# BIOMETRIC IDENTIFICATION SYSTEM BASED ON EYE BLINKING

**CONTACT DETAILS:**

Research Results Transfer Office-OTRI
University of Alicante
Tel.: +34 96 590 99 59
Email: areaempresas@ua.es
http://innoua.ua.es

## ABSTRACT

The Optics and Vision Sciences research group at the University of Alicante has developed a method for biometric authentication by recognizing the blinking of a subject.

The method consists of studying and characterizing the changes in the intensity of diffused light during the blinking process. Those changes are used to classify the blinks using different algorithms. A subject can then be identified according to the parameters recorded.

This method allows the authentication of subjects by means of a non-contact procedure, and even unconsciously. Commercial or built-in on mobile devices video cameras or webcams can be used for its application provided that the video is recorded at rates higher than 150 frames per second (fps).

We are looking for companies interested in the commercial exploitation of this technology as well as in adapting it for the development of related projects.

## INTRODUCTION

Biometric authentication is the automatic study for the unique recognition of human beings based on one or more identifiers. These biometric identifiers can be classified as behavioural or physiological traits.

Physiological features are related to intrinsic physical characteristics of the body such as fingerprint, veins or palm print, face, DNA, iris, retina, electroencephalogram (EEG) or electrocardiogram (ECG). Behavioural traits, on the other hand, are related to a person's behavioural pattern, such as the rhythm of writing, signing, or voice.

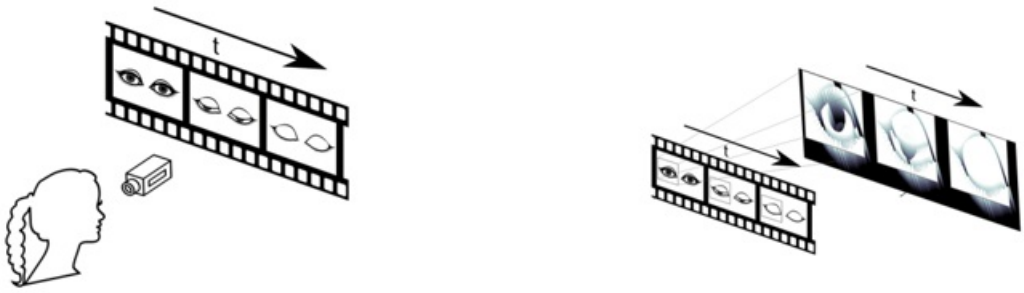
Eye movements have recently been used as physiological traits suitable for human biometric authentication.

Traditionally, blinking has been evaluated primarily by contact techniques that require the use of electrodes to measure the electrooculogram (EOG). However, it is also possible to use non-contact recording procedures, such as photography or video, that allow quantitative evaluation of eyelid movement during blinking without interfering with the subject. The most frequently studied characteristics of blinking are frequency and duration due to their relationship with mental states such as fatigue, attention spans and stress. In this case, authentication blinking parameters are related to the intensity of light diffused by the eye and eyelid during the blinking process.

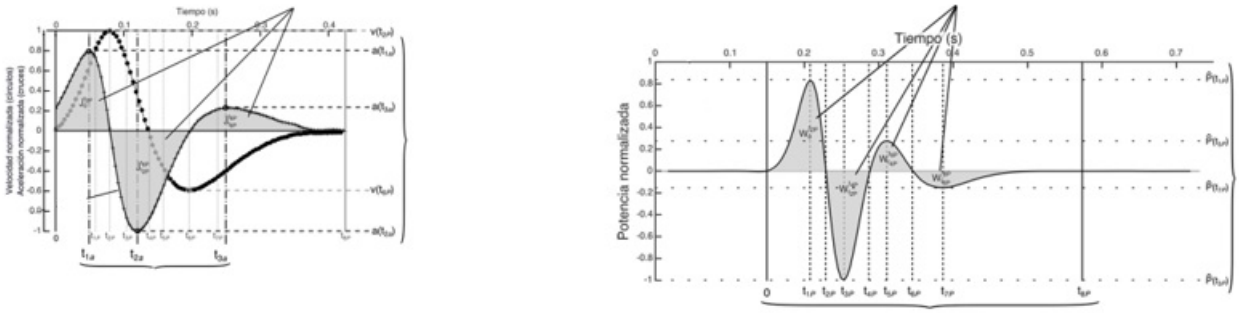
## TECHNICAL DESCRIPTION

The method developed comprises the stages of:

