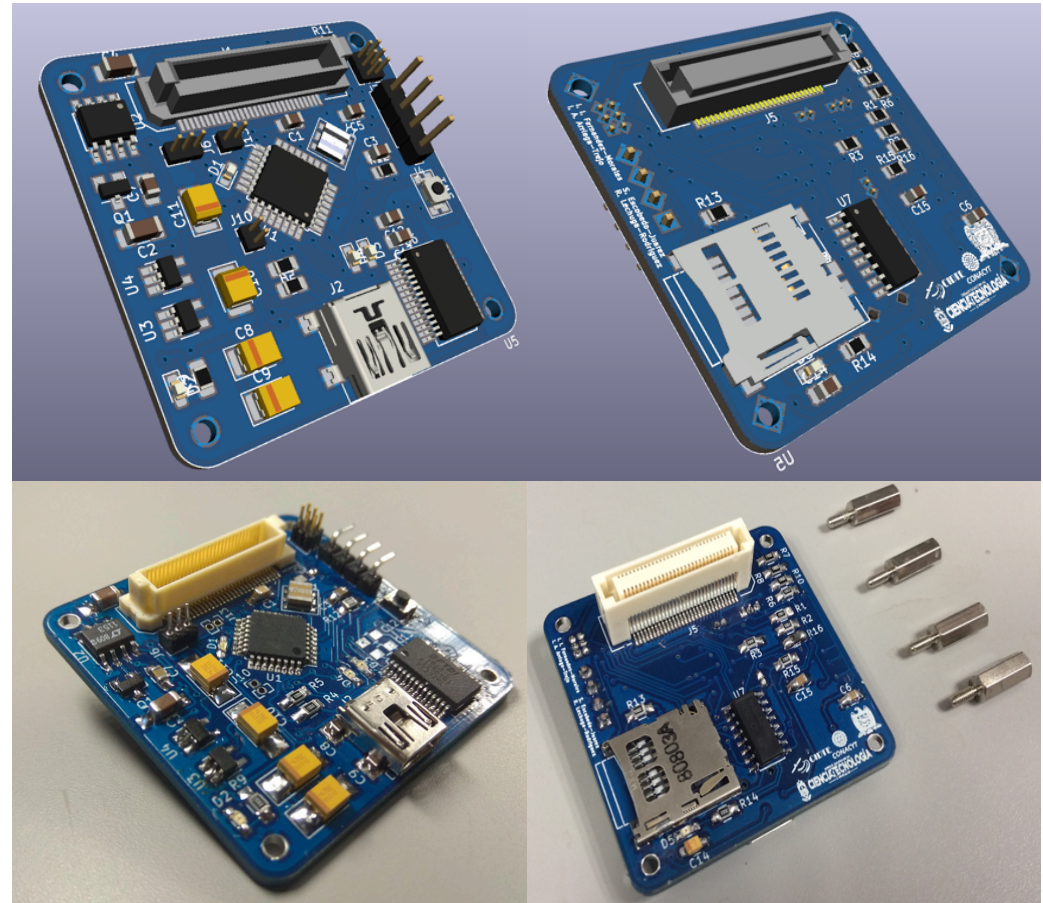
Electric Power Supply



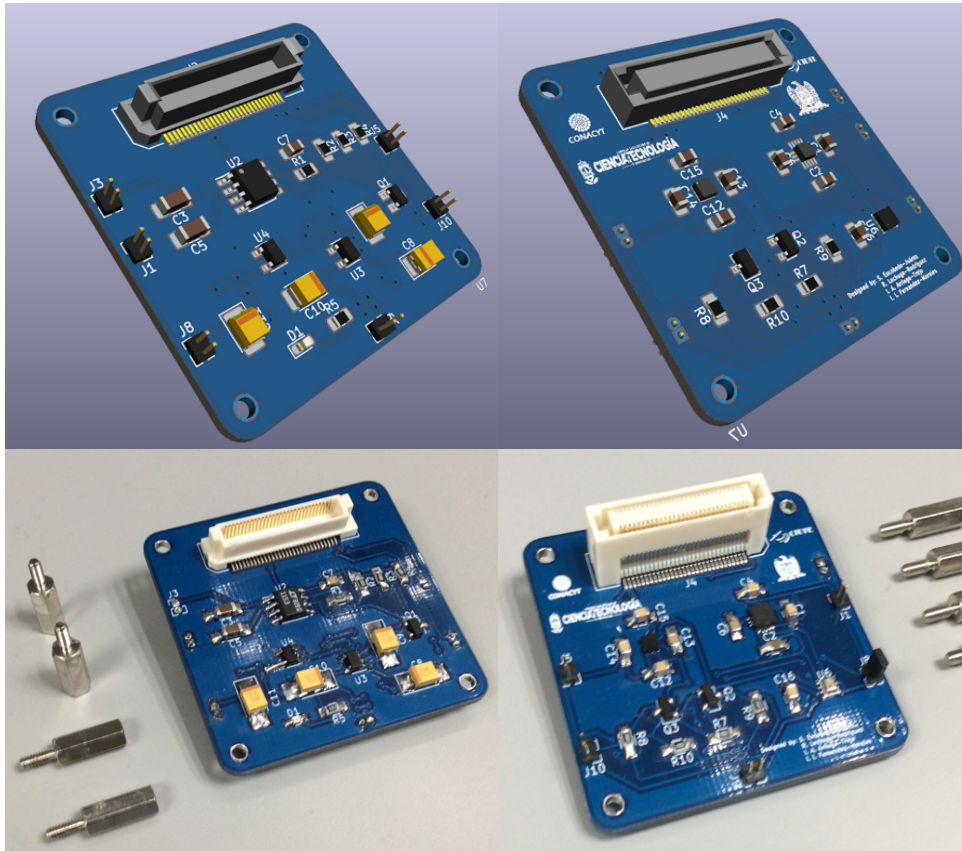
- The system is energized with a 3.3V Lithium battery.
- No solar cells are considered for the time being.

Onboard Computer (OBC)

- Based on the 8-bit **ATMega328P** MCU.
- 3.3V and 5V regulated lines.
- Programmable via **ICSP** and **USB** port.
- **SD** card.
- **I²C**, **SPI** communication with subsystems.
- **LTC1153** circuit breaker for voltage protection.



