



## Driver state recognition and vehicle control using a brain-computer interface in the scope of the Innotruck Project

*Cooperation of International Graduate School for Science and Engineering, TUM-Institute for Advanced Study and Siemens AG*

### 1 General data

**Type:** BA, SA, MA, HIWI

**Project leader:** Prof. Dr.-Ing. Gernot Spiegelberg

**Supervisor:** Prof. Dr.-Ing. habil. Alois Knoll

**Advisor:** Ljubo Mercep, M.Comp.Sc.

**Research area:** Signal processing, User interfaces

**Required skills:** C / C++ / Linux

**Language:** English or German

### 2 General overview of the project Innotruck

Worldwide activities in the field of electric powered personal vehicles are in constant state of growth. However, the complex interconnect between the vehicle, the infrastructure and user behavior are only marginally taken into account. Due to the considerably higher energy consumption and CO<sub>2</sub> output inherent to goods transport vehicles, these factors have to be thoroughly considered and dealt with accordingly.

The goal of our project is to implement a holistic approach to electromobility, with an emphasis on the goods transport. Focus is being placed onto three research areas:

- System architecture
- Drive train and energy management
- Human-machine interface

The experimental vehicle platform was provided by the project leader Prof. Dr.-Ing. Gernot Spiegelberg, a senior research fellow at the Institute for Advanced Studies of the Technical University of Munich.



### 3 Task description

The task has two main parts:

- The first includes using the helm as a data-collecting device only.
- In the second part the helm is used for both user input and data-collection.

The Emotiv EPOC EEG helm is being used to determine the driver mental state during the test drives in a simulator located in Garching-Hochbrück. The simulator can be operated via classical steering wheel or with a joystick.



Picture 1: The EPOC helm on the right, the driving simulator on the right

Data can be gathered directly with the Emotiv Research SDK. It can also be processed and gathered in openVIBE. It is possible to use other brain-computer interface frameworks or Mathworks Matlab, if the applicants can justify the choice. The criteria for the tool selection are support for experiment design and data processing flexibility.

In the second part of the task, the simulator is operated directly with the EPOC helm, that is, the helm is used as an input device for various driving functions. It is necessary to test various mappings of the driving functions onto the helm and perform simulated test drives.

The scope of this work might include setting-up and performing experiments with groups up to 30 people in Garching-Hochbrück.

For more information or for applications contact Ljubo Mercep (ljubo.mercep@tum.de) .

For more information on the Innotruck project please visit: <http://www.innotruck.de>