



HUMABIO 4th Newsletter

Human Monitoring and Authentication using Biodynamic Indicators and Behavioural Analysis

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EDITORIAL



Dear reader,

HUMABIO is at its final year of activities and new and interesting results are emerging. In this issue of the newsletter the Transaction Gateway (page 3) and the Multimodal Fusion (page 5) are described. In addition the pilot scenarios evaluating the project's

results are described in page 2.

Finally, you can find a short article and a few photos of the HUMABIO Demonstration workshop that was realised between 30-31 of October 2006 to Pisa, Italy at page 6.

As always the way to register at the project's

End User Forum and the HUMABIO partners' contacts are included in pages 8 and 9 respectively.

Have fun!

When security

meets Technology...

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HUMABIO PILOTS

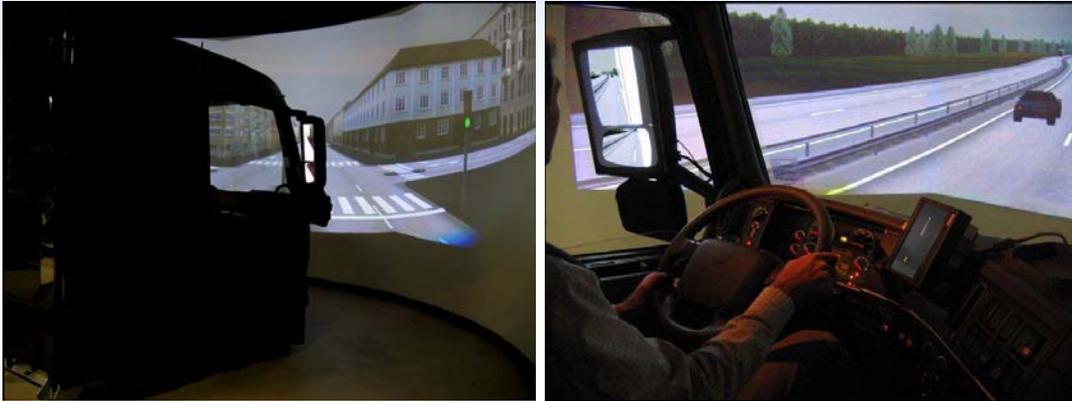


Figure 1: The Volvo Truck Simulator is fixed-based with programmable driving scenarios projected on a 135° cylindrical screen.

Pilot site in Sweden (VOLVO)

In this evaluation scenario, HUMABIO will be installed in a truck, in order to authenticate the driver. Volvo will provide the vehicle simulator and its facilities in Gothenburg for the implementation of this pilot. The application environment targets primarily professional drivers and transportation companies. Due to the nature of the application environment, the use of a fixed seat will allow the use of physiological measurements. The face and speaker recognition techniques will function in parallel to the physiological authenticator, in order to increase the system's reliability.

The main facilities/equipment that this site is going to

utilize for this pilot are:

- VOLVO truck.
- Face and voice recognition measures (Note that noise levels and illumination must be taken into consideration when creating the user template; e.g., traffic sounds, radio, weather conditions, etc.).
- Seat sensors.
- EEG, ECG (Note: the use of dry electrodes is preferred).



Figure 2: The LIC is composed of 'classic' lab/office settings to high-tech workspaces.

Pilot site in Germany (FhG)

The Lab Innovation Center (LIC) of Fraunhofer IAO will provide their new facilities and personnel for the implementation of the HUMABIO office/lab pilot. The high level requirements for safety and access authorization make the Fraunhofer LIC an ideal testing site for most applications developed within HUMABIO.

Therefore, the primary aim of HUMABIO in this pilot is the authentication of the authorized computer and lab-systems operators, in order to minimize the risk of unau-

thorised data access.

The main facilities/equipment that this site is going to utilize for this pilot are:

- Office/laboratory application environment at the Fraunhofer LIC.
- Face and voice recognition measures.
- Seat sensors.
- EEG and ECG physiological measures.

