

A Review on Anti-Theft System Devised Using Brain Waves

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Abstract— Cars are providing luxurious way of driving but due to the increase in the number of car thefts cars need to be made more secured and safer. Safety and Security are two important things that are to be concerned in today's life. The Brainwaves are to authenticate different set of people that can be used to identify feeling and behavior of different people. This article talks about the application of brainwave in cars. The family code will be assigned to the car owner which will be a secret code given by the manufacturer .The car seat consists of embedded EEG sensors that help capture the brainwaves that identifies different individuals. If the mismatch occurs the triggers get activated and the fuel-motor pump cut off the supply to engine and the car gets stops and everyone within the car gets locked. The mechanism allows the surety of the system allowing the functions to be carried out in a negligible amount of time. Therefore it acts as an attempt to provide safety against the thefts.

Keywords— EEG (Electroencephalography); Embedded Sensors; Fuel motor; BATS(Brain waves anti-theftsystem).

INTRODUCTION

The name anti-theft can be given to any device or equipment that is either prepared or invented to counter the Theft (The act of stealing any valuable thing or an item). Over the past few years, studies show that there has been increase in theft measures mainly due to rise in unemployment. The vehicles remain the very vital part in today's world by providing the kind of luxury the owner wants, which occurs as a main reason behind the car thefts. Meanwhile for an experienced thief, the car is just In and Out as much of the security measures of the vehicle doesn't provide much security and the thieves either flew away with the luxury car or the valuable items stored within. The manner that represents our driving in today's lifestyle goes to the point of no return sometimes. Modern vehicular systems are itself a far more approach than varies with the automobile industry that comprises of special production vehicles. Anti theft is considered far more advanced automobile protection that prior to the security that a manufacturer can provide an owner with. There remains a need for the upgrade till the keyless security[16] got breached resulting in many major information losses, which now have become a simple habit for the attackers to go on find a luxury vehicle break in and get away with that.

To answer these problems, this paper discusses a far more advanced approach of enhancing the security with the advancement of brain wave capturing methodology[1]. Here that technology is named BATS i.e. brain waves[9] guided anti-theft system, an approach that monitors the incident brain waves of the driving of the vehicle through the sensor sheet embedded in the driver seat of the vehicle[13]. The output from these sensors is then passed onto the embedded touch panel which operates in the background to monitor and compare those brain wave results within the database that is the information pool for the working of whole system that fetches and write onto the same database for different brain waves results.

The BATS system interpretation starts up with the driver seat embedded sensors that remains Idle till the BATS monitoring is turned ON within the BATS USER panel management that works on the passwords likely being the Family pass and the user pass itself. The privilege is provided within that account to modify the BATS Monitoring. The sensory output i.e. the output from the sensors that goes on to get processed in the touch panel or an embedded laptop that mostly comes pre-embedded through the manufacturer in luxury sedans like Audi A6 lineup. The BATS panel at the background goes in the processing phase if it is turned on in the BATS User Management panel. The plot that come as a result of brain wave monitoring by the sensors are then compared to those stored values in the database which allows a minimum function fluctuation to be neglected, if there is far more difference in the desired and the actual plots that The Database query gets fired which in-turn fires the triggers through to the vehicle fuel pump and the car [10] doors. This whole functioning comprises BATS as a

vehicular system that can either be purchased manually or can be placed within during the manufacturing of the vehicle itself. Before the actual system is taken, the processing is taken onto the capturing of brain waves and before that what actually are brain waves and what the categorization is. Shows the different phases who the communication in the brain takes place and at what time which signal activates which type of brain waves.

