**EL3995 Statement of Work**

**Home Security System with Face Recognition Software**

**Robotic Engineering**

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**1 Aim & Objectives**

The aim of the project is to have a series of sensor systems that detect unauthorised activity on property. The predominant focus is to have the system to both identify and recognise different faces via a camera.

There is also a goal to demonstrate the systems function by having the software interface to a stm32l476 microcontroller and for it to receive serial data, in which it can then accordingly proceed to activating or deactivating a lock. This will represent the recognition of a home user and appropriate steps taken to allow them to enter a home.

An aspired feature is to introduce hardware and external sensors that detect motion on front lawns and feedback to the system.

In order to complete the above aim, the following objectives must be completed:

●Research face recognition concepts, framework and find suitable integrated development environment and coding language.

●Develop code to simply detect the presence of faces.

●Improve code to recognise faces and implement basic learning in system.

●Enhance system to detect foreign objects just as masks, covered faced and recognise a human frame.

●Experiment with different sensors and test feedback sent to computer via serial data using Xbee module.

●Experiment with implementing additional sensors to the system.

The face detection and recognition system will be developed based on simulated faces only, with faces generated using FaceGen software. This will allow for the evaluation of the system with different face characteristics and occlusions (e.g. glasses) as well as different camera view-points.

No real faces or indeed any images of identifiable human participants will be used on the project and therefore it is deemed that the project does not pose any ethical or legal issues.

The project is computer based, i.e. no outdoor experiments are planned for the project. It is expected that all the experiments (e.g. including motion sensor) will be performed in the project lab. If during the project it will be concluded that an outdoor experiment is needed/essential a suitable ethics checks and health and safety risk assessment will be performed before any such experiment would take place.

**2 Background**

Biometric security measures is becoming a necessary feature for securing homes and sensitive private environments. Particularly face recognition is a growing branch of pattern recognition in the area of images and vision (Vezzetti and Marcolin, 2015).

There are challenges when working with face recognition particularly with in the context of dealing with head positioning, facial expression, illumination, occlusion and different facial features Kumar et al. (2017).

**3 Activities**

**3.1 Work breakdown structure**

1. Facial Recgonition Research

1.1 Develop Understanding of different Types of Algorithms and Frameworks

1.2 Select appropriate integrated development environment (ide) and programming language

1.3 Research appropriate libraries and functions to use for the chosen language

2. Software Development

2.1 Produce face detection element of program

2.2 Develop software to incorporate recognition

2.3 Fine tune system to work efficiently

3. Hardware and Additional Sensor System

3.1 Experiment with Bluetooth and sending serial data from chosen ide to a stm32l476 microcontroller

3.2 ensure when user is detected that the software activates or deactivates a lock

3.3 Experiment with additional sensors and attempt to send feedback to main development environment.

**3.2 Task Description**

1. Facial Recgonition Research This task involves improving knowledge around the area of face recognition and finding the best suited framework to use. The required step then involves selecting the integrated development environment and appropriate programming language based on current knowledge, skill and related application. The final step to this task involves finding appropriate libraries and functions to utilise and code around.

2. Software Development This task will demonstrate the incremental development of the system by first producing the detection of a face, then the recognition improving the system to respond accordingly to specific requirements such as how to proceed when an unknown user approaches.

3. Hardware and Additional Sensor System

The goal of this section is to have the system send serial data either through Bluetooth or xbee modules from the chose ide to a stm32l476 microcontroller. This is to demonstrate the activation and deactivation of house locks.

**4. Dependencies**

Access to visual Studio Software and Mbed. Use of an STM32L476 microcontroller. Over-night access to labs in CNT and EIC buildings.

**5. Deliverables**

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| 1. Planning Documentation |
| 2. Final report |

**8. References**

Vezzetti, E. and Marcolin, F. (2015). *Similarity measures for face recognition*.

Kumar et al. (2017). 'A Study on Face Recognition Techniques with Age and Gender Classification,' IEEE Conference. Greater Noida.