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ARDUINO UNO BASED ARTIFICIAL VISION

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ABSTRACT:

Wounds or hereditary imperfections may cause visual deficiency at any phase of life and this is extremely grievous. This paper takes a gander at a skilled method to defeat this unfriendly glitch in people and visionise the visually impaired. Since vision relies for the most part upon sensory system, it would mean attempting to recuperate or change the sensory system. It is smarter to state - "we see with our cerebrums than with our eyes". The sole rule used to visionise a visually impaired is – "Beguiling OUR BRAINS" utilizing installed frameworks and mems innovation. Phenomenal advancements happen when two parts of science combine and right now and designing sciences meet up with such strategies to avoid visual impairment. The qualification part of this paper centers around these strategies, a) Microchips. b) Nano tube embed. c) Digital fake vision. d) Ocular prosthetics. e) Braille type essayist. Insurgency in scaling down, nanotechnology, picture preparing and so forth has cleared route for vision. Visual impairment at any stage can be turned away. Flexibility of people made implantations adaptable utilizing inserted and mems system .

INTRODUCTION

Genetic defects or injury may cause blindness at any time during the life of a person. The visually impaired are the most unfortunate people bearing darkness throughout their life. A blind mans quench for vision has made destinated science to tour its journey. Since vision depends mainly on nervous system, it would mean trying to heal or change the nervous system. It would be better to tell -"we see with our brains than with our eyes". The sole principle used to visionise a blind is **–"DECEIVING OUR BRAINS".**

Evolution in miniaturization, nanotechnology, image processing etc has paved way for vision. Blindness at any stage can be averted. Adaptability of humans made implantations flexible. The credential part of this paper focuses on five different methods available as on now for the noble cause of vision.

a) Microchips.
b) Nano tube implant.
c) Digital artificial vision.
d) Ocular prosthetics.
e) Braille type writer.

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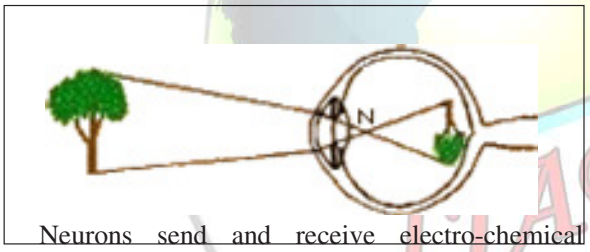
Our advancements have surpassed human brains in accuracy. The novel idea is "With these method the brain should not feel the difference whether the signal came from a natural, healthy or from our implant retina." A key note on future scope is also discussed in this paper.

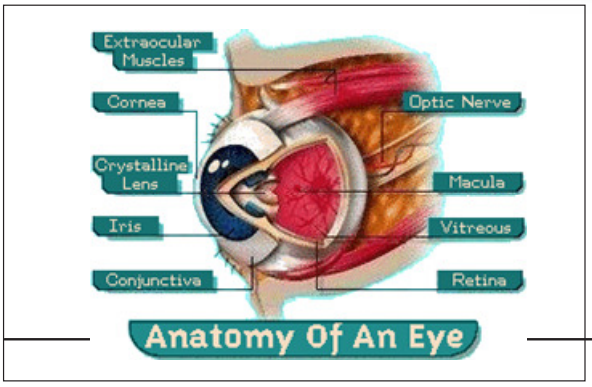
Striving to eliminate the word **"BLIND"** from our vocabulary.

Human Visual System

Prosthetics are artificial substitutions to the organs of the body which are disabled. Neurons of the human visual system exhibit electrical properties. Cornea (dome), pupil (center of iris), crystalline lens (inverted), vitreous retina (into electrical pulses), optic nerves and occipital lobe constitute basic parts of eye.



Neurons send and receive electro-chemical signals to and from the brain up to 200mph.The chemicals like sodium and potassium cause an electrical signal in the neurons. When a neuron is not sending a signal, it is "at rest", then the inside of the neuron is negative with respect to outside. The resting membrane of the neuron is about -70mv. When the depolarization reaches about -55mv the neuron then fire an action potential (signal). This is the threshold level. When the action potential is fired we start to visualize.



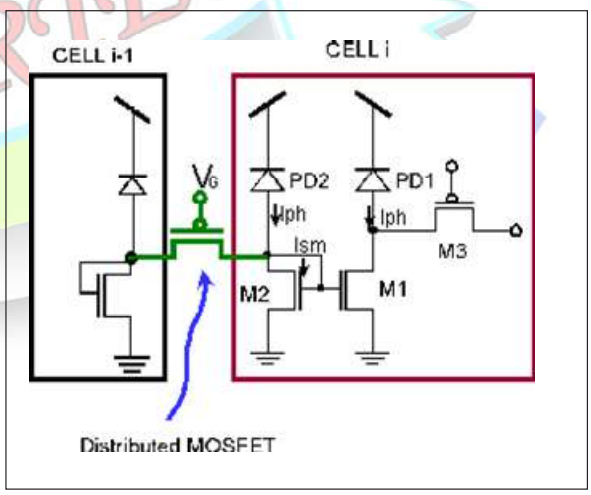
Retinal "Transducer"

An equivalent circuit of a retina is realized using

- A distributed MOSFET
- Three MOSFETs
- Two Photo Diodes
- Two Current Mirrors

The functions of Photoreceptors, Bipolar Cells and Horizontal cells are implemented by this circuit.

