

Autonomous Mapping of Inaccessible Archeological Sites with Mobile Robotis

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Introduction

The conservation of archeological sites and historical buildings is an important goal for both, scientists as well as the general public. Precisely modeling such sites is often a prerequisite for conservation, maintenance, restoration, security, and other tasks. To this end, technological advancements in information and communication technology and especially in artificial intelligence and robotics have the potential develop valuable tools for mapping and digitally preserving archeological sites.

While intelligent robots have been already applied in applications related to cultural heritage such as robot guides for museums or robot surveillants, there are many other application scenarios that can benefit from the use of intelligent robotics technology.

In this work, we focus on archeological sites that are difficult to be accessed by humans, such as catacombs or other similar underground areas. These environments are often not open to public because they are not safe and operation within them is difficulty and sometimes even risky. Therefore, standard digitizing techniques, such as static 3D laser scanners operated by human operators, may not be feasible. On the other hand, mapping and digitizing such sites is very important for both enlarging their fruition and for their maintenance. In these environments, autonomous mobile robots can assist and sometimes replace human operators for these tasks. Our goal is to develop autonomous mobile robots for mapping archeological sites that are difficult to be accessed by human operators.

The ROVINA Project

The ROVINA project is a new European FP7 project starting in 2013 focussing on the exploration, digital preservation and visualization of archeological sites. Its key objectives are

- developing autonomous robots for creating digital models of hard-to-access environments,
- improving autonomous navigation for robots exploring unknown underground environments,
- building large 3D textured models of poorly structured environments,
- offering a cost-effective support for performing continuous monitoring of these sites and to enable comparative analysis that will allow to devise better preservation plans.

These objectives require dealing with a series of challenges, due to difficulties in perception including no/poor lighting, unpredictable situations, difficult scene interpretation, complex traversability analysis, as well as limited communication capabilities, which restrict the continuous supervision and tele-operation by human users, difficult terrain, limiting the mobility of the robotic platform, etc.

The experimental evaluation of the developed system will be performed in the catacombs of Rome and Naples, Italy, in which exploration, digitization and visualization tasks will be performed and evaluated. Moreover, the ROVINA components will be released as open source software, allowing many other research groups and possibly companies to develop new applications for operating in similar kinds of archeological sites.