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ROBOSTAR

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Verifiability
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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
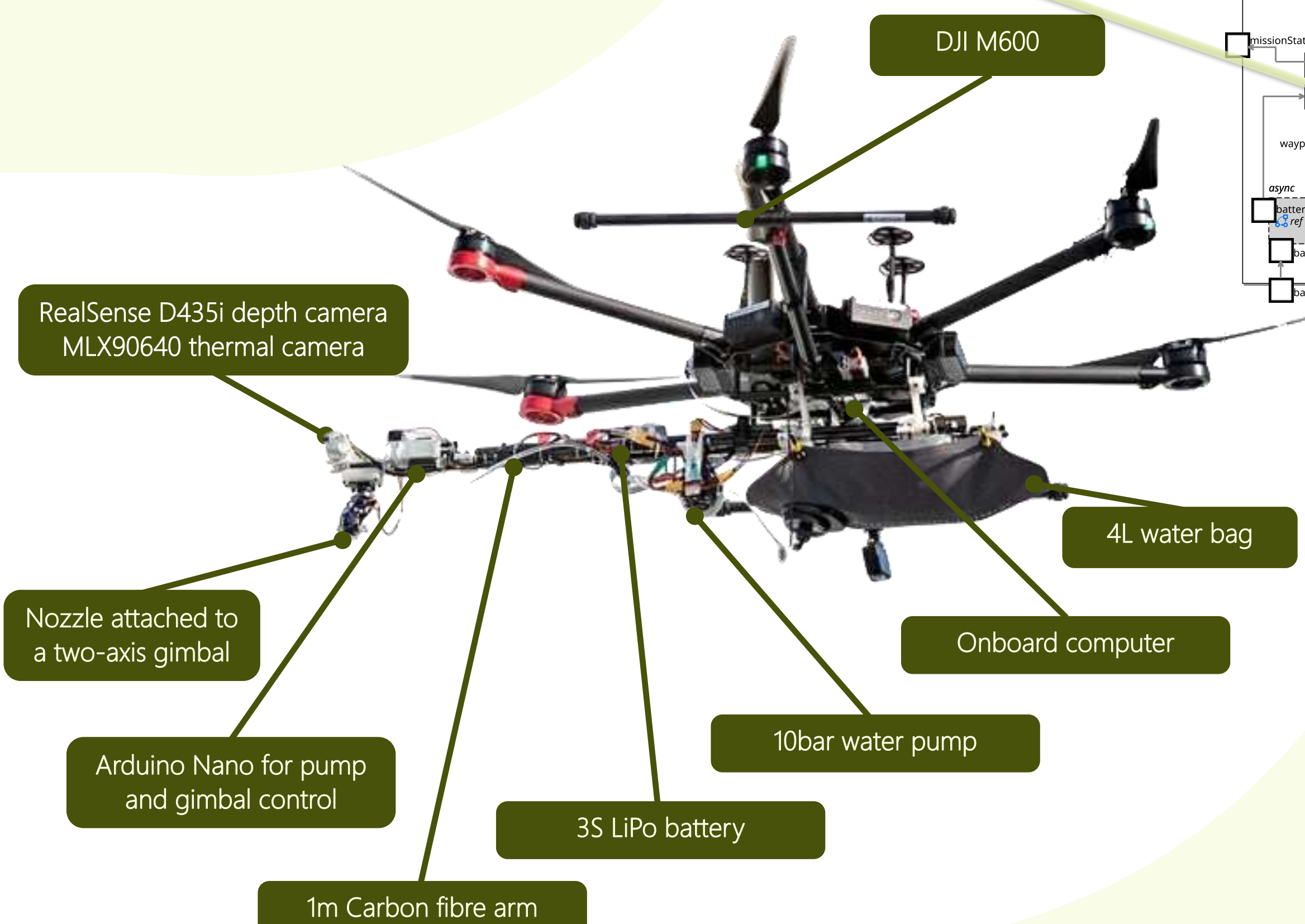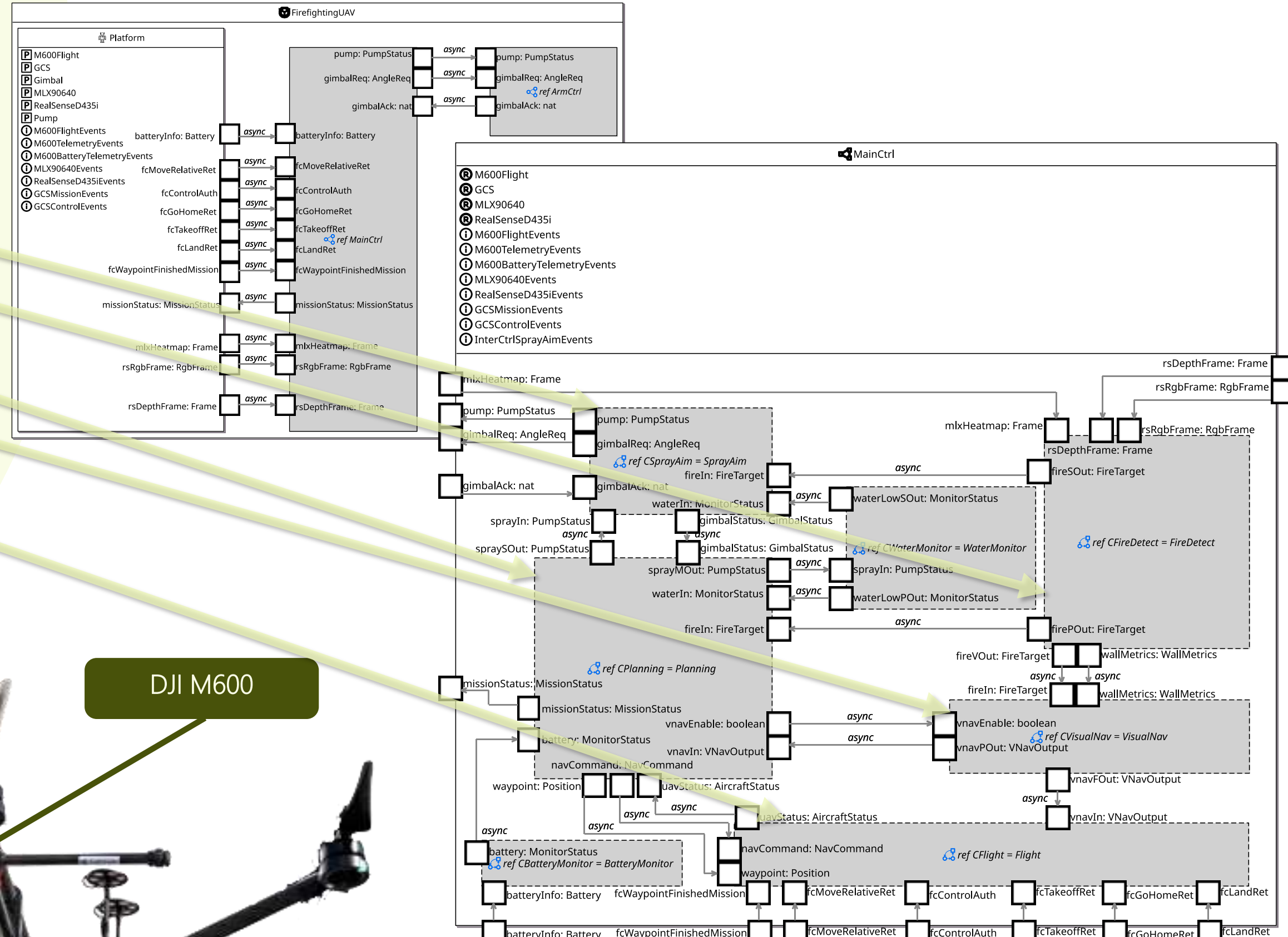- Fire extinguishing from aerial platform

