Turtlebot3을 사용한 클라우드 기반 동시 로컬라이제이션 및 매핑

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Cloud Based Simultaneous Localization and Mapping with Turtlebot3

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요 약

이 논문에서는 SLAM (Simultaneous Localization and Mapping)에서 로봇이 환경 맵을 획득하는 동시에 맵과 관련하여 로컬라이제이션을 수행합니다. 클라우드 기반 SLAM을 사용하면 환경 맵과 같은 리소스 및 데이터 공유를 최적화 할 수 있으므로 공유 가능한 온라인 맵 중 하나로 사용할 수 있습니다. 이렇게 하면 우리 환경에 중요한 변화를 추가하거나 제거하지 않으면 환경에 추가 된 새로운 모바일 로봇에 새로운 환경 맵 재구성의 본질이 생략되어 센서 추가 요구 사항이 줄어들게 됩니다.

ABSTRACT

In this paper, in Simultaneous localization and mapping (SLAM), the robot acquire its map of environment while simultaneously localizing itself relative to the map. Cloud based SLAM, allows us to optimizing resource and data sharing like map of the environment, which allows us, as one of shared available online map. Doing so, unless we add or remove significant change in our environment, the essence of rebuilding new environmental map are omitted to new mobile robot added to the environment. As result, the requirement of additional sensor are curtailed.

키워드

클라우드 로보틱스, 사물의 인터넷, SLAM, TurtleBot3, ROS

I. Introduction

Due to the advancement of technology, there has been a growing interest in mobile robots as well as autonomous vehicles. In Mobile robots, withier it's indoor or outdoor they deal with one common problem: Navigation. The application of navigation can be categorized in to four general categories: land navigation, marine navigation, aeronautic navigation, and space navigation [1]. For example, a land navigation, Automobile that perform tasks in real world environment use GNSS (Global Navigation Satellite System) to estimate and enhance its positioning information [2]. While the in an indoor navigation relative positioning with respect to previous positions (Dead Reckoning) was considered.

In mobile robot, navigation is the essential part to navigate from starting point to destination. But to accomplish this journey from position 'x' to position 'y' and vice versa at list we need to have a map of given environment, position and orientation, sensors and route planning and path finding.

Mapping is one of the fundamental core competencies of autonomous robots [3]. Since robots can only plan a path with respect to map, there are variety different types of maps used in the given environment of mobile robots: as an example, topological maps, grid maps, maps consist of geometric beacons, etc.

[4]. Being to solve and update a map from scratch can greatly reduce the efforts for later use that enable our robots to use accurate map for path planning and navigation.

Placing mobile robot in certain environment for example, our university corridor to provide service to staff members, we need to give a map of the environment in advance. Appling SLAM (Simultaneous Localization and Mapping) in this field in not a new idea and is not the focus of this paper. Instead, the contribution of this paper is reducing on board computational requirements, whenever new mobile robot added in to place the requirement of generating new map for each new robots are avoided. As a result, this help us to reduce the time and computational requirement by hard ware and software and increase efficiency and accuracy by using cloud computing approach.

This paper organized as follows: we started with an introduction. Follow by Section 2, system model and methods. Section 3 concludes this article.

II. System model and methods

In this paper, targeted our research based on TurtleBot [5] is a platform that allow us to conduct our research on complex technology such as autonomous navigation at low-cost, with open-source software based on Robot Operating system (ROS). TurtleBot is originally created at willow garage by Melonee and Tully Foote in November, 2010. Among the TurtleBot generation serious, TurtleBot3 (TB3) is a new generation mobile robot which is modular, compact, extensible, customizable, and strong sensor lineups.

Creating clean map with SLAM, increase the chance to have global optimum path planning when our mobile robot navigate from current position to destination. As shown in figure 1, the master robot, which is responsible for creating overall map of the environments with the help of high computing public cloud. The remaining robot $_1$ robot $_2$ and robot $_n$ will be consider as slave and they are not responsible to create environmental map. This method allow us to reduce the additional time required to create map for each robots, use stable single map for all nth number of robot that will add to service environments.

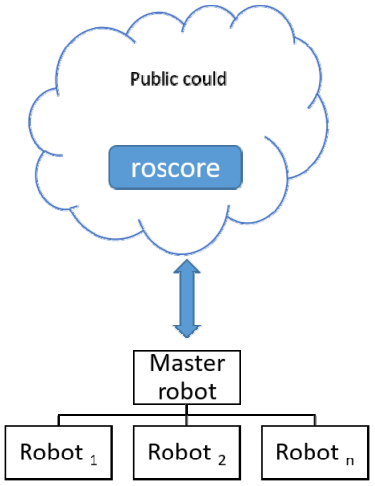

Fig. 1. Overall system architecture.

The master robot also update if change occurred in the environments like adding or removing big furniture on preexisting environment affect the performance of global path planning algorithm.

III. Conclusion

In this paper, we propose cloud based Simultaneous Localization and Mapping approach based on TurtleBot which is ROS enabled standard platform for robot. Cloud based SLAM, allows us to optimizing resource and data sharing like map of the environment, which allows us, as one of shared available online map. As result, whenever a new mobile robots added to environment the requirement of generating map that use for path planning and navigation are avoid. So, this allow you to minimize cost of additional sensors, computational requirement by hardware and software, increase efficiency and, accuracy of map.

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