



Task Description Master's Thesis

Integration of V-HAB and Synera for Enhanced Life Support System Modeling and Automation

Motivation:

The next generation of human space exploration missions will require increasingly sophisticated life support systems (LSS) to sustain crews on long-duration missions far from Earth. V-HAB, a powerful simulation system for modeling complex LSS, employs a unique bottom-up approach that allows for high-precision modeling of all LSS components up to a user-defined granularity. This approach enables V-HAB to maintain high modeling accuracy by providing detailed information on mass flow, temperature, pressure, humidity, and composition for each individual process and subsystem.

Currently, V-HAB operates entirely within MATLAB without requiring additional packages or toolboxes. It offers a library of pre-defined basic LSS components, allowing users to integrate existing subsystems into their designs rather than starting from scratch. However, V-HAB lacks a user-friendly graphical interface (GUI), hindering its accessibility and usability, especially for new users. This master's thesis will work in parallel with the ongoing development of the V-HAB GUI to compare the suitability of Synera as an alternative approach.

Synera, a modern low-code automation platform, offers the potential to address these gaps and enhance V-HAB's capabilities. The integration of V-HAB with Synera provides significant potential to improve the functionality and user experience of the LSS modeling platform. By leveraging Synera's capabilities, the integrated system could provide a user-friendly graphical interface, streamline the design process with quick options and arranging tools, and offer real-time feedback through automated logic tests and live updating feeds. These features would make V-HAB more accessible to new users while providing comprehensive overviews of designed LSS and enhancing understanding of their operations.

This master's thesis aims to investigate and implement this integration, creating an advanced modeling platform that enables more efficient data generation, improved visualization of simulation results, and enhanced automation of modeling workflows.

Task Description:

- Familiarization with LSS technologies, V-HAB's architecture, and Synera's features
- Develop a conceptual framework for integrating V-HAB simulations within Synera
- Implement custom nodes in Synera for V-HAB operations and LSS components
- Design and implement a user-friendly graphical interface for V-HAB using Synera
- Conduct a case study of a complex LSS scenario using the integrated V-HAB-Synera platform
- Evaluate the integrated system's performance
- Documentation

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