Blind People Can See Through Tongue Using Brain Port

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ABSTRACT:

For all the wonderful uses of technology, none is more wonderful than when it can be used to improve the lives of the handicapped. A device called the Brain Port is a sixth sense for the blind, translating images from a video camera to electrical impulses that are transmitted via the tongue to the brain of a blind person. The Brain Port is the strangest gadget for the blind of them all, translating visual images into electrical impulses, sent to a plate that rests on the tongue. The technique, called echolocation, uses reflected sound to help subjects "see" their surroundings by measuring the distance, size, and density of the objects around them, it is reported. Interestingly, the blind subjects are intensively using the camera zoom on the current Brain Port vision device, even if it was not included in our original natural design.
The Wicab Brain Port is a device that takes information gathered by the sensors in a pair of glasses and sends them to a "lollipop" electrode array that sits on your tongue. Visual data are collected through a small digital video camera about 1.5 centimeters in diameter that sits in the center of a pair of sunglasses worn by the user.

INTRODUCTION

Wicab Brain Port is a device (Fig.1) that takes information gathered by a small digital camera in a pair of glasses and sends it to a "lollipop" electrode array that sits on your tongue. The device was designed to help people who are blind or who have extremely low vision.

The camera in the glasses transmits the light information to a small base unit the size of a cell phone, an article at Scientific American explains.

The base unit converts the light information into electrical impulses; this replaces the function of the retina. The retina is the surface at the back of the eye that encodes light into nerve impulses and transmits them to the brain.

The base unit then sends that information into a set of 400 microelectrodes arranged on a lollipop-like paddle that you place on your tongue.

The microelectrodes stimulate the nerves on the surface of your tongue. Although it seems incredible, the user's brain actually learns to interpret the tongue sensations as a kind of visual image. After all, your brain cannot "see" - it can only interpret the nerve impulses from your eyes and then create a picture that helps you move through a room, or find nearby objects.

Fig.1: A Haptic Feedback device

The base unit has features like zoom control, light settings control and intensity. Using these controls, users can successfully use the Brain Port device to find doorways and elevator buttons and even read letters and numbers. At the table, users can easily see cups and forks; I suppose you'd take it out to eat.

HOW BLIND PEOPLE USING SUN GLASS:

Augmented reality glasses with a camera allow for real-time image processing as needed for generating augmented reality overlays that are not just based on GPS location sensors and orientation sensors, but that really take the user's visual environment into account. Apart from applications for the sighted masses, this then also enables providing live visual input to the blind, be it through corresponding auditory stimulation (The vOICe) or tactile stimulation, or through implanted electrodes as with retinal implants and cortical implants.

The voice for the blind is in principle best used with unobtrusive USB video sunglasses - dark glasses featuring a hidden camera, also known as spy glasses - that can be connected directly to a PC's USB port for both the video signal and the camera's power supply (just like one would use a regular plug-and-play USB webcam), preferably based on a CCD camera chip rather than a CMOS camera chip for best results under low-light conditions and with a viewing angle on the order of 90-135 degrees.

Dark glasses will often be preferred over uncolored glasses by those blind users whose eye condition affects appearance. Low cost is important too, while options for stereo vision through a dual camera setup hidden inside sunglasses would be desirable as long as depth imaging sensors prove too costly, power consuming or inadequate under broad daylight conditions.

Fig.2: Dark glass

Existing solutions involve use of sunglasses that contain a tiny analog covert camera or surveillance camera with the inconvenience of a separate battery pack, USB video capture device, and extra (fragile) wires, but there do also exist possibilities for easy assembly of a convenient and affordable USB power supply for video sunglasses. Note that depending on your type of video sunglasses, you may need to change settings of your video capture device for PAL versus NTSC, and composite video versus S-video.

The legs of the glasses in the assembly shown on this page also contain tiny hidden microphones for giving speech commands. Depending on the choice of image sensor, the same wearable setup could also be used for night vision (with light amplification), infrared vision (e.g., thermal imaging using micro bolometer infrared imaging arrays, for easier detection of other people from their typically high temperature contrast), ultraviolet vision, UWB radar imaging, or other special uses, including sensor fusion.

Accelerometers may be added for easier or more accurate motion detection. For third-party vendors of various components for wearable and fully immersive use of The vOICe, see the third-party suppliers page.

BRAIN PORT VISION DEVICE:

The Brain Port device has been developed specifically for people with visual impairments.

The basic premise of this device is in creating tactile images on the tongue, and thus enabling the patient to 'feel' the images.

The input for this device comes from visual information gathered by a user-adjustable head-mounted camera. The processed information is sent to the Brain Port base unit, which converts it into electrical patterns projected on to the tongue. The resulting image is perceived as stimulation.

