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Autonomous Fire-Fighting UAV

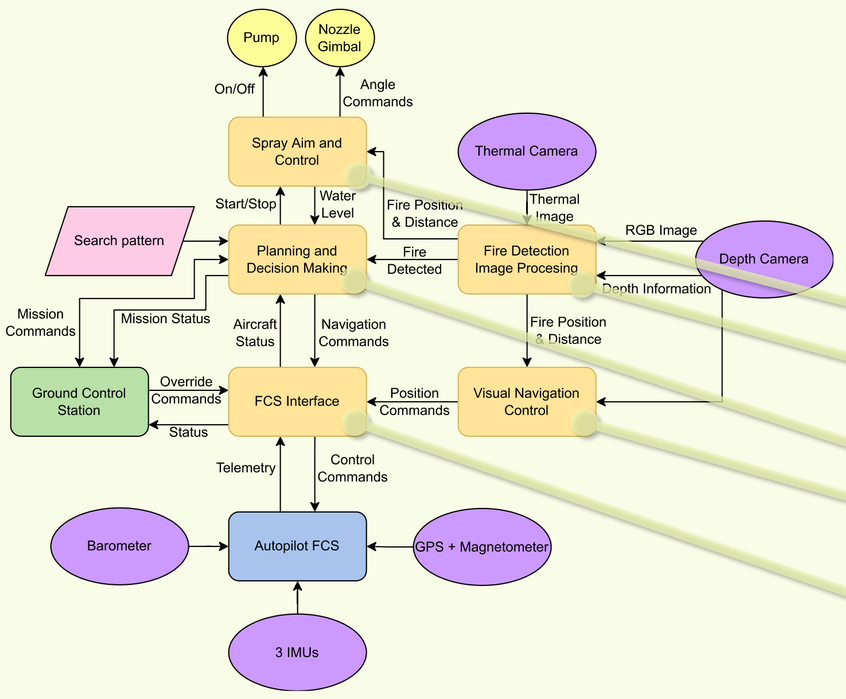
Description

The primary mission of the autonomous UAV is to search and identify a fire on the wall of a building, fly close to the fire and spray suppressant liquid onto the fire.

Challenges

- Accurate detection of fire sources using vision-based perception
- Navigation and alignment against centre of fire
- Fire extinguishing from aerial platform