A. What Exactly Are Brain Waves?

Brain comprises of millions and billions of brain cells commonly known to be 'neurons'. The communication between the neurons generates neural oscillations that result in brain waves. Now the confusion arises that what are neural Oscillations? The term 'oscillation' is the name given to the repeated motion. In Neurology, neural oscillation is used to describe motions between the neurons which communicate through these neural oscillations. These oscillations depend upon the firing capability of a particular neuron. These oscillations are basically depicted by phase, frequency and amplitude. The neural oscillations possess different values for different types of brain waves determined by the frequency. Neural oscillations come under the cognitive sciences that discusses about the brain activity. During communication the neurons form up patterns commonly named to be 'Spike Trains'. These are microscopic activities that are mostly captured using the electroencephalograph (EEG).

Neurons are considered main part of the human brain. These communicate through passing electrical and chemical signals which correspond to the number of activities going through the human behaviour. These electrical signals generate spikes like signals when recorded thus depicting how fast the communication occurs between the neurons. There are different neurons that correspond to certain activities such as sensory neurons for touch, sound and light etc. In considering the structure of the neuron 3 parts are discussed namely—body, axon and dendrites.

- Dendrite is name given to thin structures that arise from cell body to formation of a complex 'dendrite tree'.
- On the other hand, axon is a special cellular process that arise from axon hillock and travels for some distance.
- Body comprises of more than 1 axon and multiple dendrites which allows exchange of signals.

B. Brain Waves Categorization

Brain as it is, acts as a very vital part of any individual as the brain transfers signals through brain waves, working as a super-computer itself which mainly works by processing multi-tasks. The brain waves produced signal is a unique wave that even differs in just a blink of the eye. So, the difference between the brain waves of the two individuals is quite a big scenario. The processing of the activities a human goes through are all part of the brain functionality. These activities are triggered through the signals that are found in human brain. For every individual the frequency of those brain waves remains the same but they differ from individual to individual. This difference is shown by the manipulation of different types of brain waves that discusses a human either possessing a larger number of any type of Brain waves or their other type in another individual. There are transitions in the wave patterns depending upon the things we do and emotions everyone possess. For stress, work, sleep and many more activities the patterns may vary infrequency. The electroencephalograph measures up to different types of the brain waves i.e. alpha, beta, gamma, delta and theta.

- Gamma Waves: These waves range in the frequency of 40 Hz to 100Hz. These waves correspond to the cognitive behavior and tasks that require more processing like that of learning, processing the information and memory itself. The way we percept our environment and adapt is up to Gamma waves but the people with disabilities possess much lower gamma waves activity.
- Beta Waves: The beta waves range in the frequency of 12Hz to 40Hz. These waves correspond to logical thinking or in conscious thoughts these are very fast ones that corresponds to tasks such as socialization ,writing ,critical thinking etc.

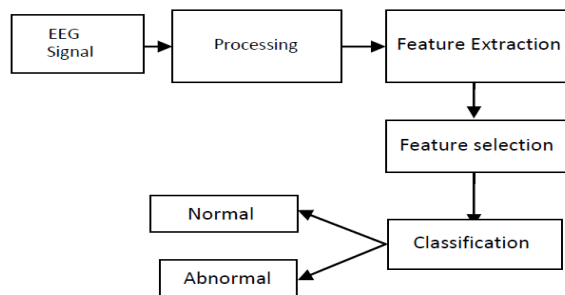


Fig1: EEG Signal Extraction and Classification

- **Alpha Waves:** The alpha waves range is much moderate that varies from 8Hz to 12Hz. In simple words these waves are the bridge between the beta and theta waves i.e. subconscious mind and conscious thinking.
- **Theta Waves:** These are the second slowest brain waves after the delta waves. These are exhibited either during daydreaming or sleeping. These waves correspond to the thoughts that humans comprise while in their sleep either leading to depression or high relaxation.
- **Delta Waves:** These waves are known to be the slowest of all detected brain waves. Their frequency ranges from 0Hz to 4Hz. These waves are mostly found in infants and children, but they tend to lower as the individual ages.