HUMABIO PILOTS

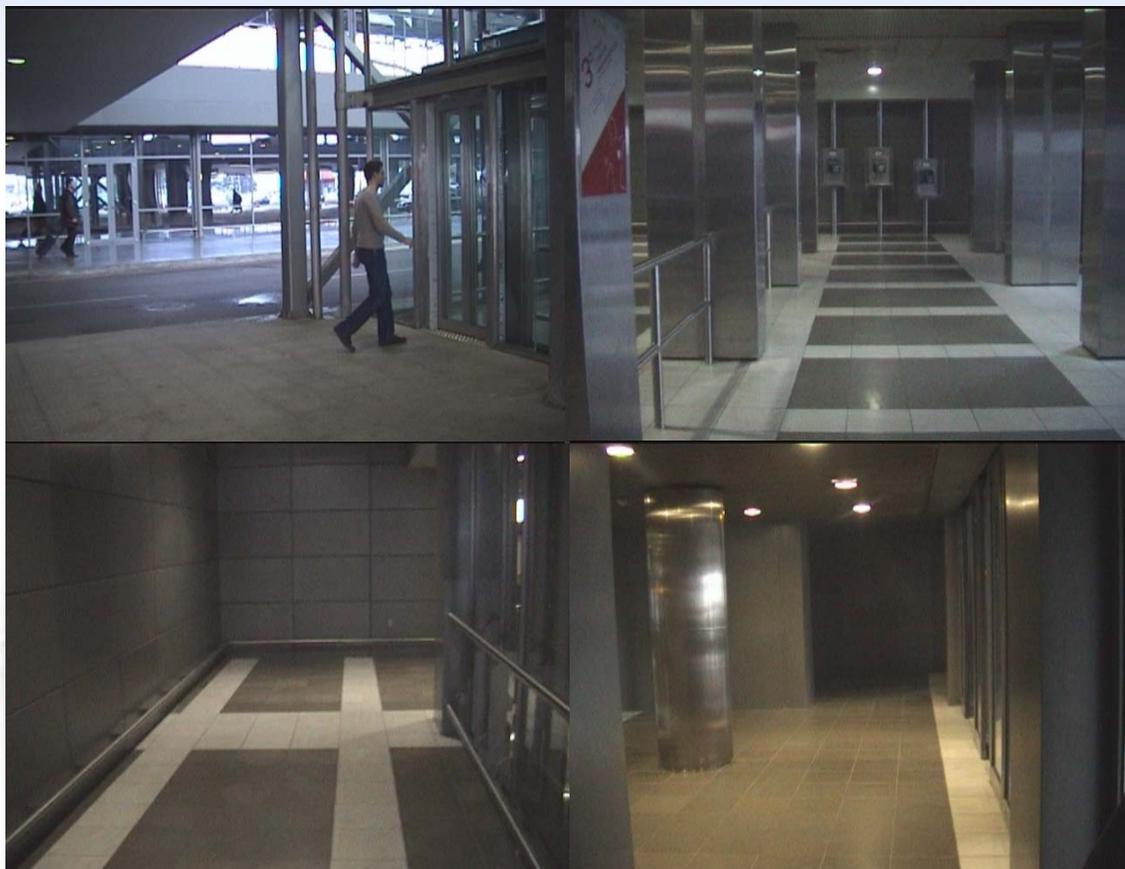


Figure 3: The private entrance to Euroairport that will be used for the HUMABIO Pilot testing.

Pilot site in Switzerland

The HUMABIO system will be installed in a controlled area in Euroairport in Basel, Switzerland (see Figure 3). The goal of the project in this environment is to authenticate the identity of authorized employees that can move freely in a workplace area. The sensors that will be used are the camera (i.e., gait information and face recognition) and possibly a microphone (i.e., voice recognition). The subject will carry an ID in the form of Radio Frequency Identification (RFID) and the authentication will take place using exclusively the behavioural profile which will comprise of the gait, face, and speaker recognition modules, whenever applicable.

