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Wireless Based Visual Prosthesis System Using Artificial Silicon Retina

Arjunan.K¹, Karthik.D², Kavitha.S³, M.Manojprabu⁴

^{1,2,3}-UG Students, ⁴-Assistant Professor, Department of Electronics and Communication Engineering
Angel college of Engineering and Technology

Abstract— According to a recent survey done on the number of visually impaired people in the world, it is found that about 285 million people in the world are blind of which 246 million have low vision and 39 million people in the world are completely blind due to the diseases such as macular degeneration, retinitis pigmentosa and glaucoma. Medical treatments are available to slow down the process of these diseases but there is no complete cure for regaining the lost vision. This paper is about visual prosthesis system where the blind is enabled to see the world virtually.

Keywords— Artificial silicon retina, micro electrodes, visual cortex, montage diagram, wireless transceiver, focus lens.

I. INTRODUCTION

This system comprises of a digital camera lens focused to an ASR, where the electrical impulses of the image is directly fed to the visual cortex of the brain using several micro sized electrodes. The brain slowly interprets these signals into vision. Thus, this system is a hope for many of the visually impaired people around the world with multi sensory defects also.

II. LITERATURE SURVEY

A. Existing system

This system uses IR and Ultrasonic sensor for detecting an obstacle before it. Then output of the sensors will be processed and based on the sensor output, an instruction already fed in the microprocessor will be heard in the microphone as the system output.

B. Limitations in Existing System

This system uses ultrasonic and IR sensor for detecting only the distance of the object before it. It can't be used to predict the object's physical characteristics, so it can be used only for indoor applications. And also it can't be used for the deaf people.

III. PROPOSED SYSTEM

Our proposed system enables the visually impaired people to see the world virtually without the help of their eyes. To implement this system a small microsurgery needs to be performed inside the patient's skull exactly on the visual cortex in order to impound receiver and micro sized electrodes over the visual cortex. The person is given a pair of coolers embedded with digital camera lens to wear. This lens will focus the images to the Artificial Silicon Retina(ASR). The ASR converts each pixel of the image into equivalent electrical signals. These electrical signals are given to the visual cortex using the micro sized electrodes through a wireless transceiver. The brain slowly learns to interpret these electrical signals as sight. Thus, the person can able to see.

A. Focus lens

A high-resolution focus lens is required for this system. The optical energy from the image is focused to the ASR.

B. ASR

ASR is a very tiny integrated device with a diameter of 2 mm which is thinner than human hair. It has large number of solar cells (photodiodes) integrated in them. These photodiodes are used to convert the optical energy of each pixel from the images into electrical signals for a particular electrode. The ASR does not require any kind of external power to perform its operation. It attains power from the light falling on over them. In human eye we have cones and rods for converting the light into electrical signal. The ASR can do this process as like the human eye system.

C. Wireless transmitter and receiver

The above process will be done in the outer side of the skull which is a transmitter section. The receiver section consist of an

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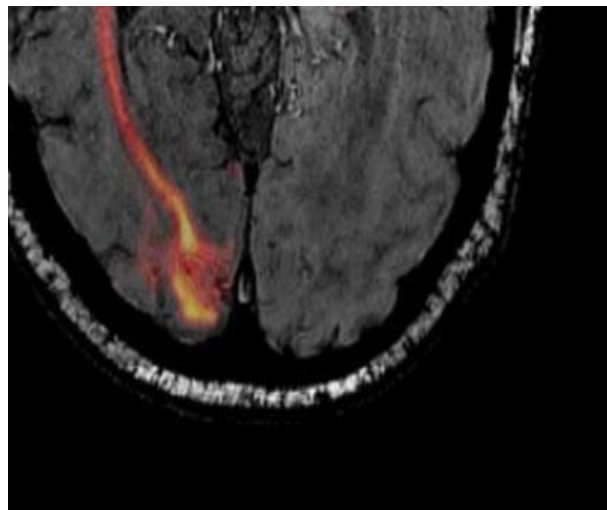
microprocessor which receives the electrical impulse from the ASR and fed it to the corresponding micro electrodes. The connection will be done using Wireless-Fidelity(WIFI) technique. The transmitter is charged outside the skull so it can be charged externally but the receiver will be inside the skull so it will be implanted with an lithium battery and a wireless coil charging technique to recharge it. When the charge of the receiver is down it can be recharged using this technique easily without any pain and harmfulness.

