This document is made to write Ideas as to how the structure of the bachelor’s contract could be.

**Front page:**

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Supervisor:

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Start date: 1. February

End data: 1. June

ECTS:

Institution

**Project description**

**Context**

Start with robot efficiency, and how robots became of great significance within the industrial world. Describe the shifting towards the use of robots is described as the fourth industrial revolution. State that the use of robots in such a large scale put pressure on human robot cooperation (HRC). As More robots mean more robot control.

SOURCE ([Electronics | Free Full-Text | On Inferring Intentions in Shared Tasks for Industrial Collaborative Robots (mdpi.com)](https://www.mdpi.com/2079-9292/8/11/1306/htm#B8-electronics-08-01306))

Explain the ideas behind how the already present cobots solution is made, to ease the use of robots By ensuring projection.

SOURCE also

([What is collaborative robot (cobot)? - Definition from WhatIs.com (techtarget.com)](https://www.techtarget.com/whatis/definition/collaborative-robot-cobot))

Expand the idea of what a coolaborative robot is. And argue, that an even more coolaborative robot is and the general idea of how cooperative a robot within the industry is (not much based on source), and how an increase in the level of cooperation can be achieved using natural language robot interfaces. Gained by the method of natural language processing.

SOURCE

([Studie-Leichtbaoter-Fraunhofer-IAO-2016-EN.pdf (edig.nu)](https://www.edig.nu/assets/images/content/Studie-Leichtbauroboter-Fraunhofer-IAO-2016-EN.pdf))

Introduce the use of natural language processing as a method for simplifying HRC, such to increase the collaboration ability of already present cobots with the intention of easing/enabling the transition made by the 4.0 industrialization. And to increase the levels of collaboration achievable.

**Related work**

Start of by precisely defining the boundaries of the given problem. Expand the idea of what natural language processing is (understanding of both active and passive human communication traits, such as speech, meta-speech (I just made up the term), body movements, and general visual representation), but make it short. Specify that this paper will focus on the spoken part of natural language processing.

Define a general process of natural language processing as such:

Voice to text -> text processing -> and/or parsing from text to robot commands.

Start of with simple command in text detection paper, where google is used to transform audio into text, whereas a simple grammatical detection algorithm sees if the text has any actionable commands. Also establish what robot they use, and the problem they tackle.

SOURCE

([IEEE Xplore Full-Text PDF: (sdu.dk)](https://ieeexplore-ieee-org.proxy1-bib.sdu.dk/stamp/stamp.jsp?tp=&arnumber=9289768))

Afterwards introduce another paper that makes use of a logic-based robot control language method. The intention behind RCL, is to have as high level a language as possible while also keeping the trait of unambiguity. Also establish what robot they use, and the problem they tackle.

SOURCE:

([MatuszekISER2012.pdf (mdsoar.org)](https://mdsoar.org/bitstream/handle/11603/14363/MatuszekISER2012.pdf?sequence=1&isAllowed=y))

The last example is a use of a deep learning RNN, such to train a neural network to map directly from written text to robot command indexes. Completely merging the text processing and parsing part, such to increase simplicity of the task, with the intention of increasing successrate. Also establish what robot they use, and the problem they tackle.

SOURCE:

([Commanding mobile robot movement based on natural language processing with RNN encoder­decoder | IEEE Conference Publication | IEEE Xplore (sdu.dk)](https://ieeexplore-ieee-org.proxy1-bib.sdu.dk/document/8391185))

Dominated way is neural networks deep learning

SOURCE

Broaden deep neural networks, as the only.

**Specifying the given problem or the project**

For this project, the robot arm will be capable of moving on natural language command. For reference, the robot and human will both know the existence of three points in space labelled Point A, B and C. The human will then navigate the robot by moving it in correlation to the points, while also being capable of redefining where the points should be. And example for a given problem which the robot must tackle could be

“move to point A, then move point A 10 centimetres in its z direction. Repeat the command 3 times”

Another aspect of the problem would be moving the Ur robot within the configuration space and the cartesian space.

“move to point a, and turn joint 4 90 degrees clockwise.”

**Proposed solution**

Start by establishing the use of a UR robot. Then show the given workflow described as such.

Diagram

Description automatically generated

The voice to text software will probably be a premade software module which transforms voice into text, a good candidate for such a program could be pythons build in google API.

The text processing step is created based on a neural network approach. The output of the given neural network will be POS tags for the text.

Using the processed output, a parser will be used to identify the given command based a grammatical rulebase and potentially combine prewritten code snippets such to create the command given.

The command is then sent to a UR robot which initiates the movements which has been called on.

**Evaluation**

The project will be evaluated, based on the accuracy of robots intended movement. As the basis evaluation depends on the quality of two main steps (text processing and test parsing), these to will also be evaluated separately using number of correct outputs as its basis.

A series of commands will be given, with the intention of creating a broad corpus of commands. The three evaluations (evaluation of the neural network, the text parser, and the overall system) will then be given a percentage score given the ratio of correct outputs robot movements in reference to the given command.

Man kan lave confusion table (True positives, False positives )

It will also be argued that the voice to text part won’t be evaluated, as it is not a process created within this paper.

**Timeline**

The time spent on each task will be given in the following sequence:

Part 1 -> Design and train a neural network, to get a lexical analysis of text as its output

Part 2 -> Create the Ur robot scripts, which will be used by the following text parser

Part 3 -> Create the text parser which would link the neural network output with a corresponding combination of UR code snippets.

Part 4 -> Write the rapport

Chart, box and whisker chart

Description automatically generated