The main facilities/equipment that this site is going to utilize for this pilot are:

- A controlled area in Euroairport in Basel, Switzerland.
- Face, gait, and voice recognition measures.

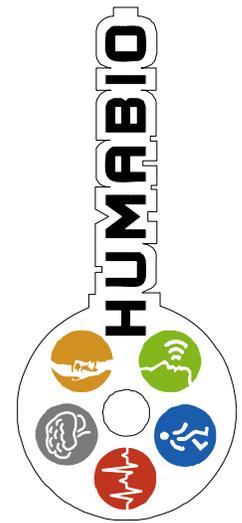
TRANSACTION GATEWAY

The HUMABIO project mainly focuses on the development of a secure human authentication system that is based upon the fusion of various physiological and behavioural biometrics. Main aim is to enhance the security of physical and logical access to safety areas. Even though HUMABIO biometric prototype offers several advantages over traditional token (e.g. key) or knowledge (e.g. password) based authentication schemes (e.g. increased user convenience and robustness against impostor users), it could be vulnerable to various attacks. Within HUMABIO, several security measures have been taken to protect the biometric templates from unauthorized access and altering and to ensure individual biometric data safety and privacy. Furthermore, all modules of the HUMABIO system communicate over a secure channel, which is provided by the transaction gateway module. The following diagram shows the architecture approach for the HUMABIO system, which addresses also the secure communication between HUMABIO modules.

As seen, all communication between the different modules is directed through the Transaction Gateway and in that way the secure channels that are created ensure that any transaction of information is secured. All the "SECURE CHANNELS" that are shown are accomplished by the use of SSL that is established by the Transaction Gateway. Actually the Transaction Gateway acts as an internal Certificate Authority for the HUMABIO system. It produces certificates that are digitally signed by itself and these have to be installed in the remaining

modules of the system, namely the sensors, the central application and the HUMABIO database. Once these certificates are installed then all modules are firstly authenticated in the Transaction Gateway, then a secure channel is created and then the modules can interact with each other using this channel.

Additionally, special attention was given to the attacks on biometric templates of the HUMABIO database, which include actions such as adding a new template, modifying a stored template, removing an existing template, or stealing the template. Among these threats, stolen templates are the most dangerous because they can be used to reverse engineer the biometric system. To reduce the risk, template data have been encrypted to prevent the reverse engineering of template structures. The encryption methods that are used for data integrity and confidentiality in the storage of the HUMABIO template are SHA-1 and AES.



