BIONIC EYE

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ABSTRACT: A bionic eye, an electrical prosthetic that is surgically installed in patients who are partially or completely blind and have a terminal condition. To advance visual prostheses, several human trials of the bionic eye have been completed. Light rays are transmitted and received by the retina, which is a crucial component of the eye. The bionic eye, which consists of a video camera formed of a pair of spectacles and translates the visuals into electrical impulses, is implanted in the retina of the eye. These impulses cause the retinal cells to become active, which causes the optic nerve to transmit visual data to the brain. The brain converts the transmitted data into an image. The research's most encouraging finding is the introduction of the Argus || retinal prosthesis system, which boosts light sensitivity and develops vision by generating light or dark patterns or spots. The patient has to develop the ability to recognise these signals as objects and shapes. In this study, we've discussed how the bionic eye functions as well as the methods, constraints, and improvements that can be done to help the blind and visually impaired. So, it can be claimed that everyone should be able to experience the joy of life. Visionless eyes can now have life added to them thanks to technology.

INTRODUCTION:

According to the World Health Organization (WHO), there are at least 2.2 billion people who suffer from vision impairment (blindness).Effective treatment can stop nearly half of visually impaired people in their tracks. Refractive error, glaucoma, age-related macular degeneration, cataracts, optic neuritis, retinitis pigmentosa, and other conditions are the leading causes of blindness. These conditions can result in vision loss or blindness in various different ways. Retinitis pigmentosa harms light-sensitive rods and cones, impairing side vision and restricting a person's vision to straight ahead. The macula, or core region of the retina, is where macular degeneration first manifests itself. The macula gathers and transmits data or images from the surroundings to the brain's optic nerve. The visuals are not clear because of macula degradation. Because of macula degeneration, pictures are not correctly processed, resulting in impaired vision that eventually leads to permanent loss of central vision. The creation of the bionic eye is the result of years of labor by scientists and ophthalmologists to find a cure for the aforementioned issues. Ophthalmologists invented the bionic eye, also known as a visual prosthesis or a bio electronic eye , to treat disorders that lead to blindness. It is a pair of spectacles with a video camera attached to an electronic implant that needs to be surgically placed within the eye. Other parts of it include a video processor chip, a radio transmitter, a radio receiver, etc. The video camera transforms environmental images into electrical impulses that stimulate the retinal cells. Through the optic nerve, these cells transmit visual data to the brain, which converts it into an image. The chip that is inserted beneath the patient's retina imitates how rods and cones work in the eye. The Artificial Silicon Retina (ASR), a very small chip with a diameter of 2 mm, gets its name from the fact that silicon constitutes the majority of its composition. The light is detected by ASR, which converts it into electrical impulses. Even though the prosthetic eye can't completely duplicate the eye's functionality, a person can nevertheless read long sentences and conduct other daily tasks with it.

HUMAN EYE:

One of the human body's specialized organs, the eye, is able to receive visual signals conveyed to the brain. The translucent portion of the eye that protects the iris and pupil is called the cornea. And that makes it possible for light to focus in the eye. The pupil and lens then receive the light. The

cornea and a lens work together to help the light focus on the retina . The most crucial component of the eye, the retina, communicates with the brain via the optic nerve. Rod and cone photoreceptor cells make up the retina. Cones and rods, correspondingly, give vision in high and low light. After receiving visual information . These cells take in visual information and send it to the retina's ganglion cells, which number almost a million. The information from the rods and cones is interpreted by ganglion cells before being sent to the brain. The information is seen by the brain as dark or light dots in the form of an image.

BIONIC EYE:

The bionic eye was created by ophthalmologist Merk Humayun with the aid of engineering and medical science. Retinal implants or bio-electronic eyes, which duplicate and carry out some or all of the tasks of the human eye, are other names for the bionic eye. Retinitis pigmentosa is a term used to describe all inherited serious vision problems. The best candidates for bionic eyes are people who have inherited eye problems. Despite losing the cells that are responsible for producing vision, individuals still have nerve tissue that can be used to produce visual signals. The bionic eye will last for over ten years, but most patients will require a replacement in four to five years due to soft tissue settling in the eye socket. As of the current market, the bionic eye will cost roughly $150,000.

COMPONENTS OF AN BIONIC EYE:

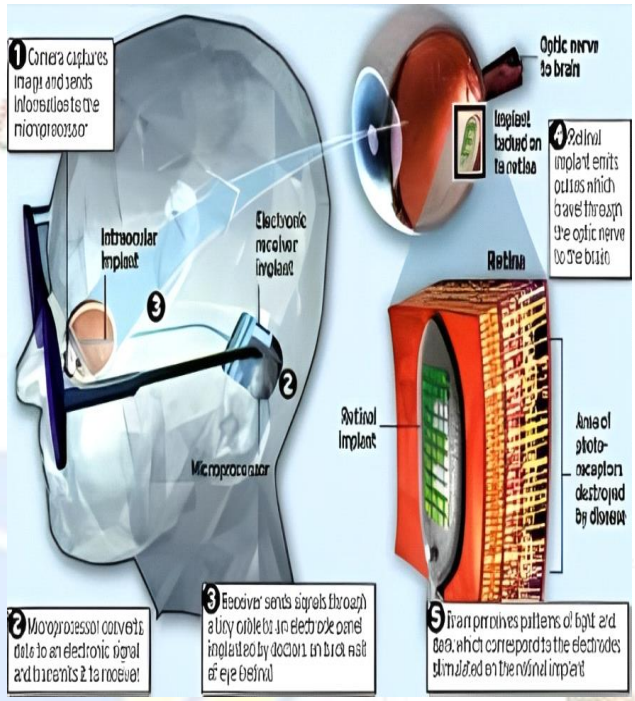
It looks like an externally worn camera and consists of exterior and interior components.
Exterior components are placed on the human body whereas interior components are implanted by means of surgery.

