3.4 Information Collection

The autonomous extraction and refueling station will collect information on the environment around it. This can be done with cameras taking optical images, or by a radar or lidar. The most useful option is optical imaging, as this has a long range and allows for orientation by using the Moon, stars and the Earth. This method also allows for identification of important objects, like rockets or identifying tags on rockets. However, the distance to the objects identified are harder to determine in this way. However, since there are very few of them, this can be done by taking multiple images and processing the change in size of the object. Then the objects can be compared to other similar objects in the databank and their distance and speed can be calculated. This is an ideal task for an AI to perform, as not all objects will be the same size and learning based on experience will be important. Sensors for checking the status of the tank in the station and potentially when a rockets tank is full or empty are also important, but these decisions are more trivial. A short-range proximity sensor can be used for the internal tank sensors, and a sensor similar to fuel stations refill sensors can be used for rockets tanks.

The planning and decision making for the system could be made by a normal program, acting in a specific way based on the situation. This would allow for a predictable station which can handle problems just as we would want. This would also lead to problems when unforeseen events occur, and thus put a lot of stress on the developer’s ability to predict problems. However, using an AI to plan what to do would be a more robust planner. An AI could adapt choices based on unforeseen events and learn from active experience in the field. Since the system is the first of its kind, this would be especially useful in dealing with new problems. On the other hand, this could lead to wrong decisions being made without anyone being directly responsible for the actions of the station. However, with careful use of simulations beforehand, most if not all these cases could potentially be avoided.

Finally, the actions of the system are either to move somewhere using small rockets, activating or deactivating docking locks, or pushing or pulling on a pump inside its tank. The rockets can use small parts of the same fuel they transport, to allow less refueling problems. The most optimal way would have been if it could have run on solar power, but electric rocket engines are not very good yet. The pump and docking mechanism can however work using electric power, and since the system needs electricity to run software anyways, this is ideal. This also has the added benefit of limiting the use of the fuel, which is of course the main point of this station.

There is no sensitive data stored which would be a direct problem if it was leaked, but the vulnerability of fuel being stolen, or the station being sabotaged is significant. This means that the decisions made and how the actual software works needs to be protected. Hackers should not be able to predict how the system will make its decisions, and not be able to influence these decisions in a way which is not ideal for the system. Since the system doesn’t contain any communication devices at this point, remote hacking is not a problem, but this should be considered if relevant. However, physical hacking or spying from either sniffer satellites or other rockets should not be possible and if a physical service port is to be installed, the code and most of the data should be encrypted to hinder tampering. The likelihood of this being a major issue in the near future is, however, limited as such attacks would be of limited use and very expensive.