SPCL-Autumn 2014: Project Proposal
EyeDROID: Gaze tracking component for Android

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BACKGROUND

Due to the emergence of everyday life wearable and mobile devices, the development of unobtrusive systems is required in order to maximize the user experience. Along with this need, new challenges arise.

The first challenge correspond to the need of redefining the traditional way on which users interact with computers by providing a more natural and intuitive input to interact with this kind of devices, moving from explicit to implicit input sources. In order to overcome this challenge, the device needs to be aware of the surrounding environment and use as much context as possible by using various sensors. In this specific case, a camera that tracks the gaze of the user can be used to recognize eye movements and use them to perform certain actions. By following this approach, for example, the user could be able to control the device in a more natural way and focus on other activities while the device can be in the periphery of the user's attention.

A second challenge that arises while using mobile and wearable devices is the need of developing low resource consuming algorithms. Gaze tracking requires image analysis techniques that are computationally intensive and therefore it is difficult for wearable and mobile devices to perform this kind of processing on the device itself due to the lack of resources, such as limited battery life, processing power and network capabilities. For this reason, efficient algorithms able to perform the required image analysis are needed in order to avoid delegating computational workload to an external computer, as is usually done.

A third challenge is given as a consequence of the previous one. When doing cyber foraging, mobility becomes a problem in the way that an external static computer capable of performing heavy processing has to be connected to the device. For this reason, the mobility of wearable and mobile devices is limited by the external computer connection range.

IDEA

The idea behind this project is to explore an alternative way of performing gaze tracking where both the sensing device and the server that performs the computation are mobile. Server-Client architecture is proposed to achieve this goal. A device attached to the user's head with an infrared camera that will capture the movement of the gaze and transmit it to a second device will be the client. On the other hand, a device running Android OS that the user carries with him in his pocket and is capable of performing the heavy computational image processing will be the server. Once the image processing has finished, the coordinates of the gaze can then be used as input to the client, to the server or to a completely separate system.

The advantage of using a smart phone as the server is that the user is likely to be already carrying one with him, so there is no need for a completely separate device to perform the server tasks. Additionally, the smart phone will need to meet the minimum requirements for image processing. By developing a system that runs in an Android environment, the possibilities to deploy the system in many other devices, such as Odroid, increase widely.

PLAN

The proposed project involves the following in order to be developed.

- An Android application implemented as a service that runs in the background that will handle the image processing.
- An interface to the server that can handle different kinds of clients running on different kinds of platforms.
- A communication protocol that will handle the client-server communication and the video streaming.
- An implementation of the algorithm for gaze tracking used in Haytham system that will be efficient enough not to drain the battery on the mobile device and fast enough for real time tracking.

For demonstration purposes the system will be tested against an already built client applications that will run on Google Glass.

EXAMPLE SCENARIO

An example scenario has been written in order to illustrate the system in use:

1. A user equipped with Google Glass and an infrared camera attached on top of it carries with him an Android smart phone in his pocket.
2. The infrared camera will capture the eye image and transmit it to the Android device for processing.
3. The Android device sends the coordinates of the gaze back to the Google Glass to be used by a running application.

4. The user is now able to provide input to the application running on the Glass by using his eyes beside the built in voice commands and touch surface.

REQUIREMENTS

Below are the requirements in order to implement the proposed system

- An Android smart phone or the Odroid platform capable of running the Android OS.
- An infrared camera with a wireless transmitter attached to it.
- Google Glass for demonstration purposes.

SUPERVISORS

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