# Brain wave Biometrics Authentication Security System

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***Abstract***

*Authentication has become an essential part of our everyday lives through systems like passwords, PIN codes, card readers, fingerprint- , and retina scanners. All designed with one purpose; to confirm a person's identity. Brain wave Biometric Authentication Security System is another addition to the wide range of authentication systems, but with a brand new concept. The electrical activity in a human brain is used to confirm the identity. Instead of physically writing a password, one can simply think about it. The password or "pass-thought" can be anything that a human mind may think about, like a colour, a feeling, an image, text or something else. The benefits over other systems are many. With a standard password someone can watch or "shoulder-surf" what others type, but no one can watch thoughts. Cards and keys can be lost, but the brain is always present. Handicaps can exclude people from systems like fingerprint- or retina scanners, but the brain still works. This project research is aimed at the possibilities for a brainwave based authentication Security system. A* Driving scenes (racing game) generated by the PlayStation 3 (PS3) was utilize as a driving simulator. *The researchers ended up with a complete authentication system, but based on what is already done in related work the researchers believes that an implementation of a brainwave biometric based authentication security system is just a matter of time.*

***Keyword****: Brainwave, Authentication, Electroencephalography (EEG)*
*Digital identity, Natural User Interface*

## Introduction

In this computer driven era, with the increase in security threats, securing and managing the resources has become a more complex challenge. Maintaining and managing access while protecting the user's identity and computer resources has become increasingly difficult. Therefore, it is crucial to design a high security system that has a strong authentication process to authenticate an individual. Authentication, verifying the user, who he claims to be, is the central to all security systems. With the world getting ready to transit from Graphic User Interface (GUI) to Natural User Interface (NUI) technology, where it is possible to communicate with computers by using touch, gestures, voice, expressions, emotions and thoughts. Gürkök, H., & Nijholt, A. (2012). In this research, the researchers has made an attempt to demonstrate an authentication system based on thoughts.

## Background of the Study

The society is transforming into a digital world and individuals are now living with digital identities. Banking, shopping, examinations, home security, information security, car security system etc has all gone

digital. Digital identities are having intensives that should be pre-recorded to help machine for user authentication.

**Statement of problems**

The problems associated with the present authentication system includes but not limited to: the danger of a onetime authentication system as a user can be replaced after authentication, Password theft and wax molding and printing to bypass fingerprint and iris scanning technology. **Aim and objectives**

The objectives of this research include designing a system:

1. That will effectively authenticate users.
2. That can provide authentication information unconsciously
3. Eliminate password theft, wax molding and printing.

**Significance of the Study**

There have been cases of breached biometric technology, situations when users finger are cut out to perform authentication elsewhere. Cases when the exact mold of a user is molded with wax, cases when a users iris is scanned and used to perform authentication, cases when an authentic user is made to perform authentication and then killed as he/she is no longer needed.

**Scope of the Study**

This study presents an overview of Brainwave Authentication Security System; its highlights are on autonomous and unconscious on-demand authentication system for a driver using brainwave.

**Literature review**

A digital identity is information used to represent persons, organizations, or machines in information systems and networks.

The term digital identity has three distinct senses: computational, legal and social.

In the computational sense, a digital identity is information that allows a computer interacting with another agent to perform the following functions: identification, classification, and recollection.

In the legal sense, a digital identity is a function of a person's civil, or national, identity (Clare, 2009).

In the social sense, digital identity refers to any collection of information that describes a person, and which was generated by that person's online activity.

**Working of biometric process**

The detail of the human being which differs from one person to other is used as unique biometric data to provide as that person's unique identification (ID) or recognition. The body parts such as retinal, fingerprint, iris, palm print and DNA. Biometric system collects and stores this data in order to verify any person's identity. The combination of biometric data and biometric identification/recognition technologies creates the biometric security systems. Biometric system is more and more personnel than anyone's passport.