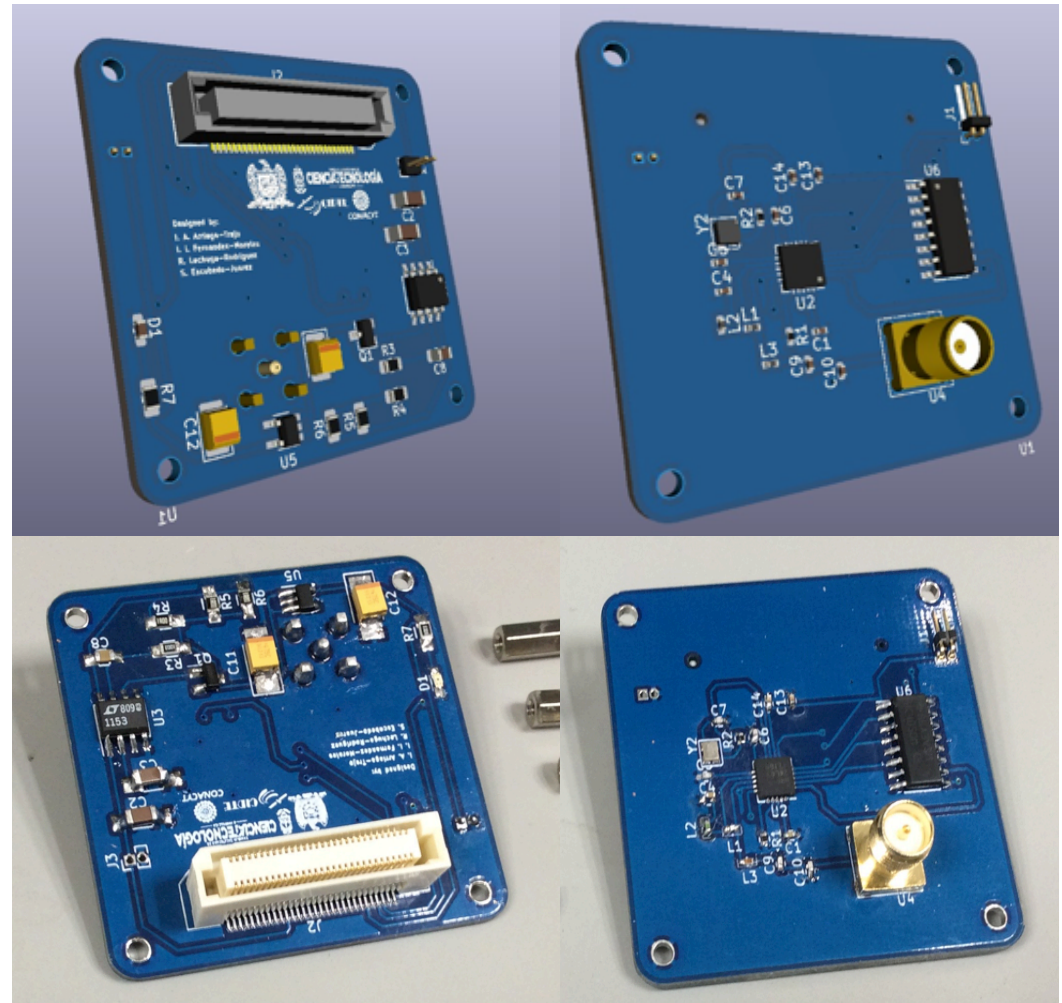
Sensors



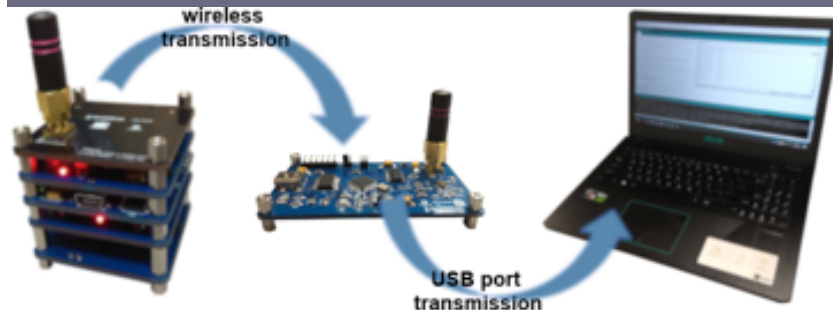
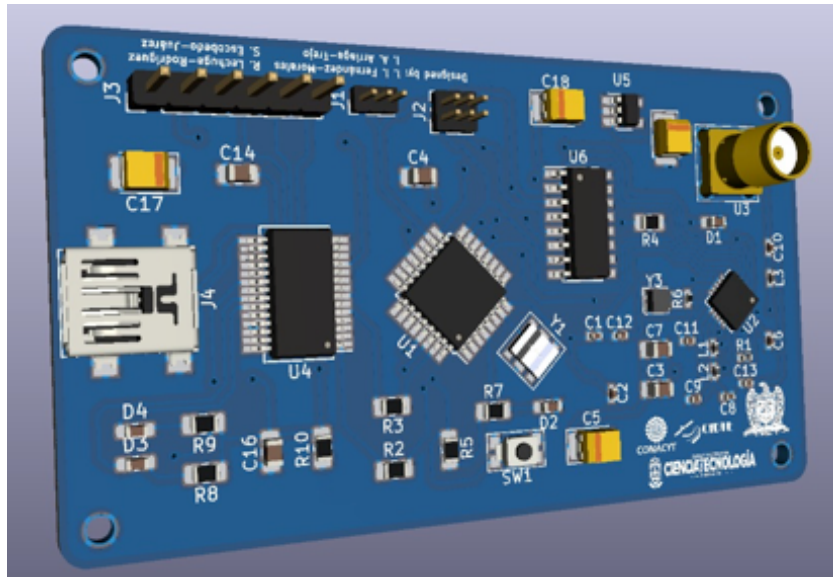
- **BMP280** – Bosch – Digital Pressure Sensor
- **LSM303DLHC** – STM – 3D accelerometer and 3D magnetometer.
- **L3GD20H** – STM – three axis gyroscope.
- I²C communication with OBC.
- 3.3V and 5V regulated lines.