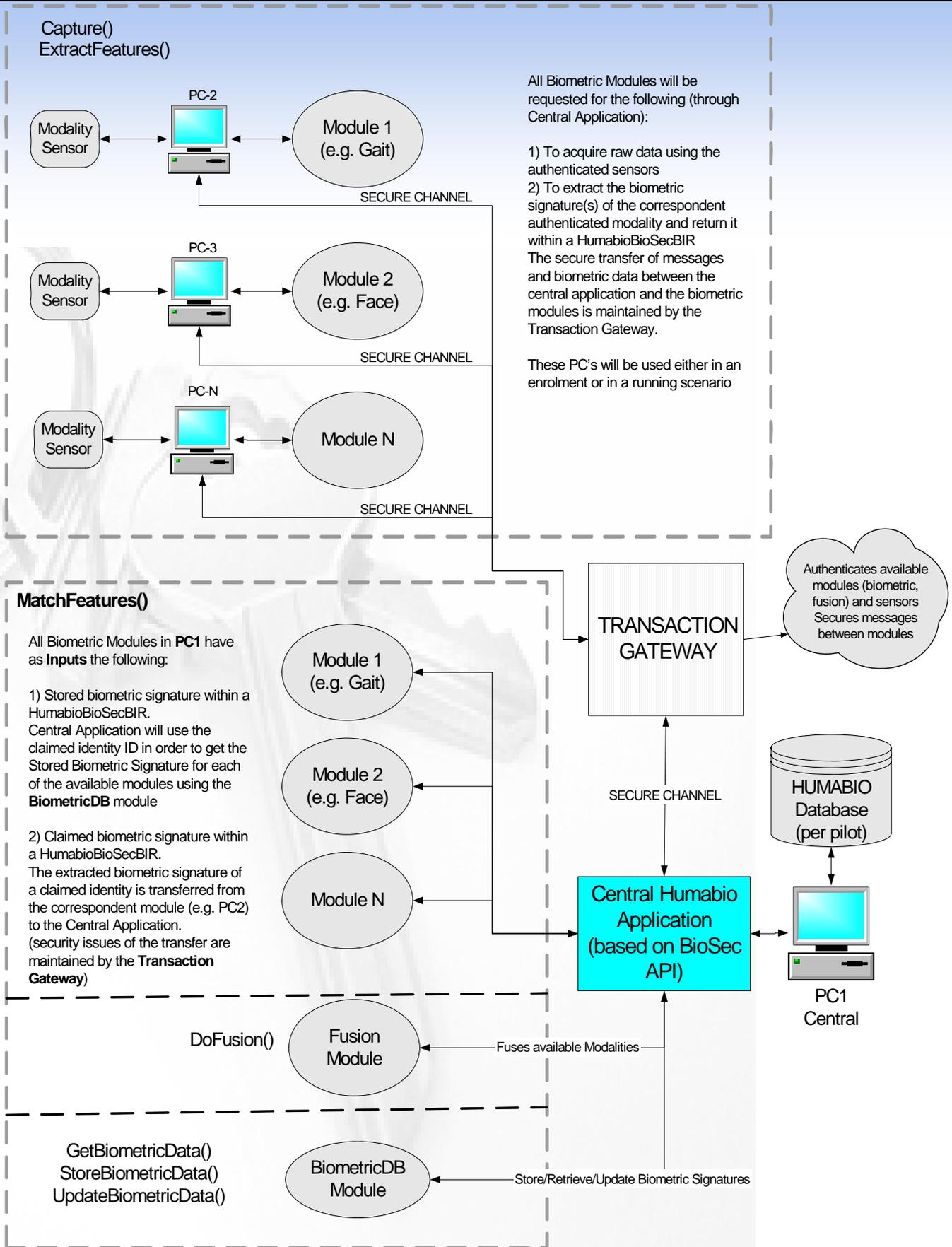


Figure 1 Illustration of the HUMABIO architecture using the Transaction gateway

MULTIMODAL FUSION

HUMABIO aims to develop multimodal biometric systems for identification applications in secure environments to grant access to physical locations or critical equipment. Multimodal biometric systems integrate information from multiple biometric features and perform more accurately compared to systems that are based on a single biometric modality. The modalities under investigation in HUMABIO include, besides conventional biometrics (face and voice), EEG, ECG, sensing seat anthropometrics and gait, that are either novel or emerging biometrics and their authentication potential is not established concretely by earlier research.

The architecture of the system is depicted in Figure 1. Initially, each unimodal biometric module performs data acquisition, processing, feature extraction, and finally communicates a matching score to the fusion module to denote the similarity (or dissimilarity) of the biometric signature of the user with its stored template. Subsequently, the fusion module employs machine learning techniques to reach the final decision and classify the person as genuine or impostor.

Advanced machine learning techniques that are widely used due to their reliability and performance were developed to perform multimodal fusion. These techniques include Support Vector Machines (SVM), Fuzzy Expert Systems (FES), Neural Networks (NNs), Gaussian Mixture Models (GMM), and simple Boolean operators, such as AND/OR rules. The developed fusion schemes were tested on the public multimodal XM2VTS database and compared with state-of-the-art fusion schemes. This comparison validated the superiority of the developed SVM scheme and indicated its appropriateness for

the applications scenarios examined within HUMABIO.