D. Micro electrodes

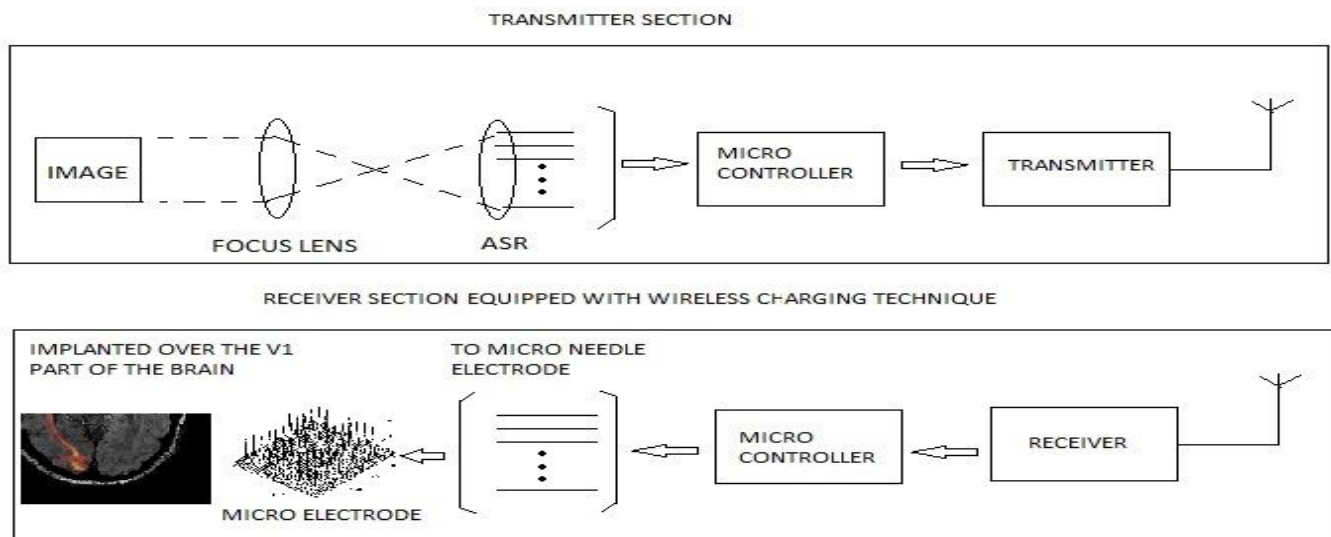
Micro Electrodes are very tiny bio electrodes basically used for receiving a very accurate signals. In this system we use this micro electrodes to give the signals directly into the visual cortex. These electrodes are places exactly over the neurons of the visual cortex.

E. Implantation

A microsurgery needs to be done in the patient's skull exactly on the visual cortex in order to impound the micro sized electrodes. The electrodes need to be punched through the pia mater of the brain at a particular speed using finely equipped instruments. A high resolution MRI scanning or a stereotactic imaging can be used to locate the exact position of V1.