Radio

- Based on the **nRF24L01 - 2.4GHz Transceiver**.
- **SPI** communication with OBC.
- 5V regulated line.
- **Limited** transmission range to avoid interference within the band.



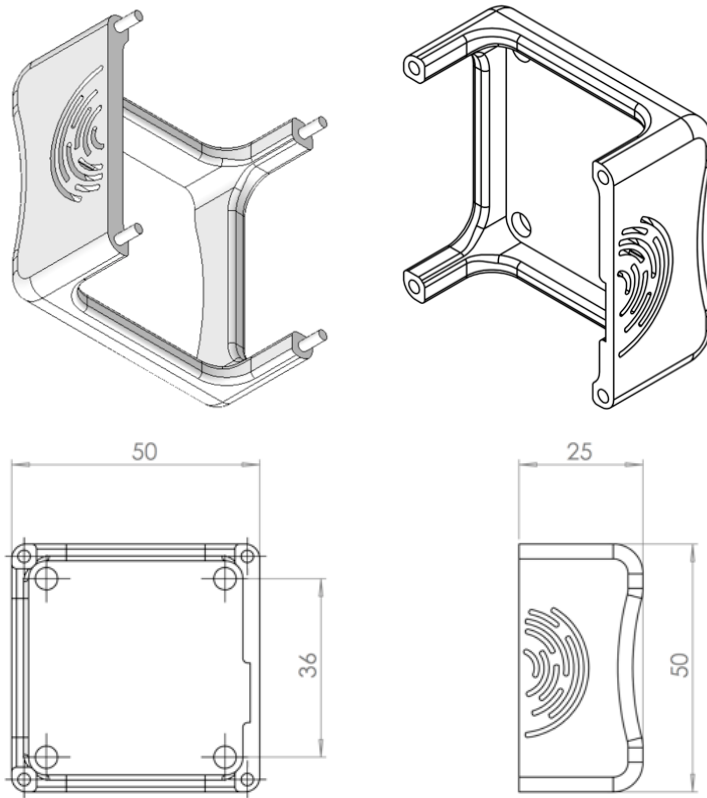
Receiving node



- Receiving node based on the **ATmega328P** and **nRF24L01**.
- Communications with personal computer via a **USB port**.
- Any serial monitor can be used to read received data (e. g. **Arduino IDE**).

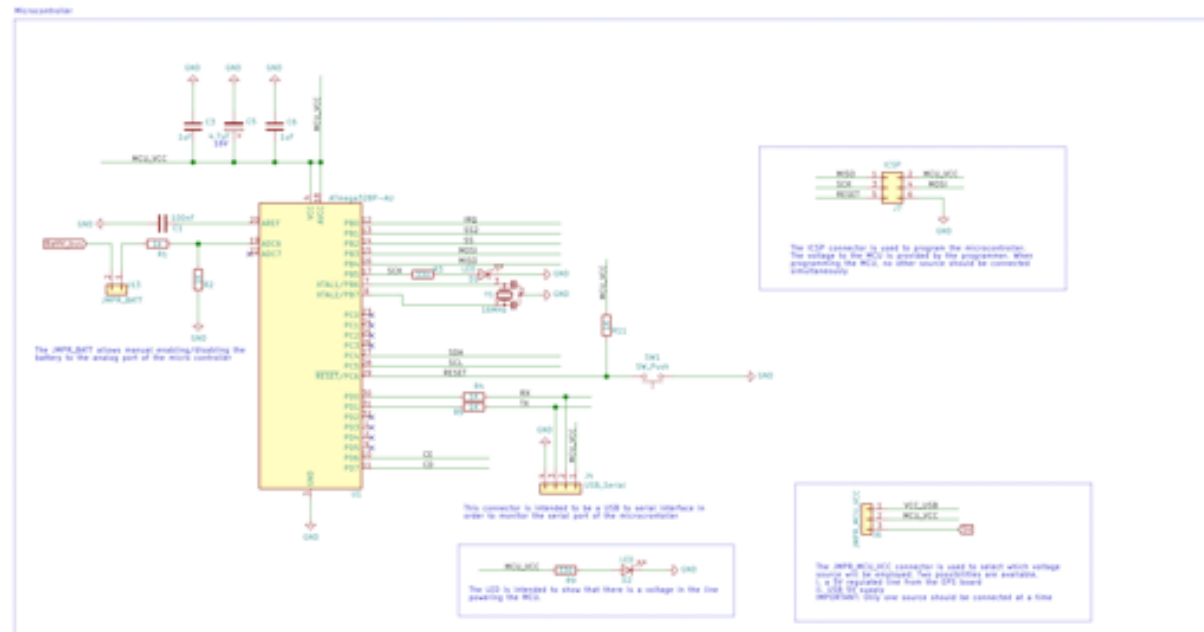
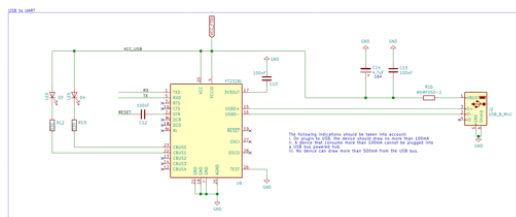
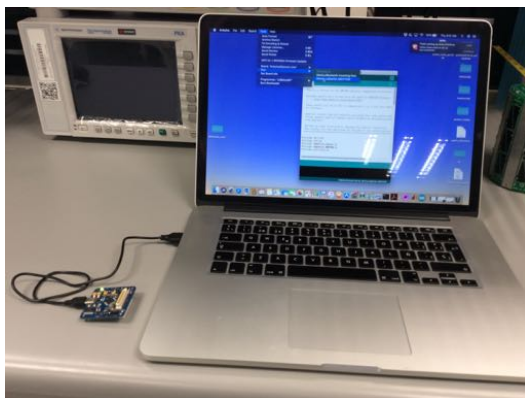
Structure