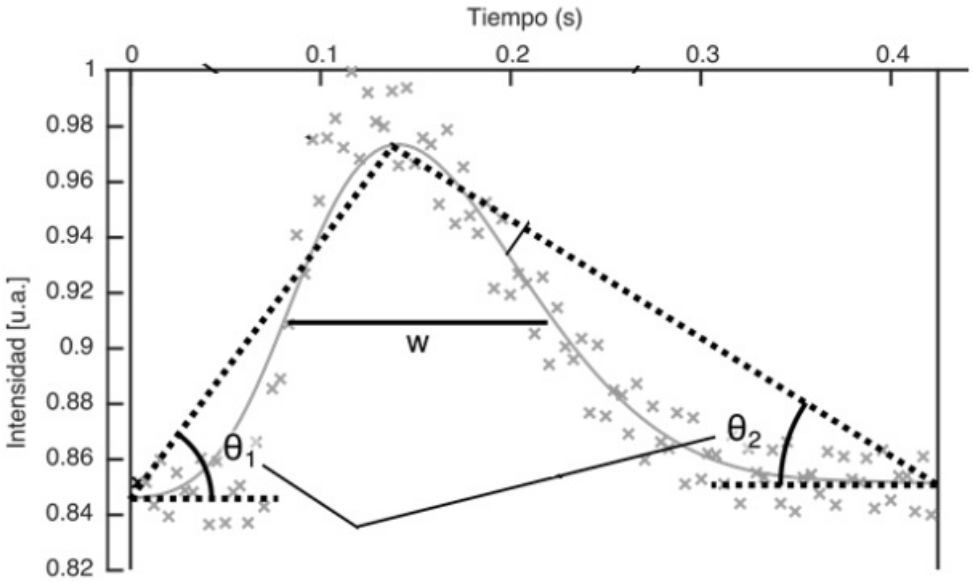
• Recording a blinking sequence of a subject with a digital video camera with acquisition speed faster than 150 frames per second.




• Analysis of the intensity changes (captured by the digital video camera) of the light diffused by at least one eye and its corresponding eyelid.




• Kinematic and dynamic characterization of the blinking: this characterization could be configured to identify a subject by means of a classification algorithm.




The identification and authentication of a subject from a video sequence of its blinking is performed by analysing the intensity changes captured by a digital camera of the light diffused by the eye and its corresponding eyelid. These changes are directly related to eyelid displacement. From the variation of the eyelid position over time, a series of physical parameters that characterize the kinematics and dynamics of blinking are calculated. These parameters will be used to identify each subject in a classification process.

The blink is one of the fastest human reflexes (300-400 ms). Therefore, in order to obtain parameters that adequately characterize it from a video, a camera with a capture rate according to that duration is necessary. This camera can be a commercial camera or a camera from a portable electronic device, such as a mobile phone or equivalent, as long as the capture rate is at least 150 frames per second (fps).

The intensity of the light diffused by the illuminated eyelid varies depending on its position, being maximum when the eyelid is closed and minimum when it is open. Thus, in a recorded video of a blinking subject, this variation will be reflected as changes in the intensity of the recorded light. In each frame of the blinking sequence, it is possible to estimate the intensity of light diffused by the eyelid by adding the grey levels of pixels in the area of interest around each eye and correlate this value with the eyelid position. Therefore, blinks will appear as peaks in the intensity profile.

A peak detection algorithm is used to isolate each eye blink and to adjust it to a smooth curve to eliminate the effect of noise. The first and second derivative with respect to the time of this curve are related, respectively, to speed (first derivative) and acceleration (second derivative) and their product is proportional to the power developed by the muscles responsible for the blinking. These curves are used to determine different kinematic and dynamic parameters that characterize the blinking of each subject.

The kinematic and dynamic parameters obtained are suitable for biometric authentication of a human being by means of classification algorithms, that assign these parameters from a blinking to a selected class among a plurality of classes.

Different classification algorithms have been evaluated and a correct identification rate of up to 99% has been obtained.

## ADVANTAGES AND INNOVATIVE ASPECTS

### ADVANTAGES OF THE TECHNOLOGY

- Non-contact authentication method, (short or medium distances).
- It can be applied unconsciously on a subject.
- Low Cost: Very affordable cameras and devices can be used.
- Possibility of use in portable electronic devices.
- Computational cost similar to that of other authentication techniques (voice, etc.)

### INNOVATION HIGHLIGHTS

- Dynamic characterization from subject blinking.

## CURRENT STATE OF DEVELOPMENT

The technology is developed at laboratory level.

## MARKET APPLICATIONS

The technology can be applied in all activities related to the Biometric Industry, for example:

- ICTs
- Electronics
- Safety and Security
- Military
- Tourism
- Health

## COLLABORATION SOUGHT

Companies interested in acquiring this technology are sought for commercial exploitation through:

- Patent licensing agreements.
- R&D projects to adapt technology to the needs of the company.

## INTELLECTUAL PROPERTY RIGHTS

The present invention is protected through **utility model application:**

- Title of the utility model: "Método y dispositivo de autenticación biométrica mediante el reconocimiento del parpadeo".
- Application number: U201831258
- Application date: 20/12/2016

## MARKET APPLICATION (4)

Computer Science, Language and Communication
Engineering, Robotics and Automation
Medicine and Health
Tourism