System Architecture
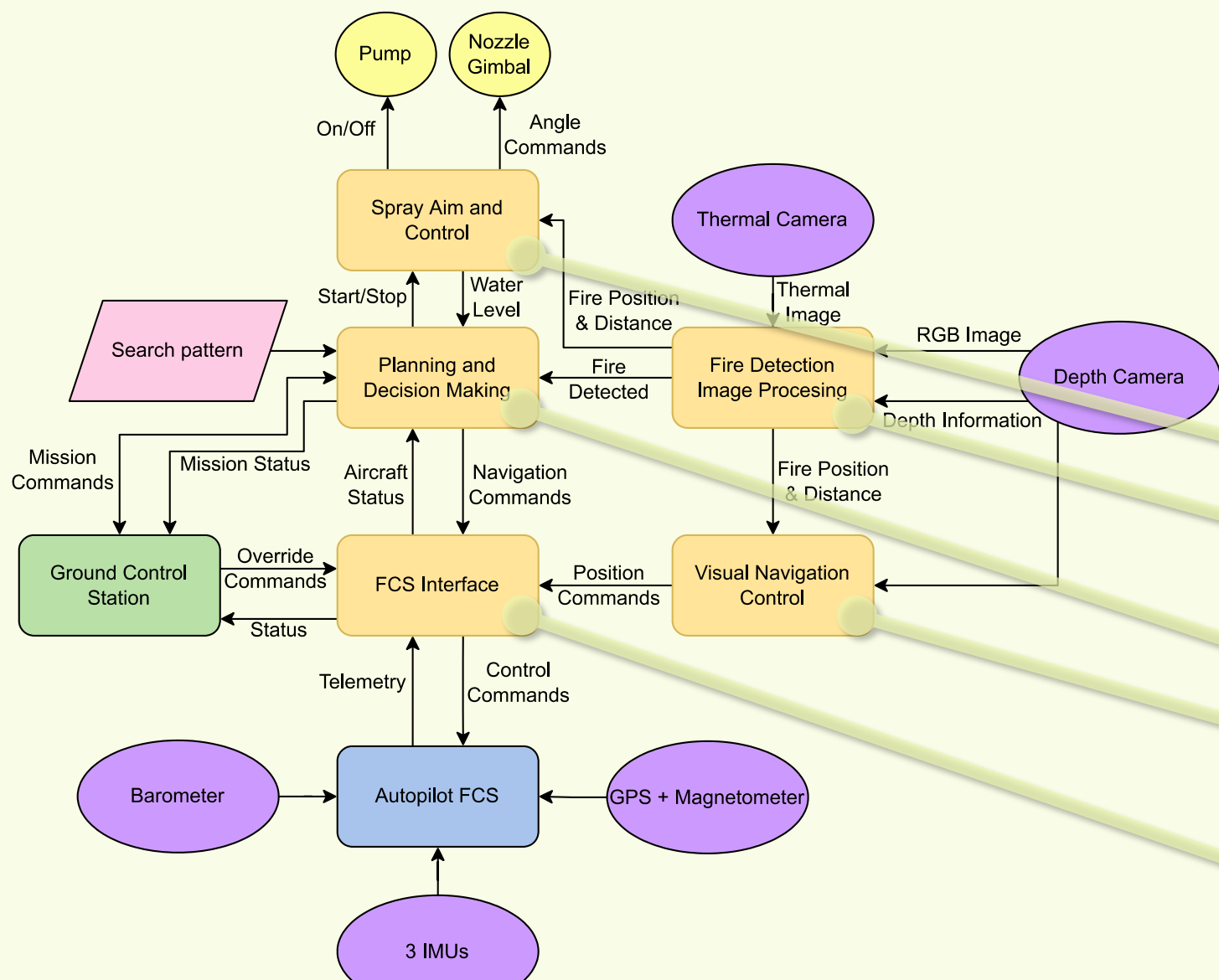
High level systems diagram with main components and connections.

