Introduction

Nowadays, unmanned aerial vehicles (UAVs) are applied to various tasks, such as search and rescue or surveillance. Quadcopters have been studied for use in such tasks due to the advantage in control that multiple rotors gives. Because of this, quadcopters can hover and fly through complex environments that traditional UAVs cannot navigate, for example in a damaged structure. Many problems need to be dealt with to achieve the autonomous navigation for quadcopters in such tasks. How to get the goal in a smooth path and avoid the obstacles as well as the dangerous area is the crucial issue we will focus on in this project.

Firstly, a map will be built based on an indoor environment which the user can edit through the interface. Secondly, a set of way points will be generated based on the RRT algorithm. These can guide the quadcopter from the starting point to the goal while avoiding the dangerous area and the obstacles. Thirdly, a path smooth algorithm will be applied to make the path satisfy the non-holonomic restriction of the quadcopter.

In this project, the problem of collision- free path planning in environments with dangerous zones will be addressed. The path should avoid collision with obstacles but it is allowed to pass dangerous zones. However, this should be avoided as much as possible. For this purpose, first, we need to express concept of danger more specifically. For instance, in the case of this project, areas with high altitude can be dangerous for the quadcopter. Next, some extra cost can be defined for these zones regarding the level of danger.  
Another contribution which will be considered in this project is implementing an algorithm for narrow spaces, such as doors or windows in a closed environment. Although at this moment it is not clear how this can be solved, we will take one of the algorithms for narrow passages which were discussed in class and modify it to be more optimal.