

School of Computing

CA326 Year 3 Project Proposal Form

Section A

Project Title: H.A.R.O.L.D (Harold, Accurately, Repositions, Optically, Located, Doohickeys)

Student 1 Name: Alan Devine

ID Number: 17412402

Student 2 Name: Sean Moloney

ID Number: 17477122

Staff Member Consulted: Alistair Sutherland

Project Description:

H.A.R.O.L.D will be a Computer Vision driven robotic arm designed for repositioning generic objects in a given area. He will be built on a Convolutional Neural Network and will make use of the Movidius Neural Compute Stick to accelerate the Network. He will be built on a modified Arduino Tinkerkit Braccio.

These modifications will be in the form of 2 HIMAX cameras and piezoelectric sensors. The HIMAX cameras will be located on the body and looking perpendicular to the surface of operation for greater positional awareness, by allowing it to visually locate itself and the object in question. The piezoelectric sensors will be located on the fingers to know how much force is applied to the object which it is grasping to prevent damage to said object.

The CNN or Convolutional Neural Network will be trained by a combination of simulated operations and training on the physical device itself. The network will be accelerated using a Movidius Neural Compute Stick, which will significantly increase the performance of the system as a whole, as it will be able to locate and classify the object much faster.

A Convolutional Neural Network is a type of network which is specialised to run inference on image data, allowing the network to label specific objects in an image or frame of a video. We plan to use this to label both the object and the arm itself in order to orientate and pickup the object accurately and place it down in a specified location.

Division of Work:

The majority of the work will be in training the network, due to the limited timescale we feel we should both work on training, using separate pcs.

We also plan on using pair programming to develop a simulator so that we can train the network simultaneously without needing access to the arm itself.

We will also work together to overcome any mechanical issues we encounter.

Programming Languages:

The majority of this project will be using C++.

We will also use python to create the simulator, since we need it to be functional as soon as possible to maximise training time.

Programming Tools:

We will use Gcc to compile any C++ that is outside the Arduino IDE.

We will use pytorch framework for training and developing the network

We will use the default python interpreter for any python scripts

Learning Challenges:

Due to the nature of this project we foresee that there will be numerous mechanical issues, which we plan to solve together since neither of us have extensive experience with robotics or mechatronics.

We will both be learning C++ for this project which will be a challenge in and of itself.

Learning to apply the simulated data to the actual network and get it to function with the arm.

Learning to train the network, and to do so efficiently, since our timeframe for the project is limited.

Hardware/Software Requirements:

We will be using an Arduino as the main controller

We will also be using a Neural Compute Stick to accelerate the inference, and to allow us to use that we will be using OpenVINO API

Special hardware / Software Requirements:

We will need to purchase a robot arm which is controlled by an Arduino, Neural Compute Stick, a number of HIMAX cameras, and 2 piezoelectric sensors.