The Smart Attentive Room

Can we measure in a non-invasive way, the attention behavior that a user has in a room ?

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Participants: Rocca François (UMONS), Fabien Grisard(UMONS)

Project objectives and benefits

The objectives of this project is the design and implementation of a low-cost tracking system to simplify the implementation of smart room and behavioral analysis environments.

To achieve these objectives the proposed methodology is to design an efficient, easy to install, inexpensive, multi-camera 3D system and allowing in real-time behavioral information extraction.

One of the features of the proposed system is to be able to measure in real time the attention caracteristics of a subject: measuring the elements that attract the attention of a person in a room through the scene analysis but also the reactions of users' attention ,for example the phenomena of joint attention.

The objectives of this project will address two issues related to the analysis of attention:

1. Modeling human attention, through computational attention mechanisms for the detection and measurement of protruding elements in an environment.
2. Detection and analysis of attentive behavior in subjects.

The ultimate goal would be to provide measurement solutions to these two problems and determine how these information can be correlated.

Technical description

Achieving this "Attentive room" is based on the establishment of a network of 3D camera. To achieve such a result, various technical problems need to be solved:

First, the design of recording units. Our goal is to provide the simplest installation to set up. To do this we propose to design small recording units capable of supporting 3D cameras such as "Kinect", "Asus Xtion" etc, with the use of a sensor connected to a electronic board as "BeagleBoard" to perform simple operations like data acquisition, recording and network streaming.

Second, the calibration of the sensors. Our goal here is to provide a software for user friendly multi-sensor calibration based on calibration techniques already mastered: Slam, PnP, pattern matching.

Third, synchronization and data fusion. Our goal is to retrieve data from each recording unit to merge in a same geometric coordinates system, synchronize and merge redundant information that may come from multiple sensors as users positions or their skeletons obtained from multiple views.

Fourth, measurement of attention element in the scene. In this case, we focus on computational mechanisms of attention for measurnig salient elements in the scene.

Fifth, social signals extraction. For measuring attentive responses from the user, we will focus on the movement of subjects' faces, which are a good indicator of where their gaze is. This information placed in a 3D environment, allows us to measure such things as moments of joint attention between different subjects.

Ressources needed

No special resources are required except access to a similar piece in a classroom for the implementation of the installation and experimentation.

Benefit of the project

The benefits of this project will be to analyze the users attentive behavior in a small environnement based on attention modelisation and body mouvement.

We hope to provide at the end of the workshop softwares that leads to simple calibration of 3D sensors in various environnement and the design of a 3D multisensors smart room.

Profile team

Leroy Julien : he holds an Electrical Engineering degree (Ir.) from the University of Mons, Engineering Faculty (since June 2010). His master thesis was conducted in partnership with Infrabel, manager of Belgian rail network, on the automatic detection of defects in the catenary. His main research interests are : social signal processing, modeling of human behavior, point clouds processing and 3D animation. His PhD thesis focuses on modelisation of proxemic behavior based on computer vision techniques. One of his goals is to develop a new methodology to measure and model proxemics behaviors that is : accurate, ecological and less time consuming. This work is conducted in partnership with psychologists and psychiatrists.

Mancas Matei : he holds an ESIGETEL Audiovisual Systems and Networks engineering degree (Ir.), and a Orsay Univ. D.E.A. degree (MSc.) in Information Processing. He also holds a PhD in applied sciences from the FPMs on computational attention since 2007. His research deals with signal saliency and understanding (http://tcts.fpms.ac.be/attention).

Staff
Rocca François : he holds an Electrical Engineering degree from the FPMs since June 2011. He did his master's thesis in the field of emotional speech analysis, and more especially on laughter frequencies estimation. He is currently pursuing a PhD thesis on facial animation by markerless motion capture at UMONS.

Other researchers needed:

1. Computer scientists with good programing skills (C/C++) with optional interest to social signal processing and computational attention. He/she would work on system integration and help on social signal processing and computational attention algorithms.
2. A computer scientist with knowledge in programming on electronic board to realize the recording units.
3. A psychologist to setup pertinent scenarios details and the most interesting psychological tests.
4. Of course any interested people are welcome both from engineering and humanities.