

Chapter 7

Sitting Postures and Electrocardiograms: A Method for Continuous and Non- Disruptive Driver Authentication

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ABSTRACT

Travelling by car is the preferred method of everyday transportation by most of the people in the world. Individuals from different age groups (at least exceeding the minimum age limit of 16 or 18 years) and health condition (meeting safe mental and physiological requirements) are traveling by car more often and increasingly by themselves.

With a rising number of assistance systems and increasing complexity of information to be presented, drivers demand the automatic operation of driver assistance systems. One of the main interaction mediums between a driver and a car is the driver seat. Given that the seat is occupied all the time while driving, it can be a possible solution for unobtrusive recording of personal characteristics to be used for continuous driver authentication. In this work we focus on a discussion of design and implementation issues for authenticating a driver based on his/her sitting profile and/or contactless collected electrocardiogram data using in-seat electrodes.

This approach is novel in terms of “participation” – the driver has neither to operate something nor to attach a device. Furthermore he/she must not be aware of the continuous collection of his/her personal profile at all.

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INTRODUCTION

Identification and verification of drivers is a topic that is increasingly attracting attention for several reasons and for different fields of application in the transportation domain. It can be used for safety systems continuously monitoring the health condition and alertness of a driver (for example a biological state observation system checking if the driver is tired or drunken). With the emergence of car sharing vendors offering different account types for rental, a problem to be solved is the rate of insurance due for the driven route. The insurance rate should not only be bound to the car and calculated on a yearly basis, but should be linked to the driver and his/her personal skills. The amount payable by a driver can be dynamically calculated based on the driven kilometers and on his/her style of driving. Driven distance can be obtained from the CAN-bus of a car or calculated from available GPS data, and the profile of a driver can be formed from sensors continuously monitoring the emotional state of a driver and/or the on-board diagnostic functions of a vehicle. An important requirement for this system is that it has to be effective in operation all the time and can also be able to authenticate a driver as he/she might use different cars.

An example showing that the topic of authentication is relevant is given by the recent developments of (Yubico, 2010). Their “YubiKey” is a USB-key for secure, easy and affordable access to different applications which also includes an authentication service. Yubico suggests using the YubiKey as a stronger and better alternative to smart cards. Automobile manufacturer have tried smart cards as method for driver authentication in the past; unfortunately, their replacement is very expensive and, more important, cards are prone to hacking – the car domain is nowadays looking for improved, universal applicable solutions.

Identity Authentication

Long-established methods of human authentication are relying on “something you have” (tokens, access cards, identity document/passport, keys, etc.) or “something you know” (secret knowledge: passwords, pass phrases; non-secret: user ID, mother’s maiden name, favorite color, birthday of the cat, etc.). Widely used methods, even in combined settings such as user ID or access card + password, are not sufficient for identity authentication – if an object used for identification was acquired or the required knowledge was attained, it can be relatively easy to forge an identity (IBIA, 2010; Revett, 2008). With advances in technology enabling precise measurement of human characteristics along with the availability of greater computational power to transfer measurements into representations that can be compared in real-time, biometrical identification as an effective and convenient way for verifying the identity of a person emerged. “Biometrics” comprises automated methods for recognizing a person based on physiological or behavioral characteristics (based on “what one is” or “how one behaves”).

Driver Authentication

The transportation domain is one of the most complex sectors involving user interaction. An important interaction involves the authentication of drivers aimed at verifying if they are authorized to access a vehicle or service, or to transport sensitive goods (IBIA, 2010). Drivers who pick up rental or shared cars will be biometrically screened to authenticate their identities, ensure that they are holding a valid driving license and are also allowed to drive the type of taken car (by checking their driving license categories) (Riener and Ferscha, 2008). Furthermore, authentication techniques can also be used in the future to verify that truck drivers are not exceeding time limits on working hours, for calculating tax or personal insurance rates, and even for improving driving comfort.

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