Brain Controlled Car For Physically Challenged People Using Artificial Intelligence

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ABSTRACT

This paper considers 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 The car integrates signals from a variety of sensors like video, weather monitor, anticollision etc. it also has an automatic navigation system in case of emergency. The car works on the asynchronous mechanism of artificial intelligence. It's a great advance of technology which will make the disabled, abled.

1. INTRODUCTION:

The branch of computer science concerned with making computers behave like humans. The term was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology. Currently, no computers exhibit full artificial intelligence. The best computer chess programs are now capable of beating humans. Today, the hottest area of artificial intelligence is neural networks, which are proving successful in a number of disciplines such as voice recognition and natural-language processing.

Devices that pick up brain waves and translate them into mechanical action are being developed to control prosthetic limbs, robots and video games. But now comes the Brain Driver, a car that is driven entirely by your thoughts and does not required to perform any mechanical operation of the vehicle. Brain controlled technology has been implemented in all types of vehicles such as cars, bikes, bicycles, etc. This technology would allow the driver to shift gears, change speed and acceleration with their mind itself.

- Laser
- Radar
- Sensors

Fig: Brain Controlled Car

4. BIOCONTROL SYSTEM:

2. ARTIFICIAL INTELLIGENCE:

2.1 What is Artificial Intelligence?

Intelligence is the ability to think, to imagine, creating, memorizing, understanding, recognizing patterns, making choices, adapting to change and learn from experience.

Artificial intelligence is a human endeavor to create a non-organic machine-based entity that has all the above abilities of natural organic intelligence. Hence it is known as 'Artificial Intelligence'(AI).It is the ultimate challenge for an intelligence, to create an equal, another intelligent being.

2.1.1 HUMAN-INTELLIGENCE PROCESSES:

- Learning

The acquisition of information and rules for using the information

- Reasoning

Using the rules to reach approximate or definite conclusions

- Self-correction.

2.2 APPLICATION:

- Expert systems
- Speech recognition
- Machine vision.

3. FEATURES OF THE VEHICLE:

- Video cam
- Neuro Headset

A mechanical system that is controlled A by biological signals. The biocontrol system integrates signals from various other systems and compares them with originals in the database.

VARIOUS METHODS:

- Brain-computer interface
- Automatic security system
- Automatic navigation system

4.1 BRAIN–COMPUTER INTERFACE:

4.1.1 WHAT IS BCI?

Brain-computer interface (BCI) is collaboration between a brain and a device that enables signals from the brain to direct some external activity, such as control of a cursor or a prosthetic limb. BCIs are often directed at assisting, augmenting, or repairing cognitive or sensory-motor functions in humans that have lost the ability to control parts of their bodies.

The aim of a BCI that involve varies by application. Currently, Brain-Computer Interfaces are used to augment or repair cognitive or motor functions. As BCIs become more affordable, more accurate and easier to use outside of medical facilities, their use will increase.

In the case of cursor control, for example, the signal is transmitted directly from the brain to the mechanism directing the cursor, rather than taking the normal route through the body's neuromuscular system from the brain to the finger on a mouse.

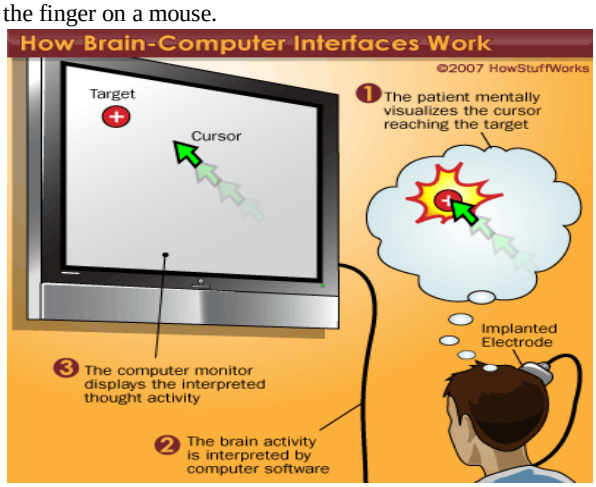

FIG: BRAIN COMPUTER INTERFACE

TYPES OF BCI:

1. One way BCI

   Computers either accept commands from the brain or send signals to it.

2. Two way BCI

   Allow brains and external devices to exchange information in both directions.

