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Analysis, Design, and Implementation of an Omnidirectional Robot

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ABSTRACT

In this Project, an omnidirectional mobile robot is designed, analyzed, evaluated and developed. A suitable design of the robot is offered considering several practical factors. The methodology and operation of its omnidirectional locomotion is analyzed by deducing a range of applicable equations for the robot kinematics. A smartphone application is designed and programmed to remotely control a motion of the robot via Bluetooth. Several tests were applied upon the robot. Reasonable results were shown after applying the analyses via computer programming. The designed omnidirectional robot is able to move instantaneously in any direction at any angle, without or with changing the orientation of the robot.

Aims and Objectives

The aim of this project is to analysis, design, and implementation of an omnidirectional robot that can be controlled remotely by a smartphone using a designed software via Bluetooth communication. This robot will be a base for development of mobile robot projects. The factors to be taken into consideration, for the design and operation of the robot, are to be based on practical requirements and limitations as well as a comprehensive theoretical analysis.

The study objectives can be summarized as:

- Mechanical design and manufacturing of the omnidirectional robot platform.
- Select electronics circuits that driving the robot, collecting the sensor data and process it.
- Proper selection of robot materials to achieve the following Criteria: speed, maneuverability, 1/cost, and aesthetics.
- Selecting the robot controller and program it.
- Selecting the Bluetooth hardware.
- Design mobile app to Control the robot motion.
- Test the robot and ensure its performance within the requirements.

Applications:

The designed Robot has the ability to move instantaneously in any direction, from any configuration. Therefore, compared to conventional platforms, this vehicle possesses multiple advantages in terms of their mobility in narrow spaces or crowded environments. It has the ability to easily perform certain tasks in congested environments foreseen with static obstacles, dynamic obstacles or narrow areas. Usually, such environments are found in factory workshops, warehouses, hospitals, etc. Hence the resulting needs to create this kind of robotic platform to satisfy the requirements of various fields, such as: industrial, military, naval, medical and last but not least, the educational field (as the basis for research).

ملخص المشروع

هذا المشروع يتناول تصميم, تحليل, تقييم و تطوير روبوت متنقل له القدرة على السير في اتجاهات و زوايا متعددة بدون الحاجة الى تدوير جسم الروبوت. تم ايضا تصميم واجهة رسومية للتحكم بالروبوت عن طريق الهاتف النقال لاسلكيا بواسطة البلوتوث.

الهدف

بناء روبوت يكون كقاعدة لتطوير المشاريع القادمة في هذا الصدد خصوصا ان جميع الاجزاء المادية قد تم تجميعها و اختبارها مسبقا.

حيث ان المشاريع القادمة سوف تكون فقط تطوير و ليس الخوض في التصميم والبناء لاجزاء الروبوت.

تطبيقات و فوائد المشروع

هذا النوع من التصميم الروبوتات له القدرة على العمل في المساحات الضيقة و البيئة المزدحمة ذات العوائق الساكنة و المتحركة كالمستشفيات و المعامل .. الخ