Development of CANSAT SentinelX

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***Abstract*—This document presents the development of the CANSAT SentinelX, a device designed to collect environmental data in a space exploration scenario. The CANSAT measures variables such as temperature, humidity, atmospheric pressure, gravity, pollutant gases, and UV radiation. Communication between the modules occurs via LoRa and MQTT, and the data is stored on an SD card. The initial communication experiment showed efficiency and speed in data transmission.**

I. Introduction

This paper describes the development of the CANSAT SentinelX, a device intended for measuring critical data for human survival in extraterrestrial environments. The system is launched by a drone and must be recoverable at the end of the mission. Data communication occurs via LoRa to a ground station and subsequently via MQTT to another device.

II. CANSAT Description

The CANSAT SentinelX consists of the following subsystems:

- **Environmental sensors**: Sensors for temperature (DHT11), humidity, atmospheric pressure (BMP280/BME680), and UV radiation (GUVA-S12SD).
- **Gas sensors**: CO2 (SCD30/MH-Z19), NO2, CO, SO2, O3 (Alphasense B4/MiCS-6814).
- **Gravity measurement**: Strain gauge extensometer.
- **Communication**: LoRa module for transmission to the ground station, ESP32 for retransmission via MQTT.
- **Storage**: SD card both in the CANSAT and the ground station.
- **Recovery**: Built-in parachute for a safe landing.

III. Proposed Method

Each subsystem was designed to operate in an integrated manner, ensuring efficient data collection and transmission. LoRa communication was implemented with ESP32, following the code available in [1]. Local storage is performed on SD cards, allowing redundancy in data recording.

IV. Expected Results

A fully functional CANSAT is expected, capable of efficiently collecting and transmitting environmental data. Initial tests have demonstrated that LoRa and MQTT communication are effective, allowing real-time information transmission to external devices.

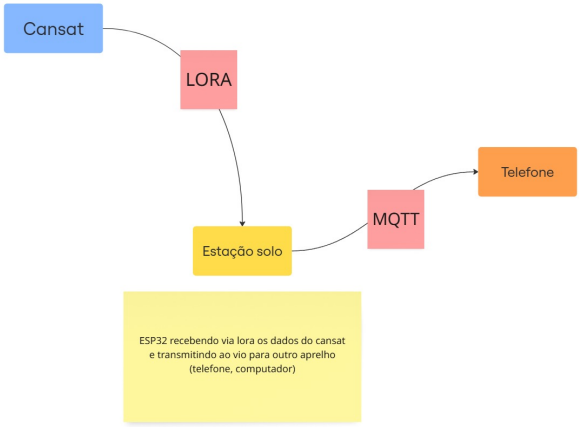

Fig. 1. CANSAT SentinelX system diagram

V. Conclusion

The development of the CANSAT SentinelX represents an advancement in environmental data collection for simulated space exploration missions. The integration of sensors and efficient communication demonstrate the system's potential for future applications.

References

[1] Osoyoo, "LoRa tutorial: How to use the UART LoRa module with Arduino," 2018. [Online]. Available: https://osoyoo.com/2018/07/26/osoyoo-lora-tutorial-how-to-use-the-uart-lora-module-with-arduino/
[2] Documentation of the sensors used. Available on Overleaf.
[3] Documentation on MQTT and ESP32. Available on Overleaf.