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

RoboSim physical model of the DJI M600

Drone callouts

- DJI M600
- RealSense D435i depth camera / MLX90640 thermal camera
- 4L water bag
- Onboard computer
- Nozzle attached to a two-axis gimbal
- Arduino Nano for pump and gimbal control
- 10bar water pump
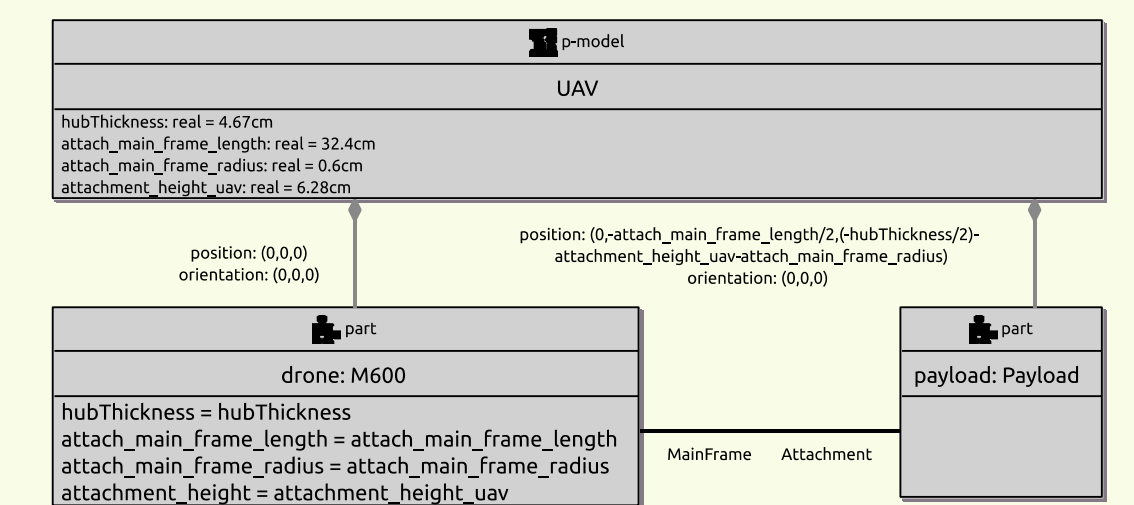- 3S LiPo battery
- 1m Carbon fibre arm

