

# Virtual Reconstruction using an Autonomous Robot

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## Abstract

Advances in sensing technology and algorithm design make it possible for a robot equipped with a laser range-finder to generate a map and localise itself within the map as the robot explores its environment. We describe a system for mapping and virtual reconstruction developed as part of a robot for urban search and rescue. The process of mapping and, at the same time, localising the robot within the map, is called Simultaneous Localisation and Mapping (SLAM). In many applications, such as urban search and rescue, information from wheel encoders is inaccurate and cannot be used for odometry to obtain a position estimate. However, iterative closest point scan matching algorithms make it possible for a robot to perform accurate positioning in unstructured environments where wheel slip is common. When this positioning is combined with a mapping algorithm such as FastSLAM, the robot can construct an accurate map in real-time as it moves. Given the generated map and the robot's position within it, a variety of exploration algorithms allow the robot to autonomously explore its environment. The robot is also equipped with an RGB-D camera. The 3D information as well as the colour video images are incorporated into the map to produce a 3D virtual reconstruction of the environment as the robot explores. This robot won the award for best autonomous robot in three successive RoboCup Rescue Robot competitions, 2009 - 2011.