NON INVASIVE METHODS:

- Electro Encephalography (EEG)
- Functional magnetic resonance imaging (fMRI)
- Magneto Encephalography (MEG)
- Near-infrared spectroscopy (NIRS)

4.1.2ELECTROENCE-PHALOGRAPHY:

One of the biggest challenges facing brain-computer interface researchers today is the basic mechanics of the interface itself. The easiest and least invasive method is the use of **electroencephalograph** (EEG), set of electrodes that can read brain signals. To be specific, EEG's electrodes measures the voltage variations caused due to the current flow within the neurons of the brain. However, the skull blocks a lot of the electrical signal, and it distorts what does get through.

The EEG is a recording of the electrical activity of the brain, similar to the ECG for the heart. When a subject thinks something or experiences some emotion, groups of neurons fire in the brain which gives rise to small but detectable voltage traces on the surface of the scalp.

To get a higher-resolution signal, scientists can implant electrodes directly into the gray matter of the brain itself, or on the surface of the brain, beneath the skull. This allows for much more direct reception of electric signals and allows electrode placement in the specific area of the brain where the appropriate signals are generated. However, this approach has many problems. It requires invasive surgery to implant the electrodes, and devices left in the brain long-term tend to cause the formation of scar tissue in the gray matter. This scar tissue ultimately blocks signals.

Regardless of the location of the electrodes, the basic mechanism is the same: The electrodes measure minute differences in the voltage between neurons. The signal is then amplified and filtered. In the case of a sensory input BCI, the function happens in reverse. A computer converts a signal, such as one from a video camera, into the voltages necessary to trigger neurons.

The signals are sent to an implant in the proper area of the brain, and if everything works correctly , the neurons fire and the subject receive a visual image corresponding to what the camera sees.

The peak-to-peak amplitude of the waves that can be picked up from the scalp is normally 100 microV or less while that on the exposed brain, is about 1mV. The frequency varies greatly with different behavioral states. The normal EEG frequency content ranges from 0.5 to 50 Hz. Frequency information is particularly significant since the basic frequency of the EEG range is classified into five bands for purposes of EEG analysis. These bands are called *brain rhythms* and are named after Greek letters.

Band	Frequency [Hz]
Delta	**0.5- 4**
Theta	**4- 8**
Alpha	**8- 13**
Beta	**13- 22**
Gamma	**22-30**

FIG: COMMON EEG FREQUENCY RANGES

The alpha rhythm is one of the principal components of the EEG and is an indicator of the state of alertness of the brain.

4.1.2.1 EMOTIVEPOC NEUROHEADSET:

The EEG device used in Brain Driver is the Epoc neuro-headset, originally developed for video games by San Francisco-based Company Emotiv Systems. Drivers will be required to wear the Emotiv EPOC neuroheadset. This headset is equipped with 16 sensors that have the ability to decode electromagnetic signals—more specifically those that can understand brain patterns that are linked to comprehending the directional commands.

Fig: EPOC NEUROHEADSET

Before the user or driver can use the Epoc to give commands to the car, he has to spend some time training the Epoc's cognitive suite to recognize the commands. The Epoc can be trained to recognize up to four concurrent mental actions within a few minutes.

The Epoc system is unique, as it can use facial expressions of the user as commands for the brain-computer interface.

It is possible to distinguish four possible directions on the computer screen – left, right, up and down. The up direction indicates accelerating the car and down indicates decelerating the car. Using such small increments of changes in steering or acceleration, it is possible to turn the car or accelerate it with mental commands that are sent to the car microprocessor through Epoc headset.

4.1.3 SOFTWARE TO RECEIVE BRAIN SIGNAL:

A person could train a computer to read brain signals associated with directional moving and speed increments. The computer then relays an electronic signal to the car which responds. Thus, the driver of the car has to interact with this computer through his mind.

The signals or data from the different sensors attached to the Epoc are sent wirelessly to a PC. The PC has dedicated software that extracts information from the data coming from the sensors. With this software and data, it is possible for the computer to detect up to 12 different facial expressions and four different emotions of the driver in real-time.

4.1.4 MECHANISM TO CONTROL A CAR:

The Brain Driver technology works by rigging a car up with video cameras, radars and laser sensors that give it a full 3D picture of its surroundings. The driver then puts on the special cap with 16 sensors on it which pick up the brain's electromagnetic signals. The signals are interpreted by a computer which can be trained to understand that two different specific patterns mean left or right.

