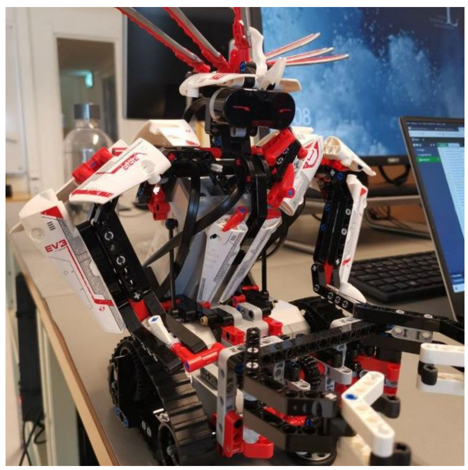
Project in Industrial Computer Systems
D7039E, Lp1-2, H20



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September 27, 2020

Abstract

Introduction

Background and motivation

Self explanatory.

Contributions

How does this report contribute. Are there any novel solutions?

Structure

The overall structure of the report

Conceptual design

Mechanical structure

The final design of the robot. Include CAD renderings etc.

Electrical components

Electrical components such as motors, MCUs etc. Why were they chosen

Requirements

Computer Vision System

ID: 01
Titel: *Line Detection*

- Given a distinctly colored line along the floor the computer vision system should be able to track it and feed back an accurate measurement of how much the robot deviates from said line.

ID: 02
Titel: *Color Detection*

- Camera input should be filterable by RGB pixel values. Objects within certain color ranges should be detectable.

ID: 03
Titel: *QR Code Identification*

- The system should be able to recognize and read the contents of QR Codes.

ID: 04
Titel: *Real-Time Performance*

- It should be possible for the system to keep up with and process a continuous video stream in real-time.

ID: 05
Titel: *Visualization*

- An accompanying GUI should exist where the raw video stream can be seen adjacent to a video stream where color and line detection is active. Detected objects should have a border and an object coordinate should be seen on screen. When the system is following a line it should be possible to see how the robot is positioned relative to the line. A measurement of the current deviation should be seen on the screen.

Modeling

Robotic arm

Forward kinematics

Inverse kinematics

Camera vision and calibration

In this section it is outlined the theory behind the camera vision system. How points in a 3D-space are projected on a 2D-plane, calibration and distortion correction.

Camera model

Distortion

Motion algorithms

Robot arm

Path planning

preliminary stuff

- Since the base use tracks, it can turn on a point. Therefor the turning radius will be the length from the center of the tracks, to the object furthest away from the center.
- The acceleration need to be slow enough to not tip the robot over, since it seems quite top heavy.
- The motors will need decoders for some of the control to work, if done the way they're planed
- The motors also need to be strong enough to move the robot, both with and without load.

Since the robot is using tracks, it can be viewed as a simple two motor system. Where one can control the turning and direction of the robot by reducing or increasing the speed of the two motors. The diffirence in the speed (Δv) can then be used to calculate the turning speed ($\dot{\theta}$)

Experimental evaluation

Prototype components

Movable base evauation

Arm evaluation

Gripping evaluation

Sensor evaluation

Conclusions

Conclusions of the robot and the course (?)

Appendix A

Team members

Martin Blaszczyk

Martin is a 5th year Y-student with interest in Control och Mechatronics. In this course he'll take the role of the Project Leader where the main objectives are to keep focus on the goal, hold meetings and an overall oversight of the project. As for the technical part the main interest will be in machine vision together with Edward K. to use cameras or other sensors to localize external objects for the robot to grip, avoid or approach.

Edward Cedgård

Master in electronic systems and control engineering. Edward's main task is to design the robotic arm and gripper mechanism together with Niklas. Tasks as deriving the kinematic equations, and implementation using forward and inverse kinematics. Choise of motors, armdesign, communication with motors using serial communication.

Niklas Dahlquist

Edward Källstedt

Albin Martinsson

Måns Norell

Appendix B

Working together

Project structure

To keep the project going and have an organized structure the project is divided in different parts, or subprojects. Each group member is either alone or in group responsible for each part of the project which coincides with their interests.

- Arrowhead
- Machine vision and localization of external objects
- Gripping tool
- Movable base

Meetings

Every week the group will be meeting on Mondays and Tuesdays to catch up and support each other. This scheme may change in the future if needed. The Monday meetings will have the following agenda where the goal is to catch up with the whole project group and discuss the project

- Status of work done the previous week by each member
- Preparation for the seminar
  - Discussion of the previous seminar meeting
  - How the weeks work has been coinciding with the seminar feedback
  - Questions to ask the teachers
  - Questions to ask the other group
  - Who does what during the Tuesday seminar
- Other

The Tuesday meeting will be after the seminar to collect and reflect over the feedback from the teachers and the other group. Also a status on the work planned to be done the coming week will be discussed so that each member has an overview of what the other members are doing. The meetings will have the following agenda

- What feedback did the teachers give
- What feedback did he other group give
- Feedback to each other withing the group
- Work to be done the following week
- Other

As mentioned, this meeting structure may be subject to changes if needed and of course if any member of the group wants to work from home a video call will be organized.