

Developing a Versatile Plug-and-Play Software Solution for CubeSat Bus Systems: Insights from Expert Interviews

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BIRDS Open Source Webinar #21

Outline

Background

- Current Challenge
- Research methodology
- Summary of proposed outcomes
- Short term improvements
- Insights from interviews
- Questionnaire



Background

BIRDS started in 2015

Main goal: provide hands-on training in satellite engineering, project management, and cross-cultural teamwork to students from non-space-faring nations through the development of CubeSats in order to gain practical experience and contribute to global capacity building in space technology.









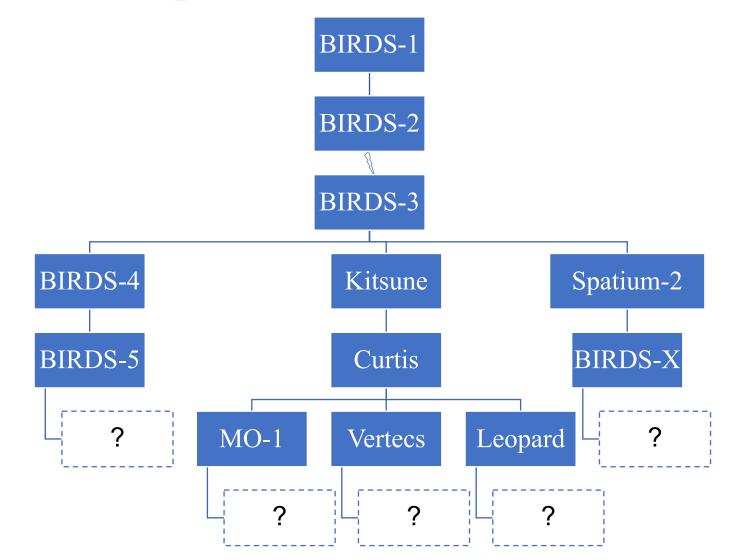






Current Challenge

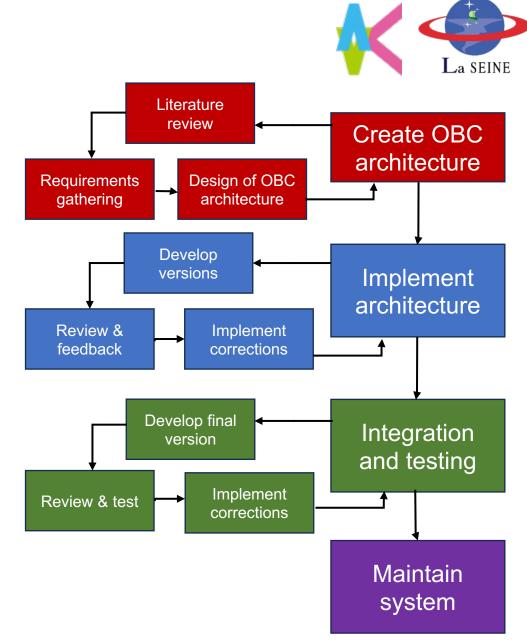




Research methodology

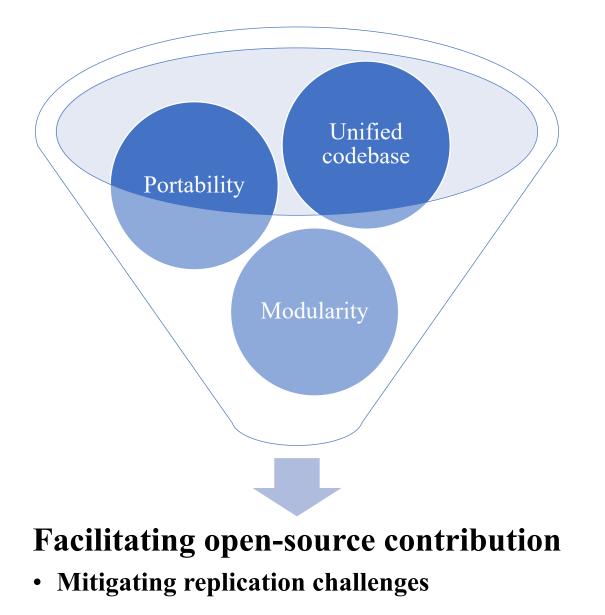
The approach that will be used to conduct the research:

- qualitative analysis of user and contributor feedback through interviews, survey,
- iterative development of a more structured codebase, and,
 - quantitative measurements of user engagement within the BIRDS Open Source repository.