Once the driver (disabled) nears the car, the security system of the car is activated. If the video images match with the database entries then the security system advances to the next stage. Here the thermo graphic image verification is done with the database. Once the driver passes this stage the door slides to the sides and a ramp is lowered from its floor. The ramp has flip actuators in its lower end. Once the driver enters the ramp, the flip actuates the ramp to be lifted horizontally. Then robotic arms assist the driver to his seat. As soon as the driver is seated the EEG (electroencephalogram) helmet, attached to the top of the seat, is lowered and suitably placed on the driver's head. A wide screen of the computer is placed at an angle aesthetically suitable to the driver. Each program can be controlled either directly by a mouse or by a shortcut. For starting the car, the start button is clicked. Accordingly the computer switches ON the circuit from the battery to the A.C.Series Induction motors.

PRINCIPLE:

The impulse of the human brain can be tracked and even decoded. The Low-Frequency Asynchronous Switch Design traces the motor neurons in the brain. When the a physical movement is made, an impulse to the motor neuron is sent. These motor neurons carry the signal to the physical components such as hands or legs. Hence we decode the message at the motor neuron to obtain maximum accuracy. By observing the sensory neurons we can monitor the eye movement of the driver.

As the eye moves, the cursor on the screen also moves and is also brightened when the driver concentrates on one particular point in his environment. The sensors, which are placed at the front and rear ends of the car, send a live feedback of the environment to the computer. The angle of turn is calibrated from the distance moved by the dot on the screen.

4.2 AUTOMATIC NAVIGATION SYSTEM:

Programming the microcontroller assists us for providing the desired movement and controlling of motors by switching them on and off for particular track following. The main aim of Global Positioning System (GPS) Its main aim is location tracking and providing us the best route to reach to that point.

The computer automatically monitors every route the car travels and stores it in its map database for future use. With traffic monitoring system provided by *an satellite radio* the computer drives the car automatically. *Video and anti-collision sensors* mainly assist this drive by providing continuous live feed of the environment up to 180 *m*, which is sufficient for the purpose.

4.3 AUTOMATIC SECURITY SYSTEM:

The EEG of the driver is monitored continually. When it drops less than 4 Hz then the driver is in an unstable state. A message is given to the driver for confirmation and waits for sometime, to continue the drive. A confirmed reply activates the program for automatic drive. If the driver is doesn't give reply then the computer prompts the driver for the destination before the drive.

4.3.1 STEPS TO BE DONE IF COMPUTER IS HACKED:

When a car's computer is hacked through wireless, control the car while it was in motion, apply the brakes, selectively brake each wheel to steer, and shut down the engine completely. They were also able to shut down the brake and accelerator completely so the driver would have no control whatsoever -- then removed malware once the vehicle had crashed.

6. ADVANTAGES:

- The mind-controlled car as a combination of an autonomous car which requires decision points via the brain-computer interface only at critically important points, e.g. the Corner of roads which are crucial decision points while driving. Thus, the driver needs to concentrate only a few seconds to give commands to the car.
- Change the perception of the driver' view and redefines the driving experience with a new dimension.
- Increased roadway capacity due to reduced need of safety gapsand the ability to better manage traffic flow.
- Increased reliability compared to human drivers.
- Alleviation of parking scarcity as cars could drop off passengers, park far away where space is not scarce, and return as needed to pick up passengers.

7. DRAWBACKS:

- The brain is incredibly complex. All thoughts or actions are the result of simple electric signals in the brain is a gross understatement. There are about 100 billion neurons in a human brain. Each neuron is constantly sending and receiving signals through a complex web of connections.
- The driver has to think really hard and concentrate a lot to produce the distinct brain patterns which train the brain-computer interface to produce the corresponding sustained physical motion of the car.
- EEG faces "noise" from electrical signals sent by the muscles and eyes.
- A delayed response rate between the thinking and command action currently seems to be the biggest flaw.

8. CONCLUSION:

This technology would allow the driver to shift gears, change speed and acceleration with their mind itself. Drivers will be able to control their vehicle much faster than they would do with the conventional methods. While braking, the time taken by the signals carried from the human being's nervous system to reach the brake pedal is saved, which will be very helpful in case of a sudden mishap on the road. This emerging technology can make even the physically challenged persons to be abled.

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