Happy Hands conducting your computer
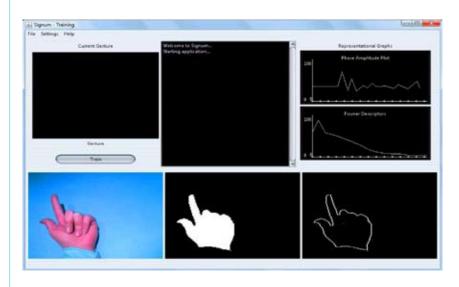## Epi-Use Prize 2007: Best Undergraduate Project in Computer Science / Software Engineering

by Chantelle Castle, Jürgen Hanke, Izelle Pelcher, Werner Pieterson, and Sayed Alireza Sadeghi

Imagine using your own form of "sign language" to interact and control your computer. No mouse, no keyboard, only the natural use of your hands. This is what a group of Bachelor of Information Technology students (see Figure 1) accomplished at the University of Pretoria, during the academic year 2007, with their *Signum* software system.

→ 1. *The young artificial intelligence software engineers and winners of the most innovative undergraduate project in computer science / software engineering (fltr Jürgen Hanke, Izelle Pelcher, Werner Pieterson, Chantelle Castle and Sayed Alireza Sadeghi)*

→ 2. *Training of the artificial intelligence module of the Signum software system.*

Signum was developed for the School of Information Technology's 3rd year Software Engineering module. The purpose of the module was to give students a taste of real world software development. The system enables the user to control playback on any Windows based multimedia player through the use of hand gestures. The students' client, Professor Andries Engelbrecht, proposed the concept of a hand recognition system which can be used to control an application. The students then decided to use this idea specifically to control a media player.

Signum subsequently won the Epi-Use prize for the most innovative application.

Development process

The students started the development process by doing thorough research on the potential algorithms and methods they could use for the system and developed a strategy that would enable them to recognise and analyse hand gestures. The system makes use of a standard webcam which is used to capture video as input. The captured stream is then processed and manipulated to control the end application.

The first step in the process of recognising a hand is to identify all skin colour present in the captured image and discard all other information. Edge detection algorithms are then used, as well as noise reduction algorithms to help determine the outline of the hand. Computation is done on the outline of the hand and transformations are then applied to this data. These transformations allow each gesture to be described with a unique pattern of characteristics. These characteristics could then be used to train a neural network to classify a gesture, which allows for the recognition of any person's hand and not just the trainer's hand.

Each gesture corresponds to a command in a media player of the user's choice. A training process can be followed if the user wants to personalise the hand gestures used (see Figure 2).

The system incorporates static and dynamic gestures. The stop command for example uses a static gesture – the gesture (for example a fist) is shown and the movie/music will be stopped immediately on recognition. The volume command uses a dynamic gesture, whereby the start of the gesture, as we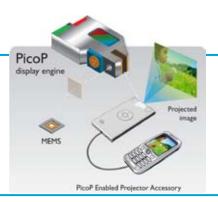ll as the end of the gesture, is indicated by a certain gesture. The volume is adjusted with the motion of the volume gesture whereby the extent, length and direction of the motion determines the proportion with which the volume will be adjusted.

Outlook

The possibilities for the system seem to be endless. It can be adapted to work with many other applications such as slide shows, sign language learning systems and more. Imagine giving a presentation and skipping though slides with the flick of a hand or surfing through channels without having to look for the remote control. ●

Pico Projector

How it works: This mini-projector will be mounted in a mobile phone and produce full-color, high-resolution images that can be displayed on any surface.
Who's working on it: Microvision
Due out: 2010

[future gadgets]