Proposed final year engineering projects for the academic year 2015

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Project 1 (Code: AFFC -1): A socially intelligent robotic face (capable of expressing six common affective states)

This project requires a group of two (2) students to work together

Several decades of research on expression of emotion suggests that humans can express a large number of their emotional feeling though six common expressions of affective states, Viz., happiness, sadness, anger, surprise, fear and disgust. Scientists have developed and provided a profound understanding of what facial muscles get involved in expressing each of these six affective states.

Interacting with socially responsive robots may help children suffering from Autism Spectrum Disorder (ASD). Presence of an expressive social robot would also be useful in greeting people entering clinics, shops, restaurants and classrooms.

This project requires design and implementation of an expressive robotic face that would, in response to human voice (for now) would express one of the six affective states. For example, if the user would say “I am happy,” the face would respond by showing a happy face. Additional details of interaction mode/s and modality /lies) can be discussed and modified.

Please contact Dr Masood Khan (Masood.Khan@curtin.edu.au) for further details of these projects.

Project 2 (Code: WD -1): A wearable age and gender counter to monitor and control the crowd-mix in football stadiums

Socio-behavioural studies show that spectators’ behaviour can be controlled by keeping a good mix of ages and genders in various parts of a football stadium during international matches. Manual counting and tracking of young men, mature men, young women and mature women is an intractable task for the gate keepers.

This project requires design and implementation of hand glove that would help track the number of young men, mature men, young women and mature women entering through the gates. The gate keeper should be able to touch any of the four fingers with the thumb of the same hand for counting either: a young man; a mature man, a young woman or a mature woman entering through the gate. The counts/ records should be communicated to a
microcontroller (mounted on the glove). The data must be communicated wirelessly to a smart phone. The data should be stored in real-time and displayed in an appropriate manner for a crowd controller to order opening and/or closure of a particular gate. The system should have the ability to show the crowd-mix through various gates of a stadium.

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**Project 3 (Code: TSHCI -1): A tongue-assisted human-computer interaction system for dysphagia therapy**

A large number of elderly people suffer from dysphagia, a swallowing disorder that prohibits from swallowing the food. An effective, low-cost and harmless method of treating dysphagia is the tongue-motor exercise. Through exercise and continuous tongue movement, the swelling of the tongue muscles can be reduced to enable patients swallow the food. Hence, activities that involve moving the tongue can help patients suffering from dysphagia.

This project requires designing and implementing a tongue-operated human-computer interface that would allow dysphagia patients to improve the tongue movement as they play computer games, operate appliances and simple devices using the tongue. *The project involves generating, monitoring and using electromagnetic signals for designing and implementing the tongue-assisted human-computer interaction system.*

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**Project 4 (Code: TSHCI -2): An infrared signals based, tongue-supported human-computer interaction system**

Certain severe disabilities and critical injuries prohibit patients from using limbs for interacting with the world around. The tongue-supported human-computer interfaces have been developed and used to enable impaired patients in interacting with computers, machines and devices.

This project requires designing and implementing a tongue-supported computer interface that would help impaired patients in interacting with computers and controlling appliances and devices. *The proposed system would rely on generation, transmission and reception of infrared signals to help users communicate with computers and devices.*
Project 5 (Code: ALGOM -1): Software and hardware design of a computer controlled, wrist-mounted algometer for pain intensity measurement (Collaborator - Prof Tony Wright, School of Physiotherapy, Curtin University) - Requires a group of two (2) students

Algometers are widely used for measuring the pain intensity. This project aims at improving the quality of user-algometer interface and allowing the patient to communicate with the system in an effortless yet effective manner.

This project requires designing, implementing and testing the software and hardware design for this new and improved computer controlled algometer.

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Project 6 (Code: ALGOM -2): Mechanism, physical design and implementation of a computer controlled, wrist-mounted algometer for pain intensity measurement (Collaborator - Prof Tony Wright, School of Physiotherapy, Curtin University) - Requires a group of two (2) students

Algometers are widely used for measuring the pain intensity. The size and volume of a typical algometer may not allow portability and adoption to various experimental conditions. This project aims at improving the physical characteristics of algometer design to enable users interact and with the system in an effortless yet effective manner.

This project requires designing, implementing and validation of the physical system design parameters of this new and improved computer controlled algometer.

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Project 7 (Code: TSHCI -3): Counting and classifying the tongue movement patterns of dysphagia patients as they play computer games using the tongue

As they play computer games, dysphagia patients improve their ability to move the tongue. This learning exercise, over a period of time, allows patients to increases salvia production in the mouth and lubricates mastication to support food swallowing and digestion. In order to monitor the performance and efficacy of this exercise, physicians need to monitor the tongue movement patterns and their effects on patients’ ability to swallow and digest the food.

This project aims at implementing a system for automatically detecting the tongue movement direction (i.e., up, down, left or right). The counts should be stored and displayed to the physician in real-time. Through observing patterns of the tongue movement, physicians would
ascertain the utilization of suprhyoid muscles. The ultimate goal is to enable physicians monitor the utilization of diagnostig muscle, stylohyoid muscle, mylohyoid muscle, and geneohyoid muscle while playing a computer game.

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Project 8 (Code: TSHCI -4): Assessing efficacy of computer games in improving the tongue movement of dysphagia patients

Exercising and controlling the tongue movement through activities like playing a computer game can help dysphagia patients who, for a swallowing disorder, are unable to swallow the food. While playing computer games using the tongue, dysphagia patients will learn how to move the tongue. This may help in increased saliva production in the mouth and lubricating mastication.

This project aims at designing and implementing a classification system for assessing the efficacy of a computer game in training the suprhyoid muscles. Utilization of diagnostig muscle, stylohyoid muscle, mylohyoid muscle, and geneohyoid muscle, while playing a game, will be monitored by recording the EMG signals. The nature and extent of the observed movements in suprhyoid muscles while playing a computer game will help in classifying the game as effective, less effective or ineffective for dysphagia treatment.

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Project 9 (Code: SEST -1): Improving reliability of economic input/out LCA models

Analysing the potential impacts of utilising a product or process requires Life Cycle Assessment (LCA). Though regarded as an effective technique, LCA models are exhaustive, time consuming and inherit some uncertainties. The economic Input-Output LCA, a hybrid LCA model based on Input Output tables that use aggregate data between industry sectors is not immune to such uncertainties. In reality, this method is quicker but its outcome is more arbitrary than that of a traditional LCA model. The EI/O models therefore need further enhancement and incorporation of techniques to control their built-in variability and uncertainty.

This project requires identifying sources of uncertainty within EI/O LCA models and suggesting measures of improving them, through application of statistical techniques.

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