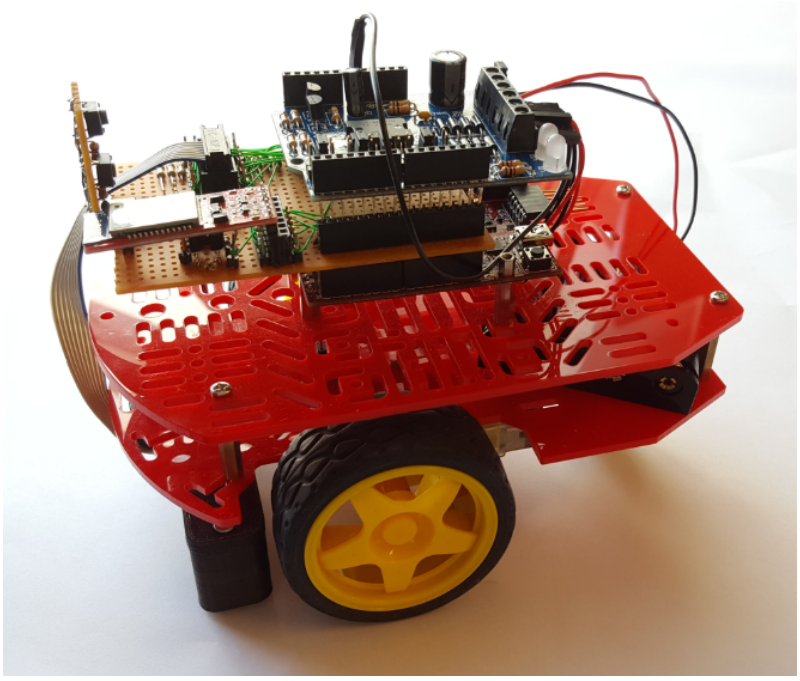
Uddannelse i virkeligheden

Fall Semester 2016

Autonomous Object Avoidance Robot

Group 2

3. Semester IT-Technology



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Title:

Autonomous Object Avoidance Robot

Project Period:

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Projectgroup:

Group 2

Group participants:

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Pages:

Appendices:

Completed:

Preamble

This project was written by group 2, for the third semester on the IT-electronics education at university college Nordjylland, Sofiendalsvej 60. The project goal is to make a line following robot with object avoidance capabilities.

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Glossary

3D print 3-Dimensional printing

ADC Analog-digital conversion

GUI Graphical User Interface

IDE Integrated Development Environment

MCU Microcontroller Unit

PCB Printed Circuit Board

PID Proportional-integral-derivative

PWM Pulse-width modulation

THT Through-hole-technology

UART Universal Asynchronous Receiver/Transmitter

1 Introduction

Analysis 2

In this section the problems found when trying to get the robot function, will be listed and analysed

2.1 Problem statement

The problem presented to the group is how to make a robot move from point A to point B, with the help of different sensors, including ultrasound and infrared, and to make use of autonomous algorithms to avoid obstacles.

Problem statement:

- Bot should be able to move from A to B
- Should be able to stop at a predetermined point
- Manoeuvre around obstacles

2.2 Problem analysis

2.2.1 Mobility from A to B

The robot receives a coordinate to reach, and will use its own starting point to determine a direction to drive towards the given coordinate. The robot will need a way to control its movement and direct current to function optimal.
The robot needs a way to effectively regulate speed and also steer itself autonomously. To dictate how quickly the robot moves, the robot will need some system that allows it to move around on a flat surface, the robot needs to be able to move around from point A to point B. .

2.2.2 Predetermined end point

After starting, the robot needs to know when to stop. The pre-determined end-point consists of a series of circles which the robot needs to detect.

2.2.3 Obstacles avoidance

As part of its functionality, the robot needs to be able to see objects that are in front of it and avoid them.

Requirements specification 3

This section specifies the requirements. The requirements have been found through the analysis.
[1]

- The robot needs line following capabilities
- The robot needs object avoidance
- The robot should make use of an H-bridge
- The robot should make use of Motors
- The robot needs a way to implement motor control
- The robot should make use of a micro-controller unit
- The robot should make use of the Magician chassis

Hardware section 4

4.1 Description of the hardware structure and functionality

In this section the different components of the hardware will be listed, described and explained.