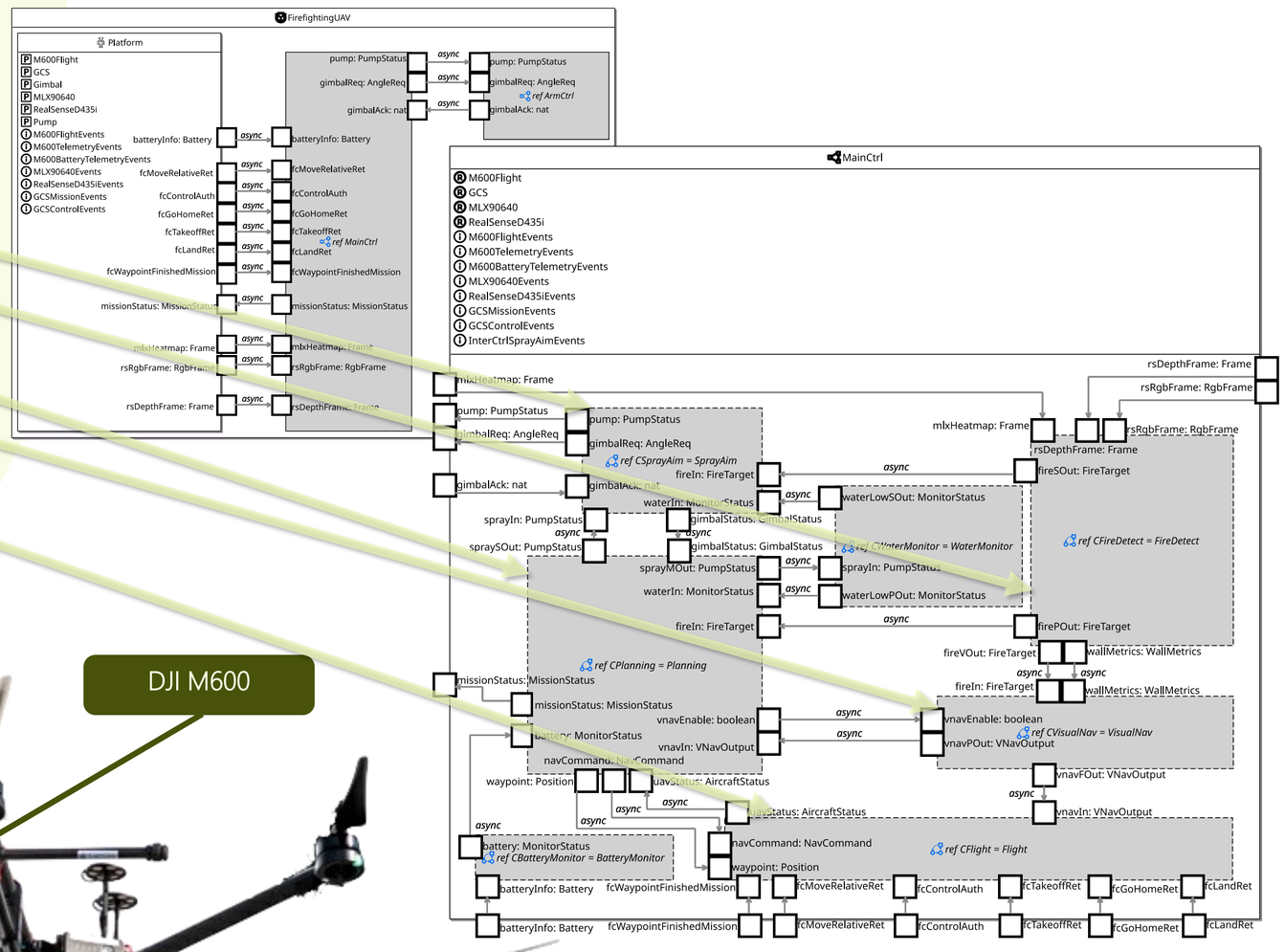
System Architecture

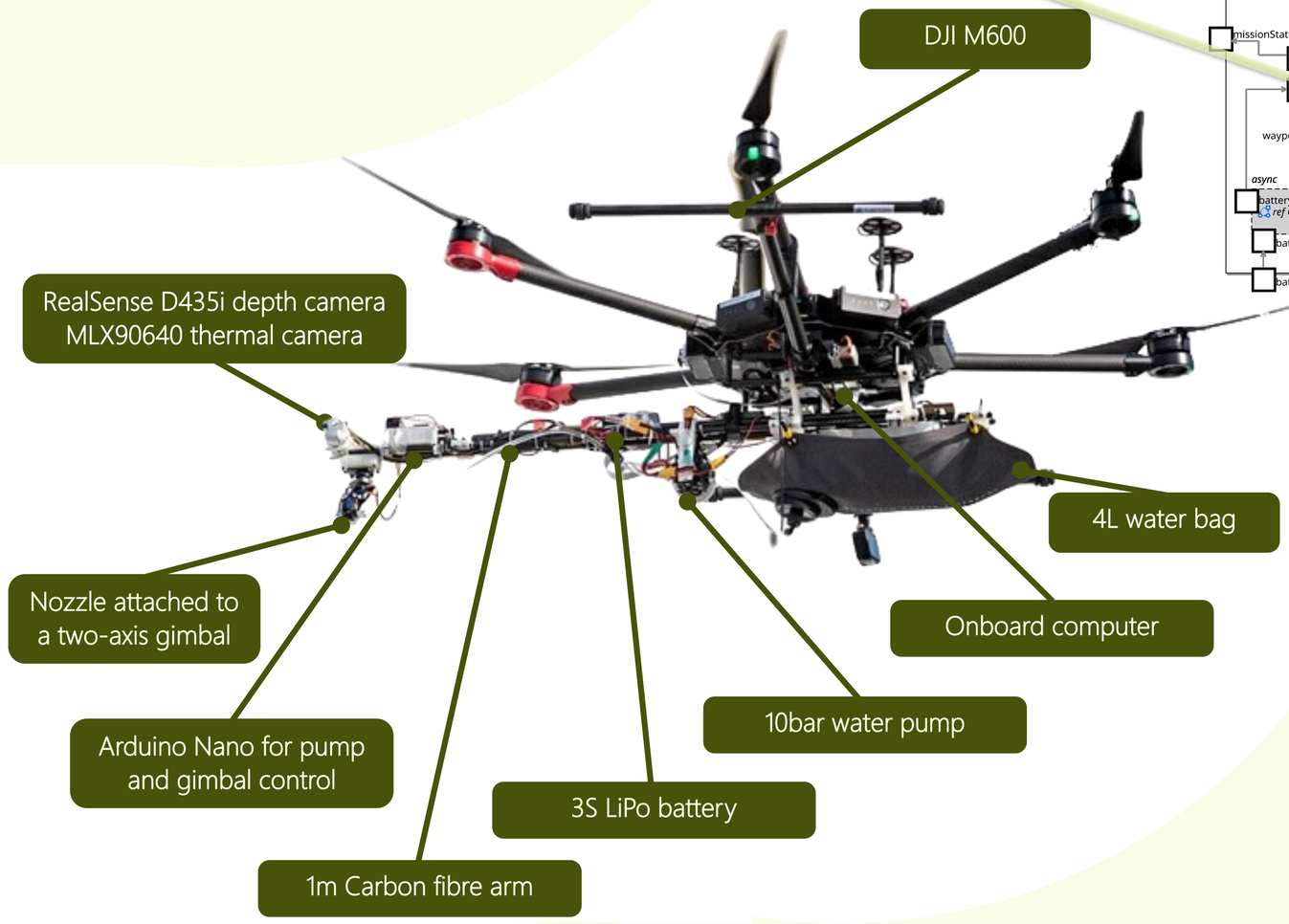


High level systems diagram with main components and connections.