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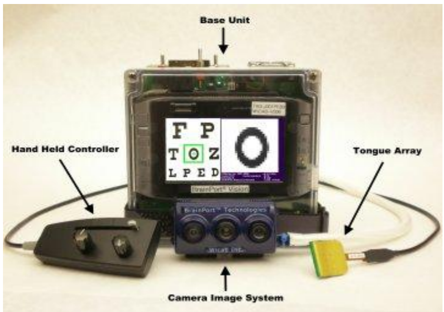

Fig.3: Wicab Brain Port

The Wicab Brain Port collects information gathered by a small digital camera Fig(3) mounted on a pair of glasses and then transmits it to a "lollipop" electrode array which the user attaches to their tongue.

The device's digital camera sends the light information to a base unit that has the size of a usual mobile phone. Afterwards the small base unit translates the light information into electrical impulses, thus substituting retina's function. Then the base unit transmits that information to a set of 400 microelectrodes that are positioned on the paddle placed on the user's tongue.

The lollipop contains a square grid of 600 electrodes which pulsate according to how much light is in that area of the picture. In other words, you're actually seeing the world around you with your mouth.

People using the gadget say that with several hours of training they can make out shapes and even read signs.

The device is currently awaiting FDA approval, but if all goes well, the Brain Port should be available by the end of the year at a cost of about $10,000.

HOW IT WORKS?

A small digital camera takes pictures of, say, a Stop sign, then turns that photographic information into raw digital pulses. These pulses are then sent, via that sunglasses-looking wire thing, to your tongue. Apparently the nerve endings on your tongue are such that your brain can interpret the pulses as images.

A mind's eye sort of thing. And while the technology won't mean that blind people will be able to read and it will permit them to "see" smaller things, like road signs and basic shapes.

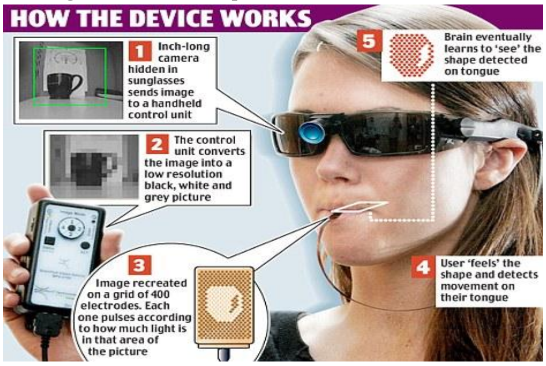

Fig.4:Working of Brain port device

Visual data are collected through a small digital video camera about 1.5 centimeters in diameter that sits in the center of a pair of sunglasses worn by the user. Bypassing the eyes, the data are transmitted to a handheld base unit, which is a little larger than a cell phone.

This unit houses such features as zoom control, light settings and shock intensity levels as well as a central processing unit (CPU), which converts the digital signal into electrical pulses—replacing the function of the retina.

From the CPU, the signals are sent to the tongue via a "lollipop," an electrode array about nine square centimeters that sits directly on the tongue.

Each electrode corresponds to a set of pixels. White pixels yield a strong electrical pulse, whereas black pixels translate into no signal. Densely packed nerves at the tongue surface receive the incoming electrical signals, which feel a little like Pop Rocks or champagne bubbles to the user.

Using BrainPort it's just like riding a bike Within 15 minutes of using BrainPort, blind people can begin interpreting spatial information via this amazing device, says William Seiple, research director at the nonprofit vision healthcare and research organization Lighthouse International. The electrodes spatially correlate with the pixels so that if the camera detects light fixtures in the middle of a dark hallway, electrical stimulations will occur along the center of the tongue.

The device, which consists of a miniature camera mounted on a pair of sunglasses, a tongue sensor and a small control unit, was developed by Wicab of Middleton. The science behind it is in the brain's remarkable ability to reprogram itself to accept and use different sensory signals if one is removed.

BrainPort is very useful gadget. BrainPort allows the blind see with their tongue. The BrainPort needs the user to wear a camera on the head and a lollipop-like electrode array in the mouth.

The camera captures images and sends it to BrainPort to decode the signals and then transformed into electrical pulses that will hit the tongue of the user. BrainPort Assists the Blind in to seeing with their Tongues. The BrainPort is a device which has a function of letting the blind see with their tongues

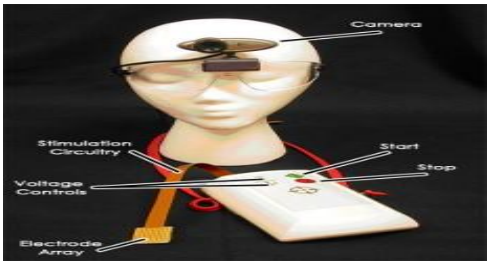

Fig.5:over all view of brain por

To work, the BrainPort uses a head-mounted camera to capture what's in front of the wearer. A device is then attached to the tongue that uses electrodes in an array. The images captured from the camera are turned in to electrical pulses and then sent to the electrodes in turn, giving the user some spatial awareness and even the ability to read some text.