- 3D printed structure



Programming

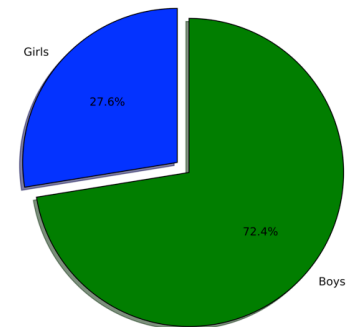
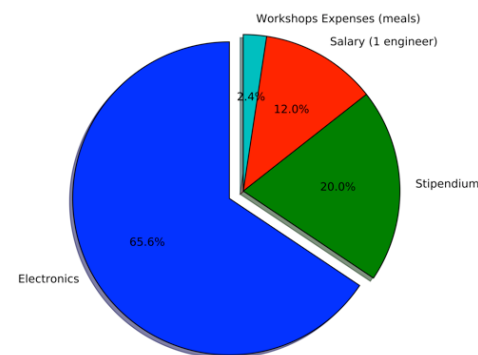
- The platform is connected to a personal computer through a **USB port**.



- Programming mode is selected with jumpers.

Workshops

- Preparatoria II UAZ, Zacatecas.
- Colegio de Bachilleres Plantel 1, Zacatecas.
- Preparatoria Francisco García Salinas, Jerez.
- Centro de Estudios Tecnológicos industrial y de servicios 114, Jerez.
- Preparatoria IV UAZ, Zacatecas.
- Elementary school Greem, Francisco I. Madero.



Workshops

- Participants were organized in groups of 4 - 5 members.



Workshops



Elementary School Workshops

- Workshops for kinder-garden and elementary school learners. More than 100 participants attended.



Lessons learned

- Beneficial for undergraduate students to acquire “know-how” skills in the design of the subsystems of a small satellite.
- **PQ 60** platform can be employed as an effective tool for **STEM** education in countries under development.
- Costs reduction compared to other platforms.
- Consider the possibility to initialize a **start-up** company, looking forward for a space mission.



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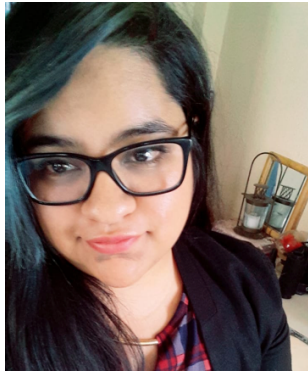


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Electrical Engineering



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