To address the lack of existing multimodal databases with the desired modalities and properties, the unimodal developers of HUMABIO collected publicly available and commercial databases and acquired new data when necessary. The final multimodal biometric database for the training and evaluation of the authentication algorithms was formed by aggregating the features of these unimodal databases, forming what is known in the literature as “*virtual subjects*” that are measured in conditions that simulate HUMABIO’s use cases and scenarios.

Three pilots are considered in the context of HUMABIO. The different application environment, technical specifications and required unobtrusiveness levels define the number and type of biometric modalities that will be exploited for the initial authentication of subjects in each HUMABIO pilot. A direct consequence is the development of different system architectures and fusion algorithms that are tailored to the specifications of each pilot scenario. The accuracy of the SVM classifier in terms of False Acceptance Rate (FAR), False Rejection Rate (FRR), and Half Total Error Rate (HTER) is illustrated in the following table.

Pilot	FAR	FRR	HTER
Airport	0.3979 %	0.3694 %	0.3836 %
Truck	0.0981 %	0 %	0.0490 %
Office/lab	0.0981 %	0 %	0.0490 %

Table 1: Performance evaluation of the multimodal fusion scheme for each pilot

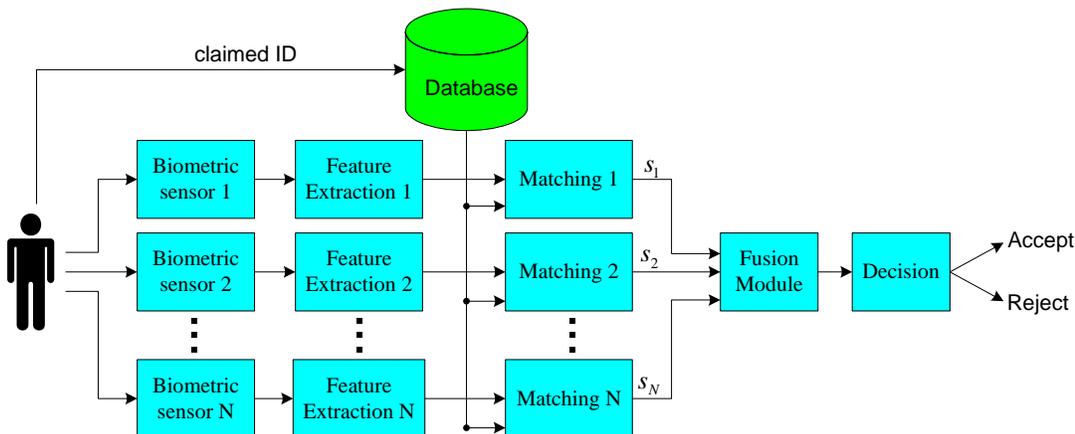
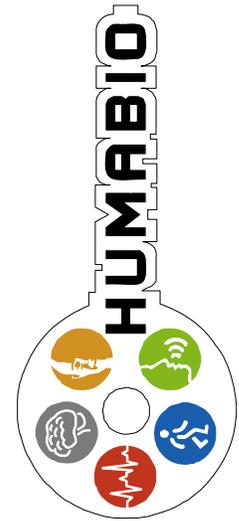


Figure 1: Fusion at the matching score level.



HUMABIO DEMONSTRATION WORKSHOP



The 2nd HUMABIO technical Workshop was successfully realized on the 30th and 31st of October 2007, in the pictorial city of Pisa. The event was organized by the University of Pisa. During the workshop the HUMABIO authentication procedure for the office and truck pilots was tested. For the first time, the multimodal platform designed by HUMABIO for these application environments was set up, consisting of the following biometric systems:

- Face authentication module
- Speaker authentication module
- Sensing seat for human authentication module
- EEG authentication module
- ECG authentication module

All authentication modules were coordinated centrally by HUMABIO central application via the Transaction Gateway, the module responsible to ensure the security of the communications between the various components.

