Embedded Robotics: A Hardware Architecture for Simultaneous Localization and Mapping of Mobile Robots

Vanderlei Bonato, Eduardo Marques

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This book presents a hardware architecture for the Simultaneous Localization And Mapping (SLAM) problem applied to embedded robots. The architecture is composed by highly specialized modules for robot localization and feature-based map building from images obtained directly from CMOS cameras in real time. The system is completely embedded on a Field-Programmable Gate Array (FPGA) device, where several hardware-orientated optimizations are exploited. The main modules of the architecture are the Extended Kalman Filter (EKF) and the feature detection system based on the SIFT (Scale Invariant Feature Transform) algorithm. Additionally, this book also presents basic concepts about mapping and state-of-the-art algorithms for SLAM with monocular and stereo vision.

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