Simulation

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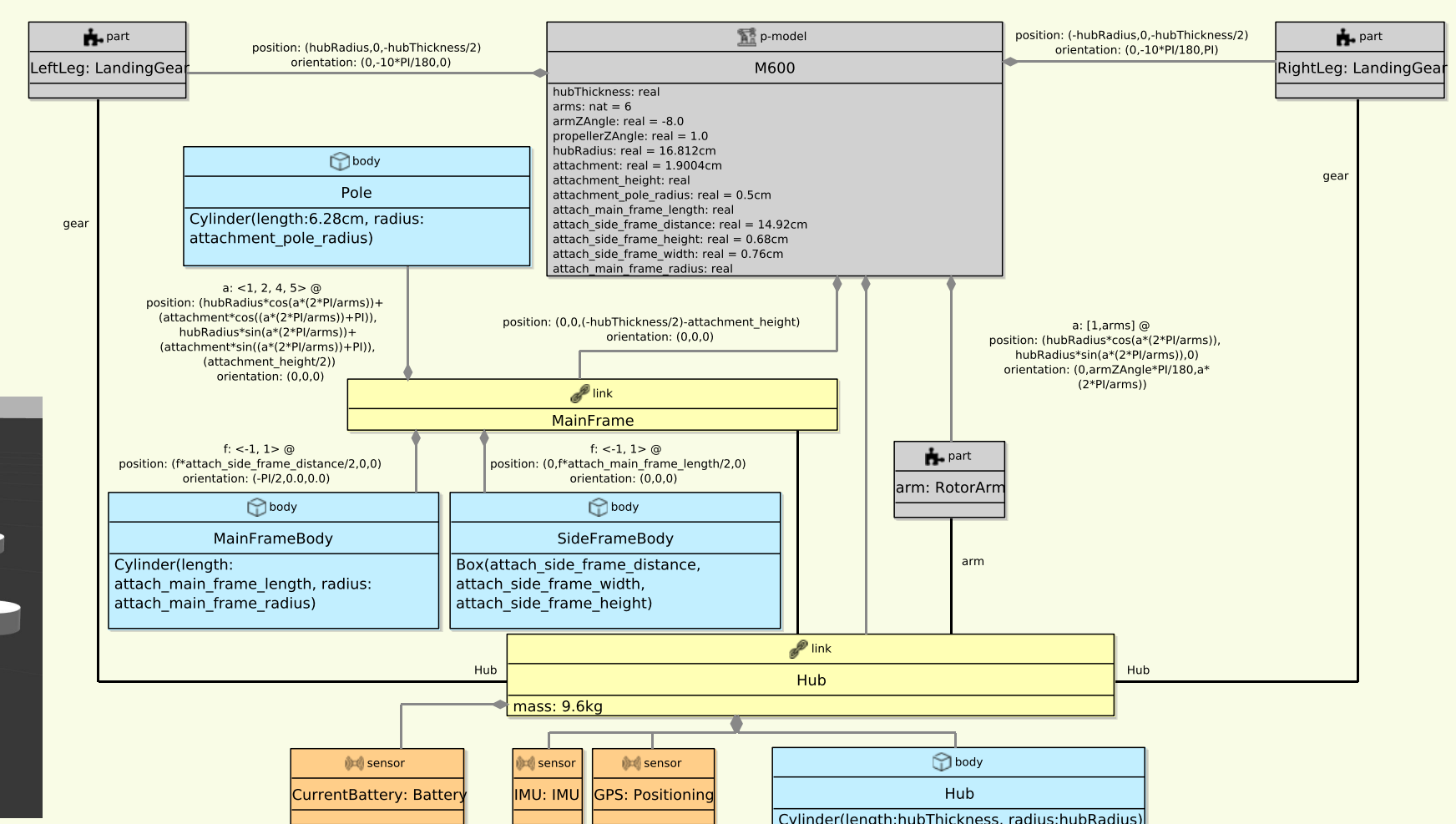

Scene in Gazebo

UAV model rendered in Gazebo after importing generated SDF

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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