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Navigate By Artificial Intelligence

Ritu. N. Lal
Department of Information Technology, Velammal Institute of Technology, Chennai, Tamilnadu, India

ABSTRACT

In this paper we shall see a car which will make life more convenient to the disabled. With least physical movements a disabled person can navigate around only using his brain. The car works on the system of artificial intelligence. Signals from a variety of sensors like video, weather monitor, anti-collision etc. are integrated. This technically advanced car will bring about a drastic change in the lives of the disabled. In the 40's and 50's a number of researchers explored the connection between neurology, information theory and cybernetics. Some of them built machines that used electronic network to exhibit rudimentary intelligence. Most of the researchers hope that their work will eventually be incorporated into a machine with general intelligence. One such invention is the brain controlled car.
Keywords: Artificial Intelligence, Nervous System, Biocontrol System, Automatic Security System, Automatic Navigation System, Brain-Computer Interface, BCI, EEG, MIDI

I. INTRODUCTION

The brain is the major organ of the central nervous system and the control center for all the body's voluntary and involuntary activities. One of the major parts of the brain is cerebellum whose main functions are the maintenance of posture and the coordination of body movements. In the human body there are several parts and all having its separate motion. Each area of the cerebellum has its separate significance in the body movements. To control movement the brain has several parallel systems of muscle control. In brain machine interface technology the electrical signals from the brain are extracted and processed to run various applications. The external activities are monitored by the video and thermo gram analyzer. The security system of the car is activated when the driver approaches the car. The computer is fed with the details of the person like the images and the thermo graphic results. If the video images coincide with the database entries of the computer the security system moves on to the next stage. The driver is assisted to the seat with the help of a ramp. The EEG (electroencephalogram) helmet which is placed above the driver is placed on his head. A computer screen is placed in an angle suitable to the driver. The driver has to start the car by pressing a start button. When the start button is pressed the computer is also activated.

Figure 1. Navigation System

II. METHODS AND MATERIAL

1. Biocontrol System

The bio control system integrates signals from various other systems and compares them with originals in the database. It comprises of the following systems:

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

Now let us discuss each system in detail.

2. Brain – Computer Interface

The word brain means the brain or nervous system of an organic life form rather than the mind. Computer means any processing or computational device, from simple circuits to silicon chips (including hypothetical future technologies such as quantum computing) once the driver (disabled) nears the car. A brain-computer interface (BCI), sometimes called a direct neural interface or a brain-machine interface, is a direct communication pathway between a human or animal brain (or brain cell culture) and an external device. Brain-computer interfaces will increase acceptance by offering customized, intelligent help and training, especially for the non-expert user.

Development of such a flexible interface paradigm raises several challenges in the areas of machine perception and automatic explanation. The teams doing research in this field have developed a single-position, brain-controlled switch that responds to specific patterns detected in spatiotemporal electroencephalograms (EEG) measured from the human scalp. We refer to this initial design as the **Low-Frequency Asynchronous Switch Design (LF-ASD**)

Figure 2. Low- Frequency Asynchronous Switch Design

The EEG is then filtered and run through a fast Fourier transform before being displayed as a three dimensional graphic. The data can then be piped into MIDI compatible music programs. Furthermore, MIDI can be adjusted to control other external processes, such as robotics. The experimental control system is configured for the particular task being used in the evaluation. Real Time Workshop generates all the control programs from Simulink models and C/C++ using MS Visual C++ 6.0. Analysis of data is mostly done within Mat lab environment.

3. Test Results Comparing Driver Accuracy With/Without BCI:

1. Able-bodied subjects using imaginary movements could attain equal or better control accuracies than able-bodied subjects using real movements.
2. Subjects demonstrated activation accuracies in the range *of* 70-82% with false activations below *2*%.
3. Accuracies using actual finger movements were observed in the range 36-83%
4. The average classification accuracy of imaginary movements was over *99*%

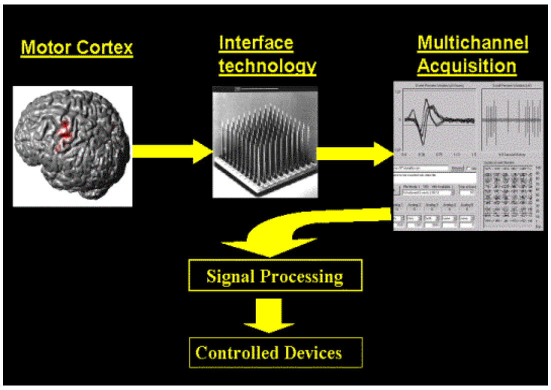

Figure 3. Brain-to-Machine Mechanism

The principle behind the whole mechanism is that 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 driver attempts for a physical movement, he/she sends an impulse to the motor neuron. 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.

Figure 4. Eyeball Tracking

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 steering wheel is turned through a specific angle by electromechanical actuators. The angle of turn is calibrated from the distance moved by the dot on the screen.

