# Overview on the Bionic Eye

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*Abstract*— The artificial electronic eye is a bionic eye. The bionic eye provide vision to the visually challenged people by using the modern day electronic devices such as CCD camera and bionic eye implant. The implant consist a small chip which is implanted surgically behind the retina in the eye ball. The bionic eye consist two methods i.e. multiple unit artificial retina chip (MARC) and artificial silicon retina (ASR). This paper tries to give a new approach of bionic eye using nanogenerator. The nanogenerator is used to provide compactness, better power and high efficiency to the bionic eye as compared to the external batteries.

***Key words:*** bionic eye; artificial eye; nanogenerator; electronic eye; retina damage; blindness

## I. INTRODUCTION

In the area of scientific research biotechnology is the fastest growing area, with design of new devices. The company, second sight create a retinal implant which gives some limited degree of vision to the blind people. It provide vision to the people which are suffering from degenerative diseases like macular degeneration and retinitis pigmentosa. The functionality of whole eye is replaced by bionic eye. An external camera placed on dark glasses send the digital images to the radio receiver that attached to the implant chip on the retina. There are two types of implant, epiretinal implant and subretinal implant. In bionic eye of proposed method, small and powerful camera is powered by nanogenerator which is implanted inside the patient's eye rather than placed on a pair of glasses. It has been show that electric stimulation of neurons can produce perception of light in patient who suffering from retinal degeneration. Using electronic stimulation of retinal neurons property the eye creates use of the functional cells to retain the vision with the help of electronic devices. In these way the lakhs of people get back their vision partially at least. It is complex combination of multiple electronic devices which work together for the vision restoration of the objects.

## II. BIONIC EYE AND IT'S WORKING

Bionic eye produce visual sensations in the brain by directly stimulating different parts of the optic nerve. It consists of image sensor, processors, receivers, radio transmitters and retinal chips. The computer chip inside the eye is linked up by mini camera built into glasses. The camera captured the images that are beamed to the chip, which translate them into impulses that interpret by brain. By passing the electrical signal to the ganglion cells, a visually challenged person can be made to see light. Hence, scientists create a device that translate images and electrical pulses that restore vision.

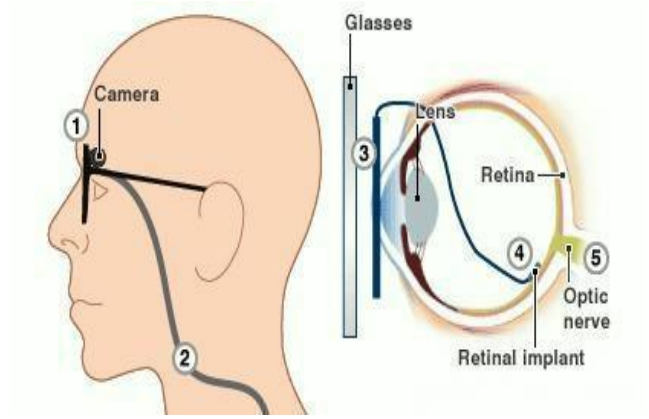


Fig. 1: Bionic eye system

## III. ARTIFICIAL SILICON RETINA

A solid state biocompatible chip is known as artificial silicon retina (ASR) which contains an array of photoreceptors, and implanted to replace the defective photoreceptor. It is 2 mm in diameter and 0.001 inch in thickness. It contains 3500 micro photodiodes, each having its own stimulating electrode. These photodiodes are designed to convert the light energy from images into thousands of small electrical impulses to stimulate the remaining functional cells of retina. The current generated by the device stimulate the neurons and activate the visual system. ASR does not require the use of external wires and batteries. The location of ASR is known as a sub-retinal space which is implanted under retina. The ASR produce visual signals which may be processed and sent via the optic nerve to the brain.