4.2 Hardware diagram

Beskrivelse af hardware diagram

4.2.1 Object avoidance sensor choices

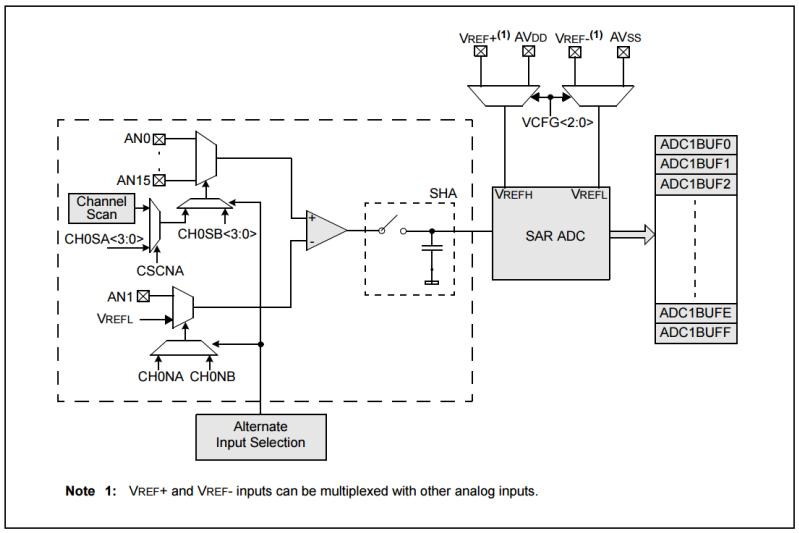
SR04 Ultrasound GP2Y0A02YK0F (long)
GP2Y0A41SK0F (short)

4.2.2 Line following sensor choice

The QRE113 sensor
Due to past experiences, the QRE113 sensor has been chosen to be utilized on the robot to enable its line-following properties. It works by emitting infarred light onto a surface, and then taking a reading based on the amount of light that gets reflected. A light surface will reflect more light back than a dark one. The sensor then regulates it output voltage from 1 to 100%. Based on this output voltage, it is possible to use an ADC to convert these signals into digital signals, which can be monitored more conveniently. Functionally, the robot is left with a way of knowing which surface the sensors are above - and in the case of a track with a black line to follow, this allows it to detect where the line it needs to follow is.
TBD sensor specs.
TBD måske lille skema over specs?

4.3 Analog-to-digital converter

ADC diagram



The usage of ADC

TBD (skal vi overhovedet forklare det igen?) :D

4.4 The chipKIT Uno32 board

The robot needs a micro controller unit, for implementing motor control and avoidance

4.5 The motor shield

The motor shield is containing the H-bridge and will be the board for ensuring control of the different components and motors. TBD (hvad er der helt præcist på boarded?)

4.5.1 The H bridge

The robot will make use of an H-bridge. An H-bridge is a circuit made for controlling the motor of the robot, by making sure the motor will never try to do forward and backward motion and cause errors. The point of using an H-bridge is to ensure motor safety and functionality.

4.6 The Bluetooth tranceiver

Software section 5

Beskriv Software section

5.0.1 Software diagram

5.1 Analog to digital conversion

5.2 PID controller

5.2.1 Proportional control(P)

5.2.2 Integral control(I)

5.2.3 Derivative control(D)

5.2.4 Loop tuning

5.2.5 Steady-state error

5.2.6 Stability

Table manual explained

5.2.7 PID Implementation

5.3 Pulse-width modulation

5.3.1 Duty cycles

5.4 The interface

Test 6

Beskriv test section

6.1 Unit Testing

6.1.1 Sensor

Setup

Results

6.1.2 DC Motors

Setup

Results

6.1.3 H-Bridge

Equipment

Setup

Results

6.1.4 PWM

Equipment

Setup

Results

6.1.5 ADC

Equipment

Setup

Results

6.2 Integration Testing

6.2.1 PWM motor control

Equipment

Setup

Results

6.2.2 Robot to Interface communication

Equipment

Setup

Results

6.3 System Testing

Equipment

Setup

Results

Conclusion 7

Skriv en fucking Conclusion!!

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8.1 Group collaboration agreement

8.1.1 Contact Information

Table 8.1: Contacts

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8.1.2 Workflow

8.1.3 Deadline

8.1.4 Milestones and goals

Gerne en kalender der viser dage arbejdet!

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10.1 C code

main.c:

ADC.c:

10.2 C# code - interface

Bibliography

[1] placeholderAuthor. *placeholderTitle*. 2016. URL: http://www.ucn.dk.