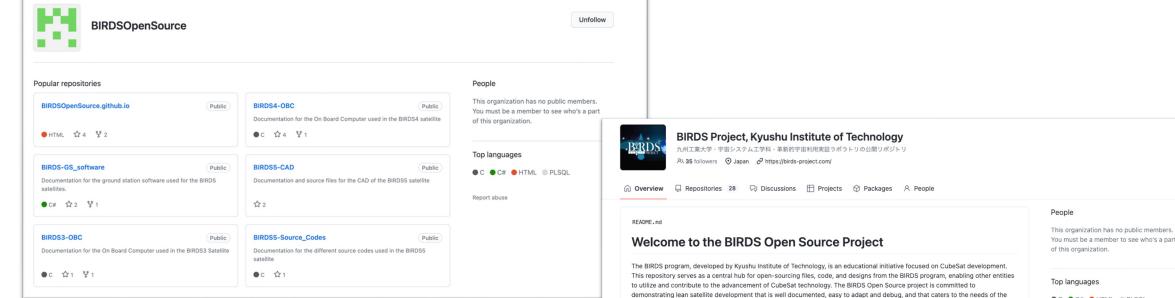
Proposed outcomes

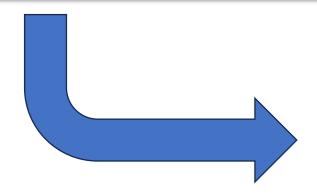




Short term improvements







entire satellite development workflow, from satellite design configurations to ground station data collection and analysis. Take a peek at the website for BIRDS Open Source for more information that may be relelvant to you. We also have a monthly webinar to discuss various issues related to the satellite bus, past webinar recordings and presentations can be found here.

About the BIRDS Program:

The BIRDS program provides hands-on training in satellite engineering, project management, and cross-cultural teamwork. Through the development of CubeSats^[1], students from non-space-faring nations gain practical experience and contribute to global capacity building in space technology.

Kyushu Institute of Technology (Kyutech) has been carrying out its BIRDS program since 2015. In the program, inexperienced student members receive training and develop multiple 1U CubeSats. Each BIRDS project develops 1U CubeSats for the capacity building of non-space-faring nations. As of Febuary 2024, six generations of BIRDS projects have been carried out:



The BIRDS program is a unique educational program that provides an excellent opportunity for learning systems engineering, project management, and cross-cultural teamwork, not only conventional space technologies.

The BIRDS BUS is a standard CubeSat bus of electrical design to support the BIRDS program. The design puts an emphasis on ease for beginners to learn and use it. For example, the BIRDS BUS uses a distributed system design, not for its performance but for the easy work sharing and simple coding work involved.

You must be a member to see who's a part

● C ● C# ● HTML ● PLSQL

Most used topics

cubesatellite satellite cubesat birds-3 cubesat-satellites



Insights from interviews

Strategies for maintaining compatibility and interoperability

Satellite Name	Main OBC MCU	Prog. Lang.	Interfaces	Size	Missions
Birds-1	H8	С	-	5*1U	-
Birds-2	H8	С	SPI,UART	3*1U	5
Birds-3	PIC18	С	-	3*1U	4
Birds-4	PIC18	С	-	3*1U	-
Kitsune	PIC18	С	SPI,UART,CSI-2	6U	4
Spatium-2	RPi	С	USB2.0,UART,I2C,SPI	1U	1
Birds-5	PIC18	С	-	2*1U, 2U	5
Curtis	PIC18	С	UART	-	-
Birds-X	PIC18	С	-	2U	4
MO-1	PIC18	С	UART	1U	1
Vertecs	PIC18	С	SPI, UART	6U	1
Leopard	PIC18	С	SPI,UART	3U	6



V Firmware update

Use of standardized communication protocols

Thorough compatibility testing

Leveraging vendor expertise

Challenges encountered during the development of heritage cubesat software



I learned the satellite operational flow from a flowchart on the white board and hearing members talking about it ... Because I didn't understand the H8 code an important function was not implemented in BIRDS-3 and that was my fault.