**Benefits of a biometrics security system**

- There are possibilities of hacking keys or duplicated; signatures could be forged, passwords could be easily stolen or hacked by a specialist people. To avoid all these accidental losses; banks and other institutions should enter biometric security and all our fears could be laid to rest.
- Signature biometric type of verification is done normally in transaction related operations.

**EEG and HCI**

Research in brain-computer interface (BCI) has established the feasibility of using Electroencephalography (EEG) signals to control computers and other devices. BCI systems can reliably evoke and measure event-related potentials (ERP) such as the P300, and use them to spell words and move computer cursors based on a user's intent (E. Donchin, et al, 2000); (T. Hinterberger, et al, 2003); (F. Nijboer, et al, 2008). This proves

very valuable in restoring the ability to communicate for patients suffering from the locked-in syndrome and other neurological diseases, and can be generalized to healthy users as well. While our work does not seek to infer user intent from their EEG signals, our choice of user tasks involving external stimuli are informed by the efficacy of eliciting and capturing these event-related potentials.

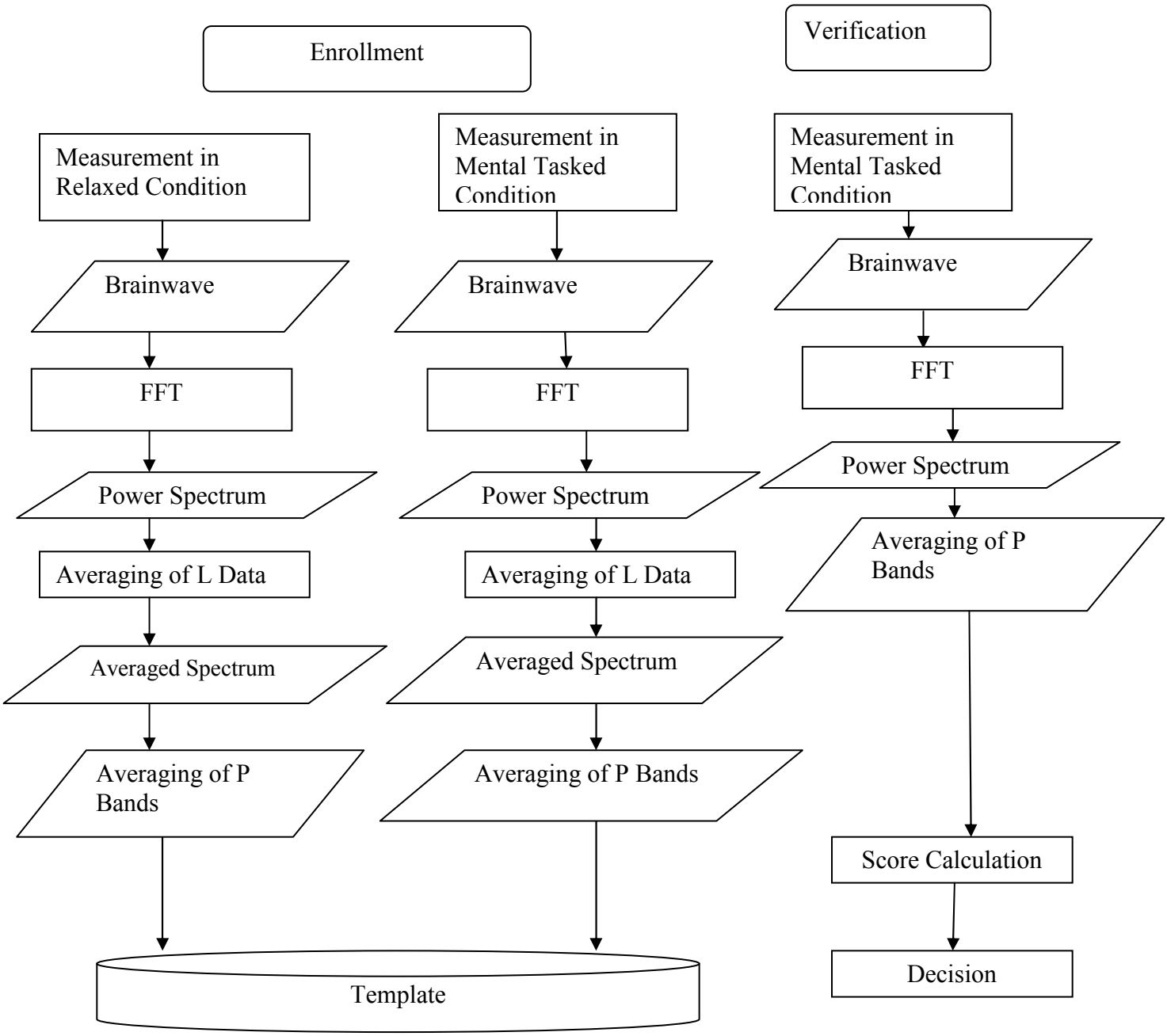


**Fig 3.1: Block Diagram of Verification system**

In the verification, an EEG is measured once in the mental-tasked condition and the verification score S is calculated by:

$$S = \sum_{p=1}^{P} \| |s^r_t - s^m_t| - |s^r_t - s^m| \|_p \quad \text{-------- (1)}$$

Where P is the number of partitions, $s^r_t$ and $s^m_t$ are templates in the relaxed and tasked condition, respectively and $s^m$ is a mean value of a partition in the tasked condition at the verification stage.
If S is less than a threshold, the user is authenticated genuine.

**Implementation Procedure**

Experiments in practical driving carry a risk of having some accident. There is a way to introduce a special training simulator that is possible to simulate the driving in a laboratory but it has also an issue of cost. Therefore, I adopted a simplified driving simulator that was composed of gaming machines.

**Simplified Driving Simulator**

Driving scenes were generated by the PlayStation 3 (PS3) as hardware and the Gran Turismo 5 Prologue (GT5P) as software produced by Sony Computer Entertainment Inc. However, the GT5P was a racing game and so the following settings were applied to utilize it as a driving simulator.

