Chair of Spacecraft Systems
TUM School of Engineering and Design
Technical University of Munich

Engineering Project / Bachelor Thesis / Semester Thesis

Start date: As soon as possible

Topic: *On-Board Computer for EventSat mission: FlatSat PCB Configuration and Subsystem Integration*

We are seeking students to help in the development on the onboard computer for EventSat mission. This is an incredible opportunity to get hands-on programming experience for a real mission going to space.

The EventSat mission is a 6U CubeSat technology demonstration mission sponsored by the Chair of Spacecraft Systems to apply event cameras to detect stars and other space objects. Event cameras are a specialized type of camera that use changes in brightness on a pixel-by-pixel level to detect motion in view. Building upon existing work, which has demonstrated the effectiveness of these cameras on ground in conjunction with telescopes, our mission seeks to demonstrate the effectiveness of this class of camera for space-based observation.

As a university CubeSat project, we recognize the fact that most students have never had the chance to work on flight software, and thus the tasks on this project are intended to be a learning process where students develop the necessary skills alongside the satellite itself. The most important skill we are looking for in students is the passion for the work and the willingness to devote the time to build the necessary programming skills and associated programs.

There are a multitude of opportunities available, whether it is writing embedded software, creating software architecture design documents, or performing unit testing and validation of existing code. We are happy to tailor tasks to your personal interests, existing strengths, and skills you would like to build professionally long-term.

Goals

- **Technical Understanding:** obtain practical experience in subsystem integration and electrical signal routing for the onboard computer (OBC) and associated modules
- **PCB Design and Assembly:** develop a FlatSat board using PC104 connectors to emulate spacecraft subsystem interconnections in a laboratory/test environment
- **Circuit Debugging:** gain proficiency in trace signal validation, using standard electronics instrumentation to confirm functionality

Tasks

- Design and assemble a FlatSat printed circuit board (PCB) to connect major satellite subsystems (OBC, Power, Communications, Jetson Payload) using the PC104 connector standard.

- Map, route, and condition digital and analog signals required for subsystem operation and communication.
- Debug subsystem interconnections using LEDs and switching elements (e.g., transistors) to verify signaling and status indications.
- Use laboratory equipment (e.g., multimeter, oscilloscope, logic analyzer) for comprehensive testing, troubleshooting, and verification of all key PCB interfaces.
- Document the integration process, PCB schematics, test cases, and integration results for future project reference.

Documentation and Presentation:

- Prepare detailed user documentation (e.g., Wiki pages, GitLab repositories, LaTeX documents)
- Write a semester thesis document in double-column paper format
- Develop a short presentation summarizing the results

Requirements

- Basic understanding of CubeSats and their operations in low-Earth orbit
- Coursework or self-taught experience in electronics/circuit design
- Familiarity with digital and analog interface debugging; comfortable using lab instrumentation
- Note: This project is subject to export control regulations. An NDA must be signed, and some nationalities might not be eligible to work on the OBC.

Expected results:

- A fully functional FlatSat PCB demonstrator, supporting integration and testing of all relevant satellite subsystems
- A comprehensive semester thesis in double-column paper format
- Well-documented code maintained on a GitLab repository
- A brief presentation outlining the project results

References

[1] L. Schuberth *et al.,* "Leveraging Event-Based Cameras for Enhanced Space Situational Awareness: A Nanosatellite Mission Architecture Study," *75th International Astronautical Congress (IAC)*, 2024. [Online]. Available: https://mediatum.ub.tum.de/node?id=1759594

Supervisor

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