Internship / Thesis Proposal – 4 to 6 months

Title:

Development of IonSat Flight Software

Context of the internship

The Centre Spatial de l'École polytechnique (Space center of École polytechnique, CSEP), created in 2010, proposes and supervises space projects for École polytechnique students. It is at the origin of one of the first French student nanosatellites, X-CubeSat, launched into orbit in 2017. The CSEP brings together and coordinates, through its projects, students, teacher-researchers, industrialists and French and European space agencies. It is financially and operationally supported by the education patronage program *Espace, science et défis du Spatial (*Space, Science and Challenges), led by Professor Pascal Chabert.

IonSat is a 6U nanosatellite project equipped with an electric propulsion engine, dedicated to demonstrating the feasibility of nanosatellite missions in very low orbit (300km). It is at the frontier of space applications, with a strong educational vocation, the project is currently led by twenty students, supported by numerous space actors: industries (Thalès Alenia Space), agencies (CNES, Onera).

Internship description

The objective of this internship is to participate in the development of the IonSat Flight Software (FS). This software is responsible for managing all the IonSat satellite platform subsystems and contributes to guarantee the proper functioning of the associated payload.

In concrete terms, the intern will work with an on-board software Development Kit with the following architecture: Simplified on-board software architecture called LVCUGEN (developed by CNES), UART driver for TM/TC, IOS partition for the inputs/outputs and a Mission partition for the payload, this allows development of the payload code in parallel with the development of the platform flight software and a simplified integration with other developments in parallel. Particular attention will be paid to documentation, testing and validation.

Notions of software development and space systems engineering will prevail. The mission will focus on:

- The development, implementation, and validation of main modes of the FS.
- The development, implementation, and validation of the communications between the on-board computer (OBC) and the different payloads, considering creating new mission partitions.
- Specify the data constraints, responsiveness with each component and functionality. Thus, precisely define the performance of the system (reactivity, throughput, data, etc.).
- Manage system errors and failures effectively with well-established scenarios and intelligent safety protocols.

The intern will work with one full time engineer of the CSEP, and can use the help of the space team of the Laboratory of Plasmas Physics, specialized in conception of space-ready magnetometers and on-board

electronics. There are also frequent contacts with experts from the French aerospace agencies (CNES, ONERA) and companies (Thalès Alenia Space, ThrustMe) partners of the IonSat Project.

Technical Requirements

- M1 or M2 level in informatics and programming, electrical engineering, or related domains.
- Experience in C/C++ programming.
- Knowledge in UNIX like systems.
- Knowledge in aerospace systems is a plus.
- Knowledge of communication buses (I2C, CAN, RS422, etc.).
- Experience on the Zynq Zybo Z7-10 target is a plus.
- Experience on the XtratuM hypervisor is a big plus.
- Good English profficiency.

Behavioural Requirements

- Self Motivation and autonomy.
- Communication and teamwork.

Internship duration: between 4 and 6 months, from September/October 2023, only presential mode in Palaiseau, France. If you are interested, send your CV and a cover letter, clearly indicating your motivation and availability dates.

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