

Fast Visual Mapping



One of the key difficulties facing any mobile robot is obtaining accurate, relevant and timely maps of the environment it inhabits. A great many sensing modalities have been applied to this task, including vision-based systems such as geometric modelling, stereopsis and structured lighting, and non-vision systems such as sonar, radar and lidar. Unfortunately, vision-based systems have generally been distinguished by low speed and enormous computational requirements, whilst non-vision systems have been distinguished by either poor resolution (sonar) or high cost (radar and lidar). In response to these limitations, we have developed a vision-based mapping system that is fast, inexpensive, and requires only modest computational resources.

The system comes in two parts: a visual range subsystem and a map building subsystem. The visual range subsystem acts as a kind of 'virtual range sensor', which takes as input a stream of images and produces as output a stream of range-and-bearing measurements. The map

building subsystem then fuses this data stream into a coherent grid-based representation of the environment. The motivation for this design arises from the observation that very good environment maps can be obtained by combining scanning laser range finders with grid-based data fusion techniques. In our system, the laser range finder is replaced with a vision-based virtual range sensor that produces comparable output. Naturally, in order to achieve adequate performance with limited computational resources, we have made certain assumptions about the environment the robot inhabits. As a result, the visual mapping system works only in *indoor* environments.

This visual mapping system has been implemented and extensively tested on [Robot J Edgar](#), where the maps produced by the visual mapping system are used for both local navigation (obstacle avoidance) and global navigation (landmark identification).

The figure to the left shows a the robot in a typical situation, together with the map produced for this location.

References

[1] Andrew Howard and Les Kitchen, "[Fast Visual Mapping for Mobile Robot Navigation](#)", *IEEE International Conference On Intelligent Processing Systems* October 1997 (to appear).

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