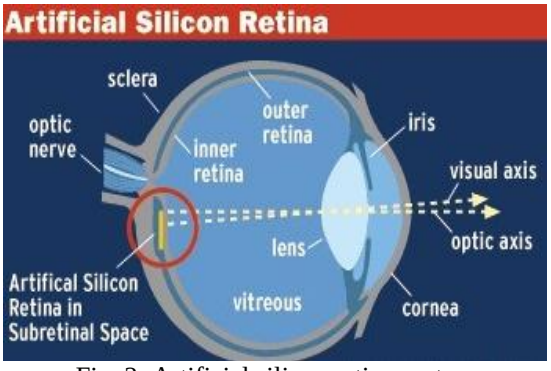


Fig. 2: Artificial silicon retina system

## IV. MULTIPLE UNIT ARTIFICIAL RETINA CHIP SYSTEM

It consists of an external camera that send the images to the receiving coil in the form of electric signals. The receiving coil is mounted in closed to the cornea. The components of MARC system are a power and signal transceiver and processing chip, stimulation current driver. Silicon biocompatibility is being studied, and its thin, light weight

 

used as an electrode array. The resolution of 100 pixel is achieved in MARC system by using 10x10 array.

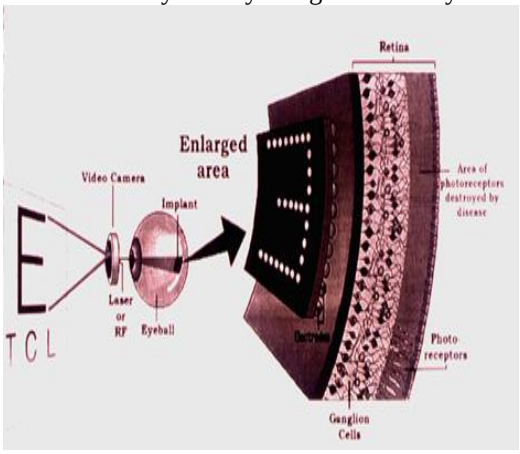


Fig. 3: Image formation with MARC system

## V. Literature Review

Many devices have been developed in the recent years, currently two different bionic eye's, one from united-states and other from Australia. The company called 'second sight' from united-states make a device known as argus-II. The argus-II is the second generation of an electronic retinal implant which designed for people who is suffering from retinitis pigmentosa. The first generation of implant contained 16 electrodes laid out in array in 2002. In 2007, the next generation argus-II contained 60 electrodes, which further help in providing high resolution images. Apart from argus-II there are number of devices which are in development and would be made available in near future. One such device is the prototype device created by the bionic vision Australia. An Australian team is developing two retinal prostheses which is led by professor Anthony Burkitt. It contains microchip with 98 stimulating electrodes and aim to provide increased mobility for patient to help them move safely in their environment. It currently develops the high-acuity device which incorporates a number of new technologies to bring together a microchip and an implant with 1024 electrodes. It's aim to provide ability of face recognition and reading large print. In future there is a new approach in development of bionic eye, the proposed method, in which the external batteries replace with nanogenerator placed on blood vessels. Nanogenerator is devices which are made up of zinc oxide nano wires. These wires are bent and released produce electric charges. We can produce enough power supply for small scale device using millions of such nano wires. In proposed method, the nanogenerator is used to produce the sufficient potential to run the video camera and the printed circuit board transmitter. The camera captures images and converts it into digital image signal and compresses it. The digital image signal transmitted via the transmitter to the retinal implant on the retina. The optical nerve of the brain is connected to the retinal implant. The brain form an image with electrical signals comes from the retinal implant.

## VI. Advantages and Disadvantages

- The system becomes efficient and more compact.
- The patient does not have to carry external battery for life-time.
- There will be no need of external wiring on human body.
- The cost is high.
- It is not work for the people who are blind as children because the visual cortex of children does not developed.
- It does not have crystal clear vision and does not work as the real eye.

## VII. Conclusion

The peoples who are blind, the restoration of sight are no more dreamed today. The bionic eye has faced number of challenges before this technology reach to the common man. This paper has tried to present the concept of bionic eye. The bionic eye is under in studied and worked upon to do more than replacement of the damage parts.

## VIII. Future Scope

The bionic eye is still under research. The major challenge for researchers is to providing power to run the bionic eye implant and high resolution of images. The upcoming development in the field of nanotechnology, the future of power supply for small scale devices are the nanogenerators.

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