- BIRDS-3 OBC Member



code review

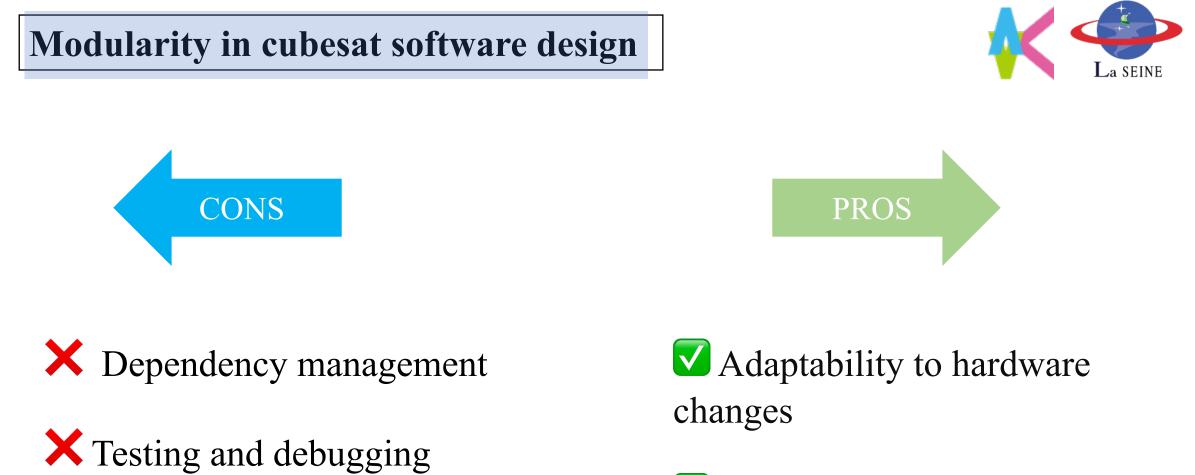


version control



issue tracking (functionality checks)





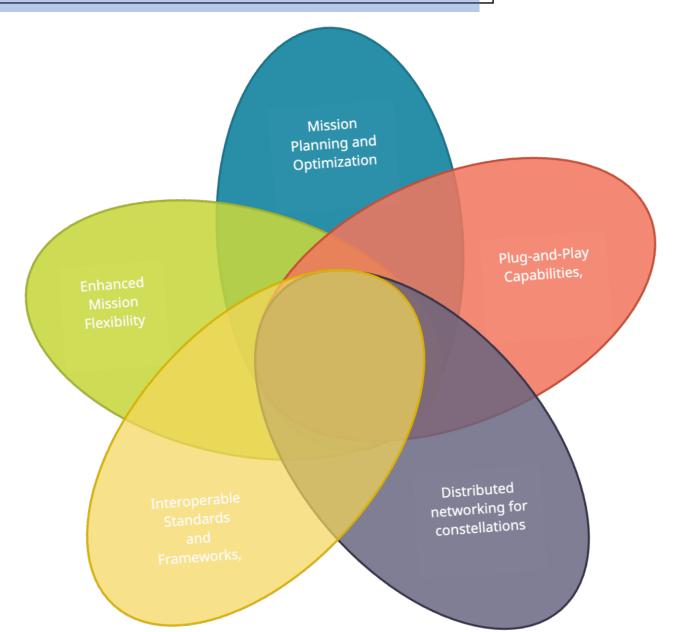






Future directions and potential applications





Your Opinions



Survey for research

- <u>https://forms.gle/3CWqpsWyNKLrUfKP6</u> (IN JAPANESE)
- <u>https://forms.gle/QfeANnToBuAHhwpb6</u> (IN ENGLISH)

- Opinions/ Observations on GitHub updates
 - <u>https://github.com/BIRDSOpenSource</u>



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