World Academy of Science, Engineering and Technology
International Journal of Mechanical and Mechatronics Engineering
Vol:13, No:02, 2019

Development of an Autonomous Automated Guided Vehicle with Robot Manipulator under Robot Operation System Architecture

Authors : Jinsiang Shaw, Sheng-Xiang Xu

Abstract : This paper presents the development of an autonomous automated guided vehicle (AGV) with a robot arm attached on top of it within the framework of robot operation system (ROS). ROS can provide libraries and tools, including hardware abstraction, device drivers, libraries, visualizers, message-passing, package management, etc. For this reason, this AGV can provide automatic navigation and parts transportation and pick-and-place task using robot arm for typical industrial production line use. More specifically, this AGV will be controlled by an on-board host computer running ROS software. Command signals for vehicle and robot arm control and measurement signals from various sensors are transferred to respective microcontrollers. Users can operate the AGV remotely through the TCP / IP protocol and perform SLAM (Simultaneous Localization and Mapping). An RGBD camera and LIDAR sensors are installed on the AGV, using these data to perceive the environment. For SLAM, Gmapping is used to construct the environment map by Rao-Blackwellized particle filter; and AMCL method (Adaptive Monte Carlo localization) is employed for mobile robot localization. In addition, current AGV position and orientation can be visualized by ROS toolkit. As for robot navigation and obstacle avoidance, A* for global path planning and dynamic window approach for local planning are implemented. The developed ROS AGV with a robot arm on it has been experimented in the university factory. A 2-D and 3-D map of the factory were successfully constructed by the SLAM method. Base on this map, robot navigation through the factory with and without dynamic obstacles are shown to perform well. Finally, pick-and-place of parts using robot arm and ensuing delivery in the factory by the mobile robot are also accomplished.

Keywords : automated guided vehicle, navigation, robot operation system, Simultaneous Localization and Mapping
Conference Title : ICMSEA 2019 : International Conference on Mechatronic Systems and Engineering Applications
Conference Location : Kuala Lumpur, Malaysia
Conference Dates : February 11-12, 2019