Software Modelling

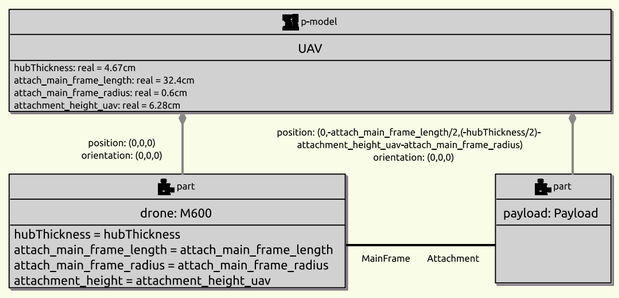
- Two RoboChart controllers reflect partition between main computer and Arduino that controls the pump and nozzle gimbal





Physical Modelling

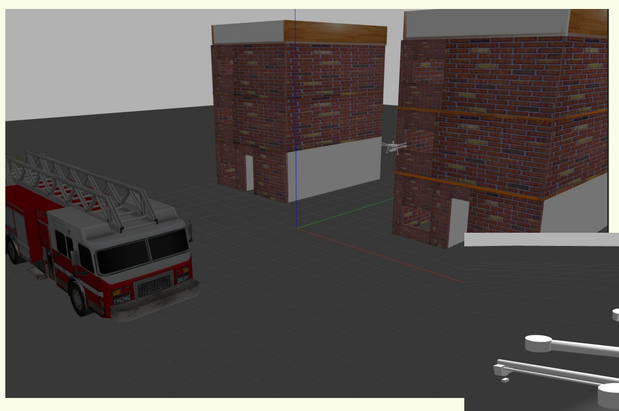
- Modular RoboSim physical model
- Parts reflect decomposition between **M600** platform, with **GPS**, **IMU** and **battery capacity** sensors (shown), and custom **Payload** with **cameras**, and **nozzle gimbal** and **water pump** actuators
- Automatic generation of SDF for simulation with Gazebo



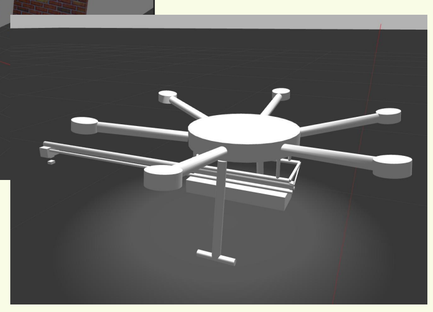
RoboSim physical model of the UAV

Simulation

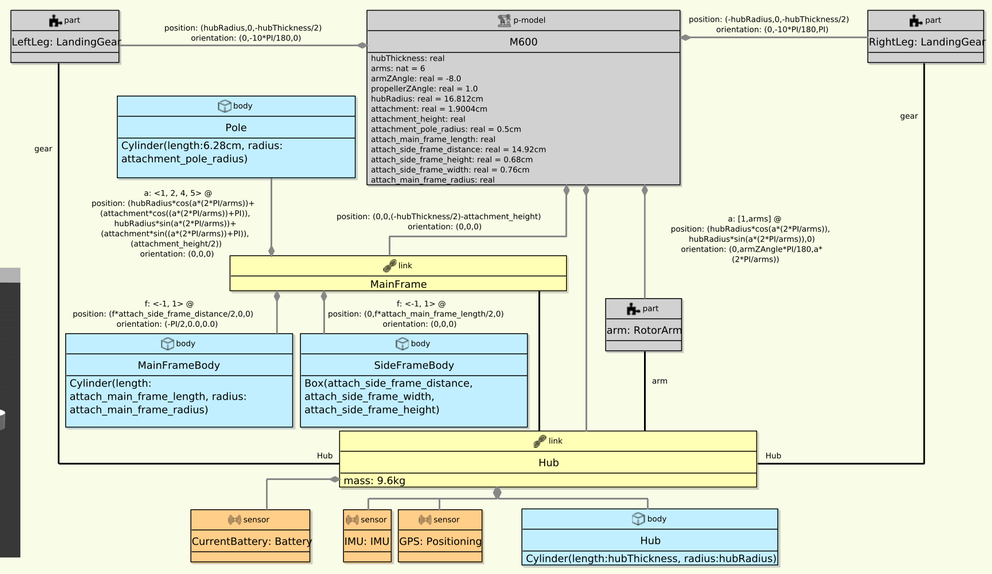
- ROS-based simulation with Gazebo
- Aim to use code generated from RoboSim software model obtained via transformation from RoboChart, ensuring sound behaviour



Scene in Gazebo



UAV model rendered in Gazebo after importing generated SDF



RoboSim physical model of the DJI M600

Testing & Verification

- Search-based approach to explore and generate test cases from a digital model
- Conformance testing of the UAV's behaviour against the expected one
- Verification of properties pertaining to the software, platform, and scenario

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