



Thesis Project Form

Title (tentative): Development of a smart wearable device for helping blind people to interact and explore surrounding environments

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Description

Motivation and application domain

Approaching unknown environments can be difficult and stressful for disabled people regardless of their disability. This thesis project focuses on the blindness disability and aims at finding an innovative solution to facilitate blind people perception, interaction and exploration of surrounding environments. The thesis project will be carried on in conjunction with and will be hosted by the company Officine IADR, a SME located in Genoa.

Other research activity previously lead to the creation of specific devices that, however, did not match the user's requirements in terms of ergonomics. The development of such a tool is challenging for several reasons: the tool should be easy to wear, handle and use. Moreover, from a technological perspective, the implementation of the tool is supposed to be scalable.

General objectives and main activities

The goal of this project is to design and develop an instrument which provides real time feedback on specific environments surrounding blind people. The student will be required to design and develop a portable device to detect the features of domestic and/or urban environments and provide an appropriate and straight forward feedback.

The system should meet the following requirements: small dimensions and discrete appearance not to interfere within human interactions; should be easy to wear and handle.

The student is required to (i) design the system such that it meets the basic requirements; (ii) choose the most appropriate electronic components to be used, (iii) implement the proof of concept of the device; (iv) test the system.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn about using Google Coral family tools to create and train a neural network for image recognition based on the TensorFlow Lite library in order to achieve the goal:

• Use a predefined dataset of objects in the user's context (cars, humans, but also objects such as keyboards, furniture etc);

• Create a neural network machine learning model that classifies images;

• Train a neural network, which can be used via TensorFlow lite on mobile devices;

• Evaluate the accuracy of the model.

The student will:

• Understand how to select and use sensors and microcontrollers

• Define a hardware/software architecture, including sensors, and communication

• Assembly/manufacture the hardware components

• Understand how to convert an idea into a prototype

• Work with multidisciplinary teams made of clinicians and patients, developers and engineers in the Company

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As a secondary goal (or further thesis), we would like to investigate improving the neural network with Reinforcement Learning techniques and implementing a gesture-based interface and a learning process for the machine guided directly by the user.

Place(s) where the thesis work will be carried out: DIBRIS - Officine IADR

Additional information

Pre-requisite abilities/skills: It could be helpful a preliminary knowledge of Python and minimal knowledge of embedded systems and development board (e.g. Raspberry)

Maximum number of students: 1