C. Why Prevent Theft Of An Item

The utmost motive remains is to either secure the item or research going to wrong hands or simply protection of an item of certain value to the rare-items & most expensive gifts. Some of the reasons for that can be:

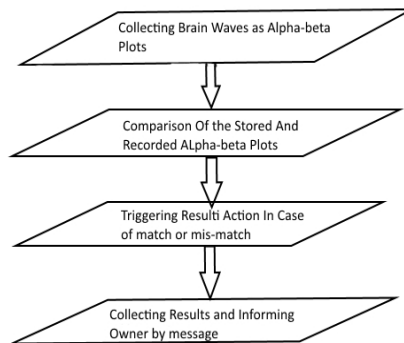
- It is much expensive in value i.e. certain amount of \$\$\$ have been spent in buying it. Examples can be Luxury car, present from a dearest, great grandfather's tokens or a rare collection.
- No replacement can be found for certain item if it gets lost or stolen. Some examples can be antiques, unique art etc.).
- It is too easy to steal the item, so there is need of protection.
- Leaving items unattended in certain place or an unsafe environment. Some examples can be laptop in a car or in a room or a library, cars in a no-parking area).
- There is certain amount of damage if the item goes in wrong hands related to some research or a government project. Examples can be car keys of a rare car, access keys to a govt. building or research Lab, identity proof etc.
- A desire possessed by other known personnel's or can be an unknown individual of possessing the items like Jewelry, Mobile and Blueprints.

D. Methods Through Which Theft Can Be Prevented

If an individual possesses an item of certain value, there is a need of protection either he opts for it or not. There are a number of general categories of anti-theft systems through which the theft can be prevented:

- **Storage of item:** This method refers to the safe storage of an item of particular importance. One method can be storing them in a certain protected safe with certain amount of capabilities depending upon the minimum threshold for the theft. Examples can be piece of art, jewelry, rare item etc.
- **Disabling the item:** With advancements in technology, certain functionalities are provided by the particular items. One of the key aspects is disabling of device in case of theft so as to protect vital information. The example can be taken of a Smartphone which goes disabled in case user loses them. The re-enabling of the item then may need certain authentication from the user so that theft activities can be reduced.
- **Security tags:** These are mostly seen in shops where the tags are attached to the clothing to prevent thefts. The tags prior to the surveillance system that goes onto activate the alarm when the item gets stolen.
- **Location tracking software:** Most of the gadgets today provide the tracking ability to the user by means of which they can track the location of their device if that functionality is activated. Through this functionality, the user is able to get the co-ordinates of the system thereby can retrieve their item if gets stolen.

E. Flowchart Of The System



I. PREVIOUS TECHNIQUES USED

- A. A prototype was devised using the capture of human brain waves using the EEG that compares data with the one stored in the database. The prototype is still needed to be tested in certain circumstances with which the system can stand.
- B. A computerized spectral analysis was put forward to compare up patients with depression and healthy elderly controls by measuring the brain waves. The lower end of spectrum depicted the demented and depressed patients differences.
- C. A brain driver car was put forward to help the disabled community which would help them drive it using the thinking power based upon the brain waves.
- D. To carry out the brain waves approach a simulated environment was put forward in which the car was controlled using brain waves within the PS3 console of the game Gran Turismo 5
- E. Based wave based authentication put forward by the English scientists in their publications suggested that brain waves can be used as a password for certain purposes in day to day life.
- F. An efficient automotive security system was proposed that is implemented using GPS and GSM technologies where the client interacts with vehicles and determines their positions.

II. RELATED WORK

Mashable, Isao Nakanishi [20] and his colleagues in the graduate school of engineering at Japan's Tottori University proposed a prototype that operates by recording the brain waves of a person on Database so as to provide anti-theft measures. That prototype designed whenever finds a person driving the car does not matches the one on the file the vehicle is shut. This proposal make it even worse for the thieves that rely themselves on various tools to go through the automobiles. But this prototype has yet to establish in situations where the vehicle is to driven by an unauthorized person thereby overriding or bypassing the system build.