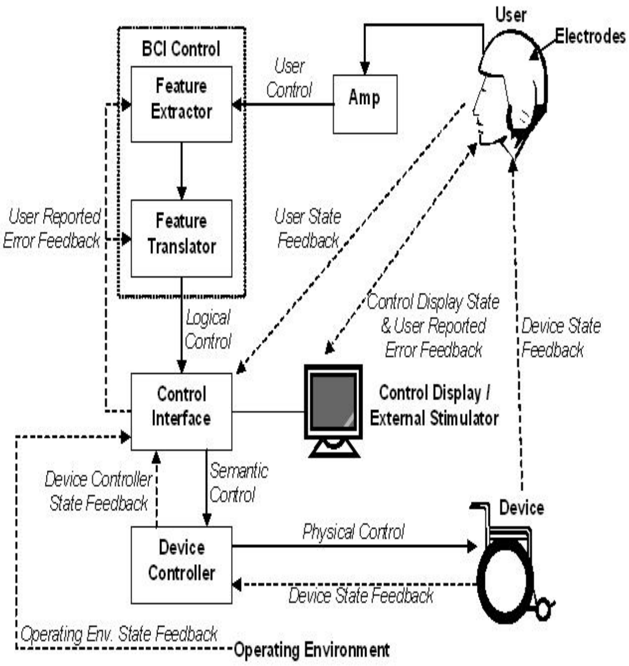

Figure 5. Electromechanical Control Unit

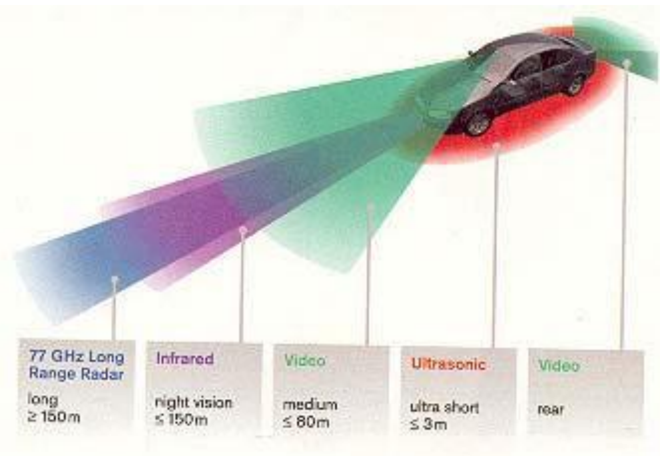

Figure 6. Sensors and Their Range

Electroencephalography (EEG):

Electroencephalography is a routine method of medical diagnostics for assessing human brain activity. The electrical signals, induced by activity of the cranial nerves, are measured on the scalp. Thinking consists of a complex interaction of electrical signal processing and chemical signal storage in the brain. Certain parts of the brain are clearly related to activities of the body, e.g. the processing of eye signals used here which takes place in the visual cortex in the back of the human brain. Such electrical processes occur in all parts of the brain and they interfere with each other. They can be measured by accompanying voltage on the skin. With the electroencephalography, caps are usually used for applying electrodes which can measure the voltage of a few millionth volts. The signals of normal vision are too complicated and too weak to be used in the EEG. But if a large part of the field of view is occupied by a blinking pattern

Figure 7. EEG Transmission

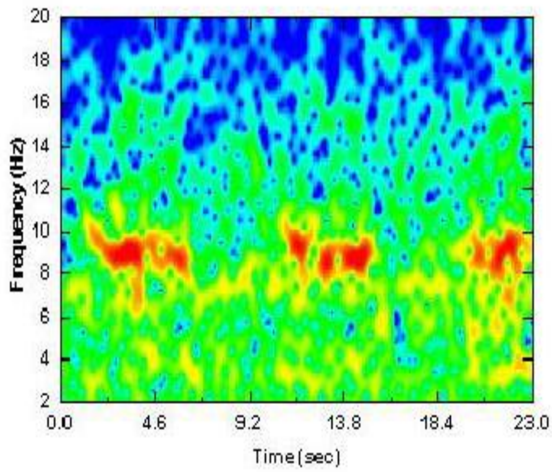

Figure 8. EEG

III. RESULTS AND DISCUSSION

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 to continue the drive. A confirmed reply activates the program automatic drive. The computer prompts the driver for the destination before the drive.

AUTOMATIC NAVIGATION SYSTEM:

As the computer is based on artificial intelligence it automatically monitors every route the car travels and stores it in its map database for future use. The map database is analyzed and the shortest route to the destination is chosen. With traffic monitoring system provided by 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.

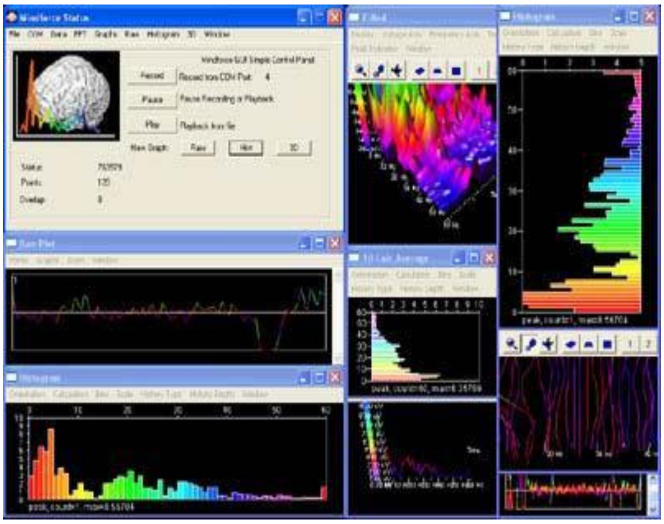

Figure 8. Automatic Navigation System

IV. CONCLUSION

With such giant leaps in technological development, we can surely say in the near future the difference between the abled and the disabled is soon to vanish. Thus the integration of bioelectronics with automotive systems is essential to develop efficient and futuristic vehicles, which shall be witnessed soon helping the disabled in every manner in the field of transportation.

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