3.1 and 3.2 System Diagram

The chosen system is an autonomous fuel extraction and refilling station in space, meant to allow the rocket Starship to get refuelled in orbit around the Earth. Since Starship uses liquid rocket fuel and has too small tank to both lift off from Earth and travel to Mars, it needs to be refuelled in orbit before leaving. This is inconvenient to do directly by pumping fuel from one Starship rocket to another, as this would allow for a much smaller amount of fuel to be carried for each rocket trip. Thus, a station is needed. This station should be able to dock with a rocket, extract its fuel, move to another rocket and empty the fuel in the new rockets tank. Since space is a hostile place, and astronauts are few and very expensive, the station should not be manned. This means the station needs to handle environmental challenges, move and make different decisions on its own, which is why it needs to be an autonomous system.

Decision

Perception

Saved data, Laws and Regulations

Sensors

Actions

Autonomous Station

The system consists of sensors sending info to a perception block where the info is processed. Then, the processed info is given to a decision block, together with relevant rules and regulations, and a decision of what to do is evaluated. This decision is given to the actions block which makes acts upon the decision. Some of the information gathered by the sensors should also be saved for later use as history of environment could be useful for making decisions.

The sensors will need to gather visual data on the surroundings of the system in 3D, which will in the perception block be used to get info on threats, objects and rockets to interact with. The sensors for the tank will also need to register piston positions used when transporting fuel from tanks. The laws and regulations are mostly related to safety of rockets, people in space around the system, and possibly anyone in distress in the future. But there are also some restricted orbits around Earth to look out for. The decision block needs to figure out movement, objectives and when to start and stop fuel transportation. Finally, the actions block controls the movement of the system and the start and stop of fuel transportation and the docking and undocking.

Though it is not needed at this point in time, it could be useful to add some communication with the ground, to potentially allow for instructions on when rockets will arrive, as well as status reports and future updates to software. This would have been a communication part giving data to the saved data and the decision part. However, this also introduces a larger risk of hacking as the system is open to outside influences.