Title: Facial Expression and emotion Recognition through Serious game and Kinect device
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Introduction/Aim/Outline

The human face is considered to be a social stimulus that provides crucial information about a person. Knowing how to read and interpret micro-expressions is an essential part of understanding non-verbal behaviour and reading people. In this study, facial expression features are captured by Kinect Xbox and EMG (electromyography). That are interfaced with the game engine (Unity3D) to read the pose and expressions. Artificial intelligence algorithms are utilised to develop the serious game (SG) that is capable of tracking facial features in a real-time. Procedural Content Generation (PCG) is employed to generate elements of the game's level to alleviate the work of designing each part of the level with different difficulty.

Method

- The Kinect device consists of an infrared laser based IR emitter and an RGB (red-green-blue) camera. It computes a depth map, infers players face feature points, head position and orientation in a real-time. The EMG records muscle tonus changes that are barely visible or totally invisible but are sensitive to different emotions. Artificial intelligence (AI) and Human-computer interaction (HCI) algorithms are developed to describe all the observable facial movements. The anatomically based system "Facial Action Coding System (FACS)" [1] measures facial expressions are the control system in this work.
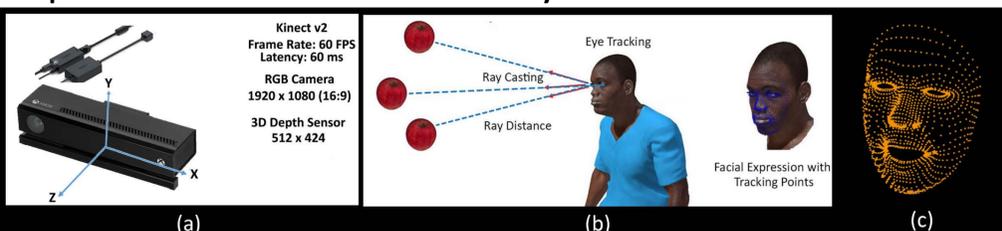

Fig1. Kinect device and it's 3D axis (a), eye, head pose and face tracking system (b) and facial points such as eye, mouth and nose corners.

Results

The system offers the possibility to provide a personalised, autonomously-learnt programme. It captures the deformation of the player's emotional and facial mechanisms via the Kinect and transfers it to the 3D avatar's face in the game. All facial movements are broken down into the visible component known as Action Unit (AU). The face and head tracking schemes combine with the facial action coding system (FACS) for coding, analysis, interpretation, and validation of the facial expressions.
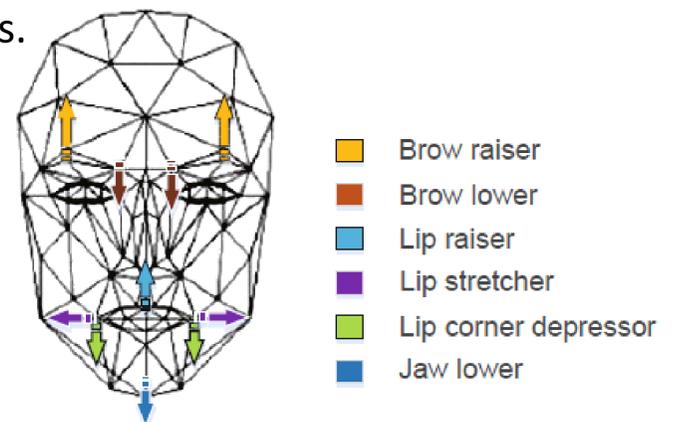

Fig2. Visualization of AUs [2].

Conclusion

3D mesh and feature point positions tracked by a Kinect sensor to recognise six basic emotions (anger, disgust, fear, happiness, sadness, and surprise) and neutral. PCG algorithm employed as an intelligent tool to take random seeds and create the game world in a multidimensional vector of real-valued parameters.

References

[1] Ekman, P., 1993. Facial expression and emotion. *American psychologist*, *48*(4), p.384.
[2] Mao, Q.R., Pan, X.Y., Zhan, Y.Z. and Shen, X.J., 2015. Using Kinect for real-time emotion recognition via facial expressions. *Frontiers of Information Technology & Electronic Engineering*, *16*(4), pp.272-282.