- Set a manual transmission to the first gear to limit the maximum speed of a car to 65 km/h
- Set a driving course to an urban road in London to drive the car in a general road
- Set a racing mode to time trial, that is, solo drive to avoid accidents with other cars

***Fig. 1. A still image of the driving scene is shown***

The driving scenes were displayed on a 60-inch screen and the size was 1100 mm by 830mm. The distance between the screen and a subject was 1300 mm. These had been preliminary determined using nine subjects based on evaluation how views from the subjects were similar with practical ones. A handle, accelerator and brake were equipped by imitated controllers: Driving Force GT

produced by Logitech. Figure 2 shows a measurement scene
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***Fig. 4.2: A measurement scene of brain waves using the simplified driving simulator.***

***Fig 4.2a Brainwave authentication gear.***

**Summary of Results**

In this research, the researchers focused attention on brain waves as unconscious biometrics. In particular, assuming driver authentication, we measured the brain waves of drivers when they were using a simplified driving simulator. We extracted the power spectrum at β band as an individual feature and proposed a verification method based on similarities of the features. In addition, we divided the β band into four or six partitions and fused sub-scores from the partitions. As a result of experiments using 23 subjects, we obtained the EER of about 20 %.

**Conclusion**

From the results of the above experiments, Brainwave as a means of authentication offer far greater efficiency than any other means of authentication used today. Car theft will be a thing of the past if this type of authentication is implored in transportation companies. It may even help to reduce kidnapping as someone else will not be able to forcefully drive your car.

**Recommendations**

Brainwave authentication will certainly be a better method of authentication than the fingerprint and passwords used in today's ATM and access control systems. The researchers will recommend that brainwave authentication be employed in those areas

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