Passthoughts: Biometric Identification

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***Abstract*—Current day technology uses passwords, fingerprint scans, or retinal scans as security measures before granting access to devices. However, this type of security is easily broken and not reliable. Electroencephalogram's (EEG) and Brain Computer Interface's (BCI) are helping to mold the future technology of biometric identification.**

I. Introduction

The cell phone is a widely used device in society today. It is a valuable source of information for hackers because more users are putting confidential information on it. This information requires high security measures in order to be protected. Researchers and scientists have looked to the brain for the level of security that is necessary for this type of protection.

People generate unique brain waves while doing the same task. An EEG uses non-invasive electrodes placed on the skull to measure brain waves as people think. This connects to a BCI which determines the pattern of thinking we have towards different types of stimuli. Researchers have developed an inner-ear EEG to biometrically identify people, using the knowledge that brain waves are unique and can be measured.

II. Methods

John Chuang and his team at the UCLA Berkeley invented a prototype of a device that measures brainwaves to create a password. Chuang took the major components out of a NeuroSKy Mindwave EEG and placed them into an earbud. The inner-ear EEG design is shown in Figure 1 below.

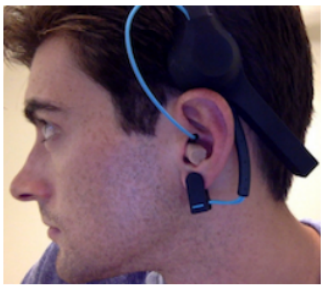

Fig. 1. Modified Neurosky Mindwave setup.

This device is still a work in progress. There are factors that greatly affect the readings. These include: caffeine, mood, medicine, alcohol, and exercise. BCIs are also highly idiosyncratic, meaning some people can easily control them while others struggle to perform with one.

The second example of a prototype that can biometrically identify a person is called the CEREBRE. This stands for Cognitive Event Related Biometric Recognition. Sarah Laszlo and her team's device is different than Chuang's device because it uses an ERP instead of an EEG. The ERP makes it less susceptible to mental states of the individual using it. This study was done with 56 participants. Each were shown pictures that were known to induce strong brainwaves. Fig 2 below shows examples of the pictures presented to the participants.

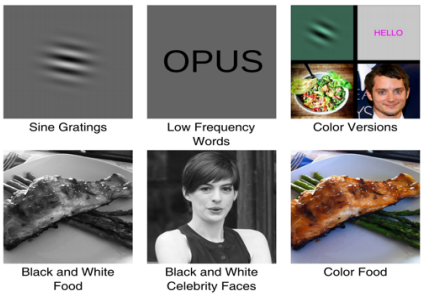

Fig 2.

III. Results

During the first experiment completed by John Chuang, the prototype measured the brainwaves of 12 participants doing mental tasks such as: taking a breath, picturing a song, listening to a tone, imagining a face, and picturing a rotating cube with eyes their open. It accurately identified the individual from doing the 2-5 mental tasks 72%-80% of the time.

The CEREBRE had a greater participant pool, as well as researched mental tasks for the subjects to perform. These tasks were known to create strong brain stimulation. This is unlike Chuang's study where the tasks were chosen at random. Laszlo's system correctly identified a person 100% of the time.

IV. Discussion

In conclusion, both studies demonstrate promising results for this technology to replace passcodes in the future. Biometric ID is much safer because no one can copy or measure an individual's brain waves without them knowing. People also have to be alive in order to use the password meaning no one can be tortured and killed due to their knowledge of a password. The last safety feature is that people don't have any conscious control of the biometric password, so they can't give it voluntarily or involuntarily to another person.

References

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