Ford motorsport[8] unveiled a driver seat with the inbuilt sensors to detect the heart attack situations as most times the cause of the accident is the heart attack in senior citizens. According to ford, the seat has been embedded with 6 sensors that detects heart rates, and in case of heart attack the steering and the braking systems too are activated to provide the safety from the accidents.

Infiniti [15] proposed another authentication prototype that identifies drivers based on the brain waves being recorded on file. If the waves doesn't match then the vehicle disables itself. The research is ongoing at japan's tottori university that uses EEG to capture brain waves.

JAGUAR[7], a brand name in automotive industry, is currently working on 'Mind Sense' project that uses brain waves to detect concentration of the driver. Their main concern bring the measurement of driver concentration, Fatigue and stress. Jaguar's land-rover Mind Sense technology is based on driver's concentration being sleepy or drunk. They are currently working on the technology to wake up driver either through the steering wheel vibration or through any kind to sound technology.

M.Sivagnanam, 2010[10] presented forward the development of a brain driven car, which would be of great help to the physically disabled people. Since these cars will rely only on what the individual is thinking they will hence not require any physical movement on the part of the individual.

Isao Nakanishi, Koutaro Ozaki, Shigang Li, 2014 [12] used a simulated driving environment to test the brain waves authentication using the Ps3 console with results on the Gran Turismo 5 Prologue Video Game.

KennetFladby, 2008, [19]in his publication "Brain waves based authentication", suggested that the brain waves can be used as a password just as simple an individual thinking of any password in his mind.

Montaser N. Ramadan, Mohammad A. Al-Khedher, IACSIT and Sharaf A. Al-Kheder[11] proposed an efficient automotive security system that is implemented for anti-theft using an embedded system occupied with a Global Positioning System (GPS) and a Global System of Mobile (GSM). The client interacts through this system with vehicles and determines their current locations and status using Google Earth. The user can track the position of targeted vehicles on Google Earth.

Ming zhangLuo, JunminWang, MingyunZhang,Hongli Wang, 2012, [13] proposed a cost-effective mobile development platform, MTK that support the functions of recording video and sending multimedia message. They proposed an anti-theft monitoring alarm system based on MTK. The design based on a high performance MTK chip of MT6226.The sensors and the alarm device attached to MT6226 through the interface of GPIO. Once one of the sensors detect abnormal signal, MT6226 call the thread of recording video, driving the alarm device.

III. COMPARISON ANALYSIS

Technique	Critical Analysis	Results
EEG based driving	<ul style="list-style-type: none"> • Uses a head mounted EEG device and captures brain wave results. • Cap needs to be worn every time while driving. 	Anti-theft abilities made easy with BW mappings detection.
Brain waves as Biometric for computer user	<ul style="list-style-type: none"> • Authentication using brain waves for logging on to computer. • Database decides the number of users. 	Authentication made more secure using mapping of BWs
ATM Brain Fingerprinting	<ul style="list-style-type: none"> • Uses Brain waves for ATM transactions. • Ensures security of individual's account. 	Improved security over hacked PINs of the ATMs.
EEG based authentication headsets	<ul style="list-style-type: none"> • Simplifies the EEG difficulties replacing it by Headsets. • Provides portable abilities to the owner. 	Improved portability over previous EEG based replica's.
Brain controlled car for disabled	<ul style="list-style-type: none"> • A car that operates using Brain waves of the disabled. • Ignores their disabilities to operate the car as a normal being. 	Much positive results for the disabled community helped them to enjoy rides they can control.

IV. SUMMARY

The functionality talks about the Sensor based approach that can be enhanced to take up the full control of the vehicle; moreover the BATS system itself can be made portable allowing the owner to carry on with the key chains that include the software key functions. The system itself can be provided within a software package comprising different functionalities added to the user control.

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