Development of CANSAT SentinelX

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***Abstract*—This study presents the design and initial development of the CANSAT SentinelX, an integrated telemetry and environmental sensing system being developed for experimental missions. The device will be equipped with sensors capable of collecting environmental data such as temperature, humidity, atmospheric pressure, UV radiation, and gas composition, enabling the analysis of environmental characteristics and their correlation with quality of life. Data communication will be conducted using LoRa and MQTT protocols, ensuring efficient and reliable transmission to a ground station. Currently, the system is in the development phase, focusing on the implementation of communication, sensing, and documentation modules. Future stages of the project will include experimental tests to validate its functionality in simulated environments, as well as data collection and processing.**

Keywords—IoT, CanSat, MQTT, Environmental Monitoring, Telemetry, Remote Sensing.

I. Introduction

A CanSat is a miniaturized satellite designed to have the shape and size of a small can. Its goal is to create a compact device capable of performing functions similar to those of a conventional satellite. [1] This paper presents the development of the **CANSAT SentinelX**, a system designed to collect environmental data in experimental missions. The objective is to investigate environmental characteristics and correlate them with quality of life based on the data collected by the **CanSat** sensors. The device is deployed by a drone and must be recovered at the end of the mission. Data communication occurs via **LoRa** to a ground station and is subsequently retransmitted via **MQTT** to another device.

II. CANSAT Description

The CANSAT SentinelX consists of the following subsystems:

- **Sensing**: A set of sensors responsible for collecting environmental and physical data, including:
  - Temperature and humidity: DHT11
  - Atmospheric pressure: BMP280/BME680
  - UV radiation: GUVA-S12SD
  - Gases: CO (SCD30/MH-Z19), NO, CO, SO, O (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.

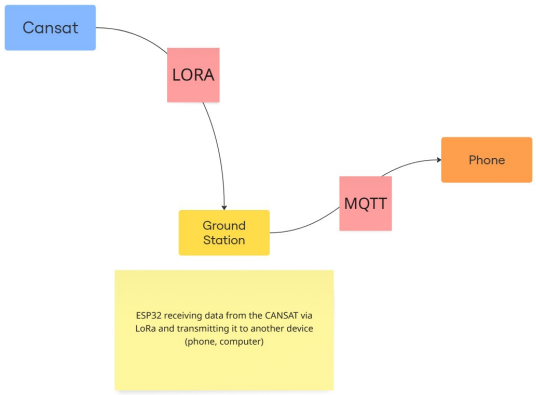

Fig. 1. CANSAT SentinelX system diagram

III. Proposed Method

Each subsystem was designed to operate in an integrated manner, ensuring efficient data collection and transmission. Initially, communication was carried out between two Arduino Uno boards, each equipped with a LoRa antenna. The receiver then forwarded the data to a broker using Mosquitto. However, this setup was improved by replacing the second Arduino Uno with an ESP32, which now acts directly as mosquittopub, transmitting the data to the broker immediately after receiving it from the LoRa transmitter on the CanSat. Additionally, local storage is performed on SD cards, allowing redundancy in data recording.

IV. Expected Results

A fully operational CANSAT is expected, capable of efficiently collecting and transmitting environmental data. Preliminary tests have validated the effectiveness of LoRa and MQTT communication, enabling bidirectional data transmission with minimal latency to external devices, ensuring greater reliability and extended reach in data dissemination. .

V. Conclusion

The development of the CANSAT SentinelX represents an advancement in environmental data collection for analyzing terrestrial quality of life and its potential use in simulated space exploration missions. The integration of sensors and efficient communication demonstrates the system's feasibility for future applications in remote monitoring. Future studies will include experimental tests to validate its functionality and enhance data transmission and analysis. [1], [2].

REFERENCES

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