Ground and Aerial Robots Synergy

Autonomous exploration of complex environments such as destroyed buildings, underground mines, and caves is an extremely challenging task. The robot has to overcome obstacles such as staircases or stonefalls. The optimal way to explore some areas can be from the air, using UAVs. However, the desired area of exploration is not in a human-safe environment, so the UAV has to travel a certain distance. This brings up a limitation of the energy stored in the UAV's battery. More time UAV has to spend on travel, less time can be dedicated to exploration. One of the solutions to this problem is using another ground robot (Pioneer rover, for example) to cover this travel distance. The energy stored in the ground robot batteries can cover a significantly larger exploration radius. However, the ground platform requires a sensor setup for autonomous navigation. This sensor setup is often very similar to the sensor setup required by the aerial robot.

Given the fact that the payload of the ground robot is limited, carrying two identical sensor setups could be a waste of resources. Therefore the proposal of Ground and Aerial robot synergy. The sensor setup will be mounted onboard the UAV and can be used for navigation of the UAV itself. At the same time, the aerial platform can land and be attached to the ground robot. The ground robot can use the UAVs sensor setup for autonomous navigation.

The main purpose will be to design, build, and control the communication between the ground and UAV. Including landing and take off from the robot back. This will include.

- Documentation of the state of the art with a detailed explanation of the pros and cons of each implementation.
- Design and implementation of adequate sensor setup.
- Design/selection of an adequate UAV platform.
- Design and implementation of the take-off and landing procedure.
- Design of landing platform for the UAV on the robot. Including mechanical connection.
- Design and implementation of the communication between platforms

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