

TTK4550

MOBILE AUTONOMOUS ROBOT

An Interesting Topic About Mobile Autonomous Robots

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Abstract

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Oppgavebeskrivelse

Introduksjon

Denne oppgaven er en fortsettelse av tidligere prosjekter med utvikling av et konsept for robotisert vedlikehold utført av en mobil autonom robot. I løpet av tidligere prosjekter er en robotarm, flere sensorer, en trådløs ruter, innebygget batteridrevet strømforsyning og en sentral PC blitt festet til en vogn av aluminium. Vognen står på fire omni-hjul med hver sin elektriske motordriver.

Målsetninger for prosjektet

For å øke robotens grad av autonomi er det ønskelig å utforske mulighetene for pålitelig og trygg forflytning av roboten uten menneskelig påvirkning. Hensikten med en slik forflytning kan være å nå frem til en ladestasjon eller et punkt der en spesiell vedlikeholdsoppgave eller inspeksjon skal utføres, samtidig som hindringer og farlige situasjoner unngås. Som et ledd i å oppfylle disse målsetningene, skal følgende punkter utføres:

1. Utforsk mulige metoder for autonom navigasjon som kan oppfylle målsetningen over, der datasyn er det primære navigasjonshjelpemiddelet.
2. Implementer en, flere eller en kombinasjon av metodene som ble funnet i punkt én. Dette inkluderer installasjon av nytt utstyr som f.eks. nye kameraer om det er nødvendig.
3. Gjør en vurdering av implementasjonens egnethet for autonom navigasjon i testmiljøet (Kontoromgivelser).
4. Vurder hvor godt systemet håndterer feil og potensielt farlige tilstander og situasjoner.
5. Foreslå endringer og forslag til videre arbeid for å forbedre sikkerheten, påliteligheten og egnethet for autonom navigasjon.

Problem Description

Introduction

This project is a continuation of previous projects in developing a concept for robotic maintenance performed by a mobile autonomous robot. Over the course of previous projects, the system has been equipped with a robot manipulator arm, several sensors, a wireless router, on-board power supply based on batteries and a central PC. This equipment is mounted on an aluminum wagon. The wagon stands on four omni-wheels, each with their own electric motor drivers.

Project Goals

To increase the robot's degree of autonomy, it is desired to explore possibilities for reliable and safe movement of the robot without involving a person. The purpose of such a movement may be to reach a docking station or a location where a maintenance or an inspection task will be performed while avoiding obstructions and hazardous situations. As a step towards achieving these goals, the following points shall be carried out:

1. Explore potential methods for autonomous navigation that may fulfill the goals above, where computer vision is the primary navigational aid.
2. Implement one, several or a combination of the methods found in point one. This includes selection and installation of new equipment, e.g. cameras, if necessary.
3. Performance and suitability assessment of the selected implementation with respect to autonomous navigation.
4. Assess how well the system handles errors and potentially hazardous states and situations.
5. Propose changes to the implementation and suggest further work in order to improve the safety and reliability of the system and its ability to navigate autonomously.

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1 Introduction

1.1 Long-term Goal of the Project

Put the task into a larger context. Bring in some points on the societal impact of autonomous robotics and the increased potential of mobile robotics.

1.2 System Overview

Brief description of the system.

1.3 Report Structure

How the report is structured, and a very brief description of the contents in each section.

2 Background Theory

The theory that is necessary to understand how the problem was solved.

2.1 GPU-Accelerated OpenCV

2.1.1 Introduction

OpenCV started... 1999 Intel. Today, it is a fully open source library with a vast number of advanced computer vision algorithms. The pre-build library can quickly be plugged into an IDE such as QtCreator or Visual Studio 2013 (not tested for compatibility with Visual Studio 2015 at the time of writing), thus giving the programmer access to all basic OpenCV features. A step-by-step guide for using both the pre-built and a custom-built library can be found in Appendix ??.

2.2 Computer Vision

2.3 Optical flow(?)

2.4 Real-Time Systems

2.5 Selection of Real-Time System(?)

2.6 LIDAR

2.7 Vehicle Dynamics

2.8 Vehicle Control

3 Implementation

Everything worked excacly as described in the theory section.

4 Testing and Assessment of Performance

4.1 Navigation

4.2 Real-Time Demands

5 Conclusion

It is a robot.

6 Further Work

6.1 Cooperation With Ole Magnus

A Code

```
printf("Hello world!")
```

B Bibliography