The **Exterior Components** Consists of:

- **Video camera**
- **Sunglasses**
- **Connection Wires.**

The **Interior Components** Consists of:

- **Video processing microchip**
- **Radio Transmitter**
- **Radio Receiver.**



Utilising the aforementioned internal and external parts , the bionic eye functions.

The video processing microchip in the retina that is surgically installed receives high-frequency radio signals from the video camera and sunglasses. The electrodes in the chip used to process video. Create electrical impulses from the signals to cause the retina's active cells to link to the optic nerve.

ADVANTAGES OF BIONIC EYE:

- Reduction of stress in the retina.
- No batteries implanted in the human body.
- Doesn't need to go under complicated surgeries.
- Implantation will be easy.
- Protects the retina from the heat.

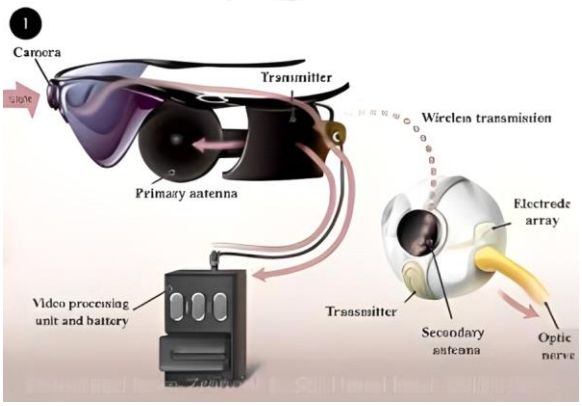
LIMITATIONS OF BIONIC EYE:

- Expensive/more cost.
- It doesn't cure vision upto 100%.Expensive/more cost.
- Surgery is required to implant electrode
- A small damage can lead to a failure
- High standard of maintenance required.

ARGUS || RETINAL PROTHESIS SYSTEM:

The creator of the Argus Retinal Prosthesis System is Dr. Mark Humayun. A three-part gadget called the Argus II Retinal Prosthesis System enables people who have lost their eyesight due to retinitis pigmentosa to perceive some light and motion. There is no specific treatment for people with retinitis pigmentosa. However, wearing UV sunglasses to protect your eyes' retina may help delay the start of symptoms. The Argus II System works by transforming video pictures into electrical energy, which activates retinal cells and transmits the signal to the brain via the optic nerve, where it is interpreted as light. In this case, the patient's retina is surgically implanted with a small electrical device. While we employ Argus to repair the damaged retina, a retinal prosthesis (artificial retina) has been developed for people with really advanced disease and significant visual loss.

ADVANTAGE OF THE ARGUS || RETINAL PROSTHESIS SYSTEM:



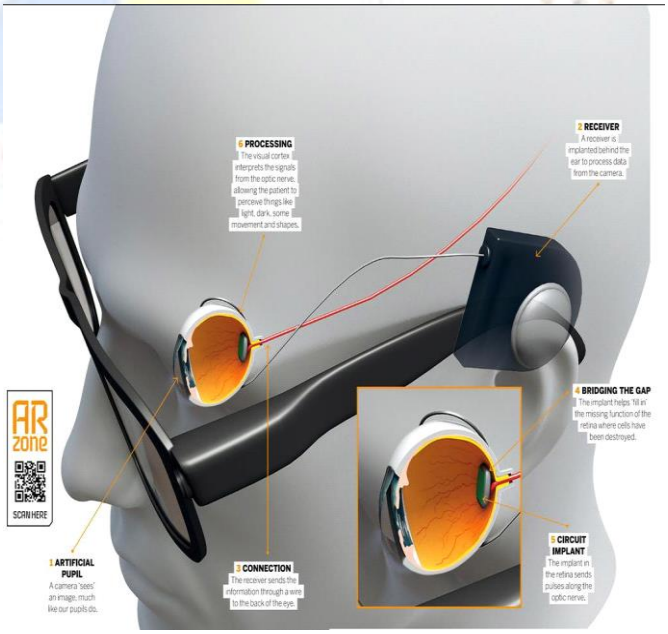
By enhancing these patients' vision, you can higher self-esteem enhanced standard of living reduced reliance on others This is currently the only commercially available prosthetic for people who have little to no vision.

MODIFICATION:

The most advanced bionic eye currently being evaluated is the Argus retinal prosthesis system. While it can't be expected to provide solutions for all vision-related issues, it does so in specific situations.

The stimulator microchip is an electrode array implanted surgically into the retina. That acts as an electrical relay in place of the retinal cells deteriorating. The stimulator picks up the radio waves from the external camera and transmitter and responds by ejecting electrical impulses.

The stimulator microchip set in the bionic eye can be replaced with the AI chip set. Field-Programmable Gate Arrays (FPGAs), Graphics Processing Units (GPUs), and highly specialised Application-Specific Integrated Circuits (ASICs) for AI functions make up the majority of it. Field-programmable gate arrays can be used to interpret the image, convert it to audio, and send it to the patient's headphones so they can better understand what is in front of them.



CONCLUSION:

The bionic eye is evolving at a rapid pace. The bionic eye is a technological advancement that allows blind or visionless persons to move safely and read huge characters. Bionics advancements are improving people's lives all around the world, thanks to researchers all over the world. Bionic eyes, as of now, cannot generate natural pictures; they can only assist those who are blind. Argus II now has just 16 electrodes, however this number may be expanded to 1000. By increasing the number of electrodes, the individual utilising the bionic eye will be able to discern facial expressions and coloured pictures clearly in the future. The success of this study will benefit millions of individuals. Despite the fact that it cannot offer regular eyesight .

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