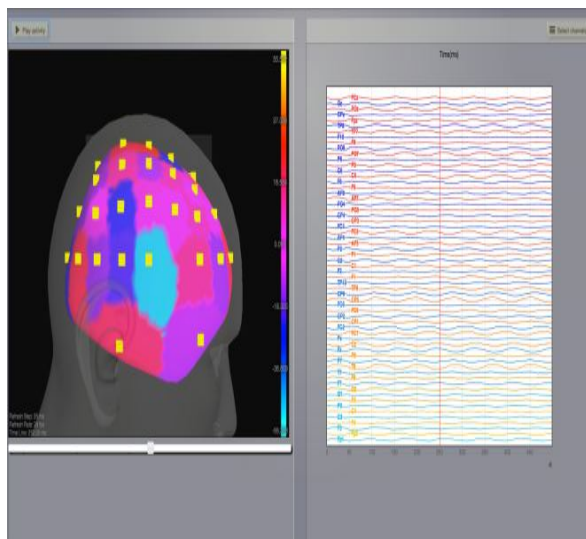


F. System architecture

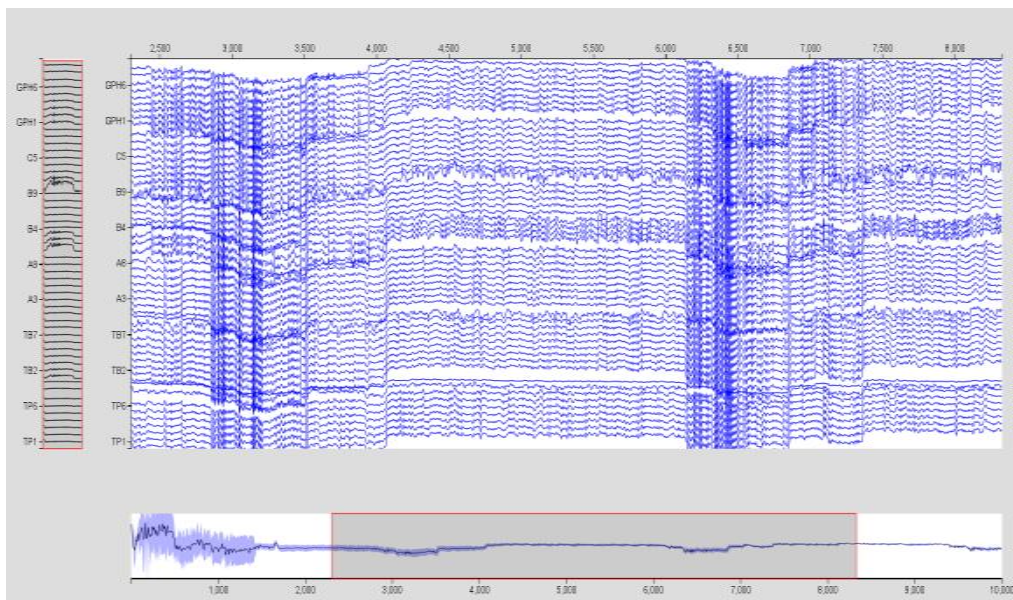
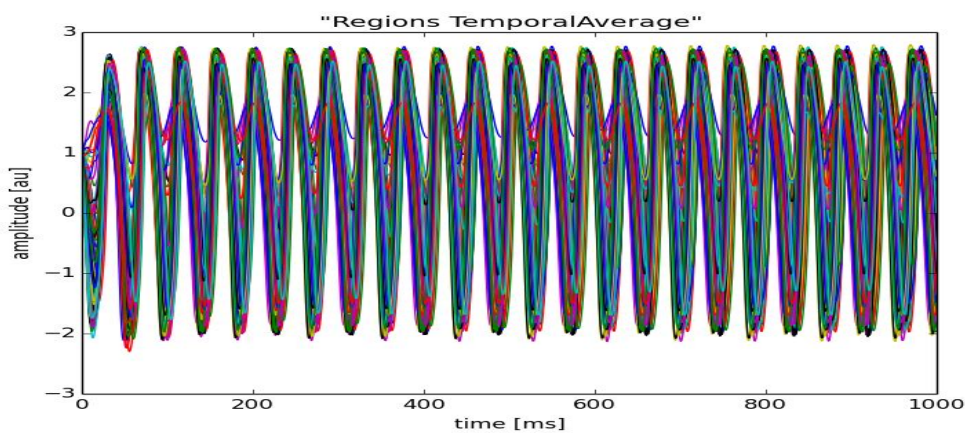


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IV.MONTAGE DIAGRAM



V. SIMULATION OUTPUT



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VI. CONCLUSIONS

From this paper the resultant output brings the hope for the people with complete blindness and deaf cum blindness to see the world. Because of the microelectrodes the visibility of the object will be more clear than the previous systems. Because of the wireless technique used, this system is more compact and painless method to obtain the vision. Though it requires high cost for implanting, the vision of the blind people can be completely achieved.

VII. ACKNOWLEDGMENT

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