Project: Snake-like robot

# Group

The group consists of three members that studies Automation. The members are as follows;

* Håkon Bjerkgaard Waldum
* Ruben Svedal Jørundland
* Marcus Olai Grindvik

All members have a broad knowledge of different subjects. Two of the members (Håkon and Marcus) has gone through an apprenticeship and has a lot of experience from working. Marcus has completed an apprenticeship as an electrician, and has worked on boats connected up electrical systems. Håkon has completed an apprenticeship as an Automatician, and has worked with service and maintenance on different types of CNC 5-axis machines.

Ruben has no formal education, but has done a year in the military, and has a broad knowledge of programming from different private projects.

# Project assignment

The assignment chosen is the Modular Robot Locomotion Control, as in a snake like robot built from several modules (hereafter referred to as “snake”). The goal of the project is to make the snake move according to what we want, and be able to detect obstacles, as well as being able to be controlled via Bluetooth if we have the time.

# Goals of the project

The project has several goals that we want to fulfill, these are as follows:

## Main Goals

These are goals we definitely will see done, and will be the main focus of the project.

* Move freely with turning, flipping in addition to normal locomotion control in different terrains
* Use front mounted camera to detect obstacles and objects
* Getting through an obstacle course
* Make the snake turn into a wheel and roll

## Optional Goals

These are goals that we would like to see done, but we have to take into account the amount of time we have

* Remote controlling the snake
* Possibly use a top-mounted camera to give a route to the snake

# Work structure

We will assign different parts of the projects to each other to have as a main focus, but will assist each other where necessary to be able to complete the project both well and in time.

## Project structure

The project is divided into three parts:

* Mechanical
* Software
* Testing

## Mechanical

The mechanical part is based on Houxiang Zhang’s concept of the snake, there has been some few changes to his concept, but because it is so heavily based on his concept the fast prototyping is not seen as that necessary.

Ruben will take lead on the modelling and printing of the mechanical parts, while Marcus will take the lead on electrical parts of the building phase.

## Software

The software part will be divided into 4 parts:

* Locomotion
* Image processing
* Communication
* Deep learning (?)

The first part of the software will be to get the locomotion down. Get it to move efficiently and be able to traverse different terrains and obstructions. Håkon will take lead on this part, and will work closely with Marcus to apply the image processing part into the movement.

The next part will be to apply deep learning to recognize what kind of object we want it to reach (i.e. reach the green box) this will be taken on by Ruben.

Communication is thought of as two things here; one is the communication between the snake and the computer that will do the processing part, as well as the communication between the snake and the remote for remote controlling the snake. The first part with communication between PC and snake will be taken by Ruben, and if we see we have time to do remote control, we will assign the programming for that part to someone who has less to do at that time.

## Testing

The last part of the project will be the rigorous testing. We will of course test the snake as we go, but after we see the project as “done”, we will rigorously test the project to see that it can perform as we expect, and do it several times without any hiccups.

# General overview of how the project will work

Here we will explain the general thought of how the project will work in practice. What components will be involved as well as how things will work together.

## Mechanical

The snake will consist of 7 modules, where each module will have a servo inside it to control the angle. The foremost module will have a camera mounted on it, to be able to do the image processing-part. All of this will be going to a ESP32. We will also possibly be using a top-mounted camera to get a overview and be able to give the robot a location to go to, or a path to go. The backmost module will also be modeled to be able to take into account the front-mounted camera. This will all be powered from battery packs mounted in between some of the modules.

## Software / Communication:

The servos will go to a ESP32, which will control the angles. The ESP32 will be controlled from a PC, so the ESP32 will basically function as a slave. The PC will do all the image processing, as well as giving the commands to the snake.

The programming language which will be used is Arduino for the ESP32, and python for the rest of the functions. In practice the ESP32 will just send information about positioning etc. and wait for commands while we will send all commands and information about locomotion from python.

The communication between the ESP32 and the PC will be done via serial communication. In the case of eventual remote control we will be using Bluetooth-communication to make this happen.