TYPES OF BRAIN COMPUTER INTERFACE:

- Invasive Brain Computer Interfaces
- Partially Invasive Brain Computer Interfaces
- Non Invasive Brain Computer Interfaces

INVASIVE BRAIN COMPUTER INTERFACES

Invasive Brain Computer Interface Devices are those implanted directly into the brain and has the highest quality signals. These devices are used to provide functionality to paralyzed people. Invasive BCIs can also be used to restore vision by connecting the brain with external cameras and to restore the use of limbs by using brain controlled robotic arms and legs.

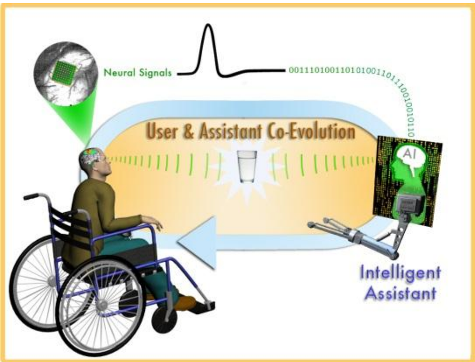

Fig.6: Invasive Brain Computer Interfaces

The problem with this type of device though, is that scar tissue forms over the device as a reaction to the foreign matter. This reduces its efficiency and increases the risk to the patient.

PARTIALLY INVASIVE BRAIN COMPUTER INTERFACES:

Partially Invasive BCIs, on the other hand, are implanted inside the skull but outside the brain. Although signal strength using this type of BCI device is a bit weaker, partially invasive BCIs has less risk of scar tissue formation.

NON INVASIVE BRAIN COMPUTER INTERFACES :

Non invasive brain computer interface, although it has the least signal clarity when it comes to communicating with the brain (skull distorts signal), is also the safest. This type of device has been found to be successful in giving a patient the ability to move muscle implants and restore partial movement. One of the most popular devices under this category is the EEG or electroencephalography capable of providing a fine temporal resolution. It is easy to use, relatively cheap and portable.

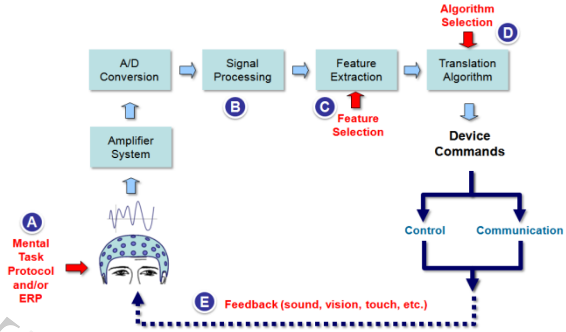

Fig.7: Non Invasive Brain Computer Interfaces

ADVANTAGES:

The tongue is considered a portal to the brain and it can be used to provide a good tactile environment for people with severe disabilities, including the blind. Tongue-based technology tools are also easy to manage. Additionally, such systems are almost invisible to other people.

"We can imagine a camera installed in the eye, which transmits an image from a device worn on the belt. This would send an electrical stimulus to the lingual stimulator mounted on a trip indicator the user wears under the palate. To have access to the camera's images, all he would have to do is press his tongue against it."

In the shorter term, we can imagine a system that would replace the Braille alphabet. In fact, if the tongue were capable of "reading" the letters of the alphabet, it would be able to read texts broadcast via electrical signals. When it has been perfected, this system could considerably improve the quality of life of blind persons. It would be a "hands-off" non-invasive system. .

APPLICATIONS

One of the applications which have been commercialized is providing vestibular or balance information for people with balance disorders. This is a simple form of sensory substitution, in which the tongue is used to present information from an artificial balance sensor.

Another application is providing directional or navigational information for people who operate under central command and control scenarios, such as military and civilian rescue personnel. Providing information via the tongue allows them to fully use their vision and hearing to respond to unforeseen threats or hazards. We have shown in the laboratory that it is possible to navigate a virtual maze (like a simple video game) using only information received on the tongue (i.e., buzz on right side of tongue means turn right, etc.). A third, more ambitious application would be providing very crude visual information through the tongue for persons who are completely blind.

A fourth application would be providing tactile feedback to the human operators of robots used various tasks. For example, UW professor Nicola Ferrier is developing a robot controlled by the tongue of persons with quadriplegia which could incorporate touch sensors into its gripper, relaying the touch information back to the user's tongue.

CONCLUSION:

Brain port's future applications is the enhancement of human capabilities and mind control (brain pacemakers are now successful in treating depression). Nonetheless, this technology has not yet attained its full maturity and is therefore still relatively below the social radar.

As of today, this technology is seen more to help much in fighting against disability through prosthetics and as a treatment for neurological ailments such as depression.

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