

Overview

MOSAIC is a multi-Robot Mission Control Centre software suite developed by Space Applications Services providing an all-in-one cloud-based or stand-alone solution for multi-robot mission planning, monitoring, control, data management and post-processing analysis.


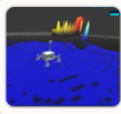



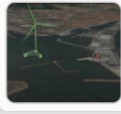



MOSAIC is a robot agnostic suite offering the possibility to integrate any robot platform, including the related payloads. By means of its intuitive web based user interface, it is possible to generate mission plans automatically via high level goals and validate complex mission plans involving multiple agents. Flexible and configurable dashboards allow the user to monitor the mission execution in real time, gathering information on vehicles status, with the possibility to issue commands to robots whenever needed.

Dedicated MOSAIC modules, deployable onboard the robots, provide on-board decision autonomy, extending the capability to adapt the predefined plan in case of deviations. A configurable data recording module offers the option to analyse the mission data, for debugging or optimization purposes.

Components

MOSAIC adheres to a component-based architecture, ensuring that each module serves a distinct purpose, thereby enhancing flexibility and customization. At the core of this architecture is the UI Server, a key component that enables users to interact with the MOSAIC Server, granting them access to the full range of powerful features. Here the wide set of possibilities with the UI plugins.




User Interfaces

- **2D World Map**
2D world map used to display the GPS and orientation of each robot.
- **Local 3D Map**
Display local data of the robots such as elevation maps or point clouds and their URDF model.
- **GANTT**
Display mission plan and robot actions in a GANTT chart view.
- **Teleoperation**
Send commands to a robot using the graphical user interface.
- **Videos**
Vizualize live and replay of RTSP video streams from each robot.
- **3D World Map**
3D world map used to display the GPS and orientation of each robot with their 3D models.
- **Mission Planning**
Configure and trigger planning process for a multi-agent mission and display plan.
- **Telemetry**
Display numerical and boolean telemetries received from robots.
- **Images**
Display live and history of images received from each robot.

Technologies

-  OpenMCT
-  SocketIO
-  Vue.js
-  PostGIS
-  PDDL
-  ROS2

Interface

-  REST API
-  WebSocket API
-  Interoperability library

Protocols

-  HTTPS
-  DDS
-  WebSocket

MOSAIC at a glance

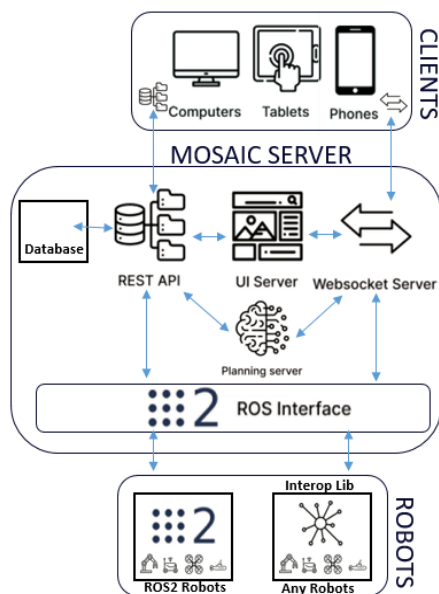
With advanced planning algorithms and real-time monitoring, MOSAIC optimizes task allocation across heterogeneous robotic platforms, and provides instant insights into agents' status and missions' progress. Streamlining operations, it automates complex mission planning and enables data-driven decision-making. The intuitive interface ensures easy navigation and effective supervision, enhancing overall mission success.

Command & Data Interfaces

The MOSAIC Server is designed to serve as an intermediary, facilitating seamless communication and control between multiple robots and operators.

Client connectivity – Stakeholders or robot operators can access the MOSAIC UI from any device with a standard web browser, displaying both historical and real time data from all robots. The REST API server efficiently serves and record data history, while the websocket API server ensures real time data exchange.

Robot connectivity - MOSAIC is natively compatible with ROS1/2 robots, enabling robust communication with configurable quality of service settings. Even non-ROS robots can be easily integrated through a custom C++ Interoperability library, using comprehensive documentation and examples provided. Wireless communications with software based QoS (Quality of Service) is also provided together with communications hardware – Satellite, SDR (Software defined radio) Mesh, WiFi etc.



Automated Mission Planning

An AI goal based automated mission planning module generates spatio-temporal sequence of tasks, actions and paths optimally for a multi-robot fleet. The task planner is based on Planning Domain Definition Language (PDDL), with specific extensions to generate an optimized mission plan. Operators can efficiently orchestrate missions, set task priorities, and establish coordinated actions among multiple robots.

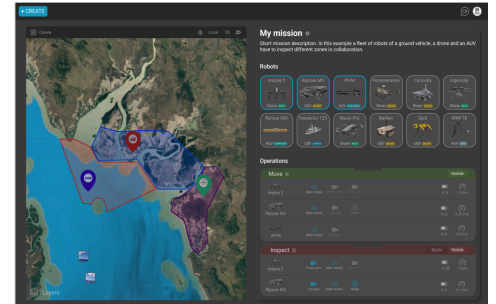
Database

A robust database is designed to securely store and link user and agent data, mission configurations and planner settings. Its architecture seamlessly integrates with the planner syntax (PDDL) for efficient planner configurations, as well as the ROS messages format to handle agents' data. The interaction with the database is fully handled by the REST API server and a Geoserver instance. Moreover, MOSAIC leverages the PostGIS capabilities for database management, enabling the utilization of geographical data fields.

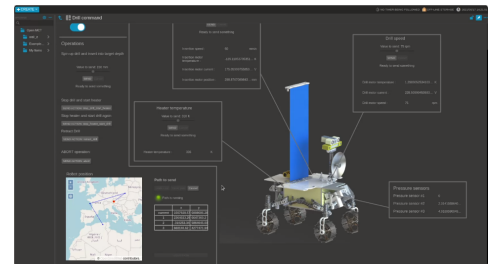
Cloud Deployment

The MOSAIC Server architecture is designed to be deployed as a cloud service, accessible on the web through a dedicated HTTPS URL. Multiple instances of the comprehensive MOSAIC software suite can be concurrently deployed, empowering distinct projects or users to join their dedicated environments. Deployable as a standalone or in-the-cloud application, MOSAIC can be tailored to any application requirements.

USER INTERFACES



Mission planning UI - With its advanced mission planning capabilities, users can effortlessly create and customize missions for a generic fleet of robots.



Mission Monitoring UI – MOSAIC UI incorporates robust monitoring features, providing real-time updates on the status and performance of each robot.



Communications – MOSAIC suite can optionally provide mesh -Software Defined Radio, satellite communications and other wireless communication integrated solutions

Join MOSAIC community

As an agnostic multi-agent planner and monitoring tool, MOSAIC offers flexibility, allowing to seamlessly integrate and manage diverse agent types and platform. By means of MOSAIC you gain independence from specific agent technologies, enabling easy scalability and adaptability. With its robust features and compatibility, MOSAIC simplifies operations, enhances coordination, and improve overall efficiency.