The purpose was to demonstrate and validate the performance of each modality separately as well as to test the integrated platform and estimate the results of the multimodal fusion. The first day was dedicated to the enrolment of all participants to the platform's database whereas the authentication tests took place the second day. The system was tested with enrolled and non-enrolled users in order to evaluate the ability of the system to recognize, not only enrolled users but also impostors. 15 people participated in total. Technical difficulties were addressed on site, and the authentication scores were within expectations.

This workshop was a big step towards the realization of HUMABIO final prototype for the pilots, giving the opportunity to integrate all components in one platform and test all modalities in a different environment, with new users. Module developers had the opportunity to identify possible failure causes and to further improve their modalities.



Figure 1: Pisa Technical Workshop

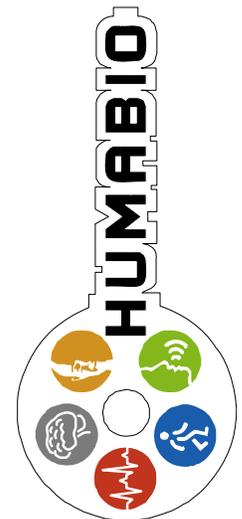




Figure 2: Sensing Seat authentication

One of the participants is authenticated based on her anthropometric profile. The Sensing Seat sensor designed for this application can be seen in the left bottom corner.



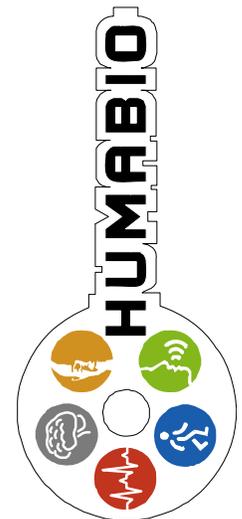
Figure 3: Face and Speaker authentication

The face image of the participant is captured by the camera in the near infrared region of the spectrum. Following, the participant's speech is captured by the microphone adjusted on top of the camera. The camera and microphone used for this application can be seen in the right (top: camera, bottom: microphone).



Figure 4: EEG and ECG authentication

The user's ECG and EEG is captured by electrodes placed on the forehead and wrist. The signal is transferred wirelessly to the base station.



HUMABIO END USER FORUM

Join now the HUMABIO END USER FORUM and:

- ✓ Regularly receive the HUMABIO Newsletter
- ✓ Receive invitations for project events, workshops etc
- ✓ Provide feedback on the project's activities by filling in questionnaires etc.

Name	
Organisation	
Position	
Address	
Postcode & city	
Country	
Tel. n°	
Fax n°	
Email	
Type of organisation	
Expert fields (please specify)	

In case you are interested to participate please return this form to:

Lila Gaitanidou

CERTH/HIT

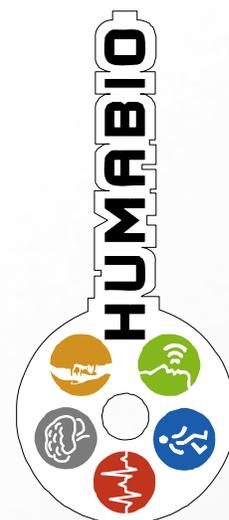
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Thank you for your support!

Note:

- All interested people are welcome to the forum.
- All data will be kept confidential and will be used only for the purposes described above.
- The members participation to any of the HUMABIO activities is strictly on voluntarily basis.
- You can unsubscribe from the forum by a simple e-mail to the address above at any time you may wish.



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FOR MORE INFORMATION VISIT PROJECT'S WEBSITE:

www.humabio-eu.org

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