

# Monocular SLAM for Low Power Devices

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## 1 Abstract

One of the abilities that an autonomous robot has to possess is the capacity of creating a map (that can be 2D or 3D) of its environment and knowing its own location in that map. This is called SLAM (Simultaneous Localization And Mapping) [2,5].

In this thesis we are interested in developing a SLAM approach targeted to low power devices, such as the Raspberry Pi 2, 3 or 4, that are usually found on small mobile robots. The idea is to have a robot navigate a scenario and be able to build a map of that scenario and locate itself in it, only taking advantage of the information received from a 2D color camera. This will be applied to solve a task called the firefighter robot.

There are already some proposals along these lines, such as [1,3], but we were unable to make them work correctly on our robot.

## 2 Goals

The main goal of this thesis is to create a ROS [4] node that complements existing code, to be able to produce a map of the scenario and locate the robot in it in such a way as to enable robot navigation.

The student will use a robot that is available at SOCIA lab for the real world experiments. The code will be made available to other people.



The information from the world is captured by the robot's 2D camera and the task is not simple since the scenario does not provide abundant visual cues, which makes the SLAM harder to do. On the other hand, the algorithm has to be simple enough to run on an ARM architecture, in real-time (at least 5 FPS).

### 3 Tasks

- T1: State-of-the-art in monocular SLAM.
- T2: Implement the proposed method.
- T3: Make extensive evaluation on real world scenarios.
- T4: Write the thesis and a scientific paper.

### 4 Schedule

Task	Start date	Duration
T1	2019-10-01	2 months
T2	2019-12-01	4 months
T3	2020-04-01	1 month
T4	2020-05-01	2 months

### References

- [1] J. Engel, T. Schöps, and D. Cremers. LSD-SLAM: Large-scale direct monocular SLAM. In *European Conference on Computer Vision (ECCV)*, September 2014.
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- [3] Georg Klein and David Murray. Parallel tracking and mapping for small ar workspaces. In *Proceedings of the 2007 6th IEEE and ACM International Symposium on Mixed and Augmented Reality, ISMAR '07*, pages 1–10, Washington, DC, USA, 2007. IEEE Computer Society.

- [4] Morgan Quigley, Ken Conley, Brian Gerkey, Josh Faust, Tully B. Foote, Jeremy Leibs, Rob Wheeler, and Andrew Y. Ng. ROS: an open-source robot operating system. In *ICRA Workshop on Open Source Software*, 2009.
- [5] Khalid Yousif, Alireza Bab-Hadiashar, and Reza Hoseinnezhad. An overview to visual odometry and visual slam: Applications to mobile robotics. *Intelligent Industrial Systems*, 1(4):289–311, Dec 2015.