1) Digital Artificial Vision: When a person is born blind, inwardly his optic nerve would not function properly. We cannot use any retinal stimulation methods.



The artificial vision system consists of a miniature camera mounted on eyeglasses and ultrasonic range finder, 1 frame grabber, 1 microcomputer, 1 stimulus generation module, 2

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DESCRIPTION OF DIFFERENT PARTS OF AVS

Microcomputer

This microcomputer consists of two parts

a) Sub-notebook computer

- The new sub-notebook computer employs a 233 MHz processor, 32 MB of RAM, 4 GB hard disk, LCD screen and keyboard.
- Interfaces with camera.
- Important areas of computing are Magnification in software (C, C++).

b) Arduino uno microcontroller

- Simulation delivered to each electrode typically consists of a train of six pulses delivered at 30 Hz to produce each frame of the image at a speed of 8 frames per second.

IMAGE PROCESSIG (EDGE DETECTION)

- Edge detection through SOBEL filters is the most common approach
- The gradient vectors of SOBEL filter are Gx and Gy.
- The masks used to implement these two equations are called Sobel operators

Gx=(Z3 + 2Z8 + Z9) - (Z1 + 2Z2 + Z3) Gy=(

Z3 + 2Z6 + Z9) - (Z1 + 2Z4 + Z7)

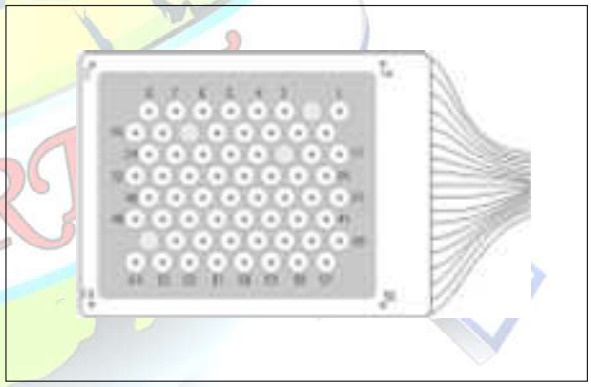
0	1	2
-1	0	1
2	-1	0

ARDUINO

- Controls the simulating electrodes
- Simulation delivered to each electrode typically consists of a train of six pulses delivered at 30 Hz to produce each frame of the image at a speed of 8 frames per second

Electrode Implantation

- Electrode implantation is one of the most critical job in this artificial vision system.
- The first step done in this electrode implantation is perforating a platinum foil ground plant with a hexagonal array of 5 mm diameter holes on 3 mm centers on the skull at the right occipitallobe.



2	-1	0
-1	0	1
0	1	2

- [9] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique.

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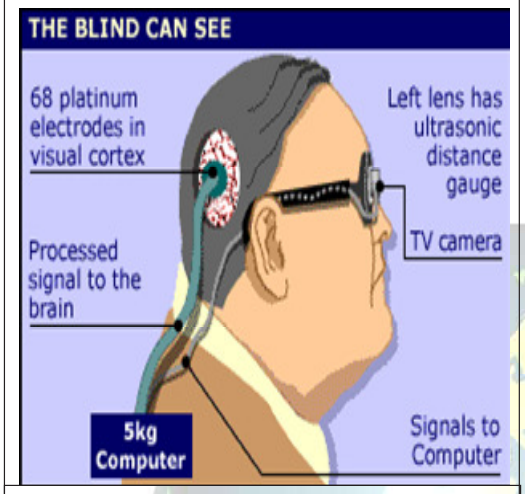
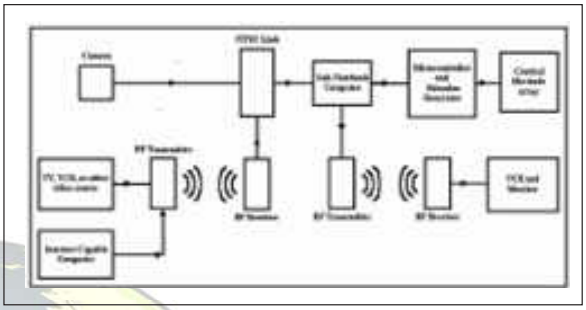
BLOCK DIAGRAM

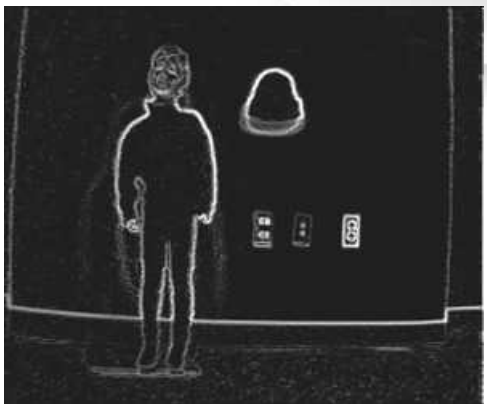
The original image seen by the camera and phosphene image seen by the visual field in the brain of the blind human are as shown.





2) Braille Type Writer

- Used majorly for deaf –blind, whose only mode of communication remains as sense of touch.



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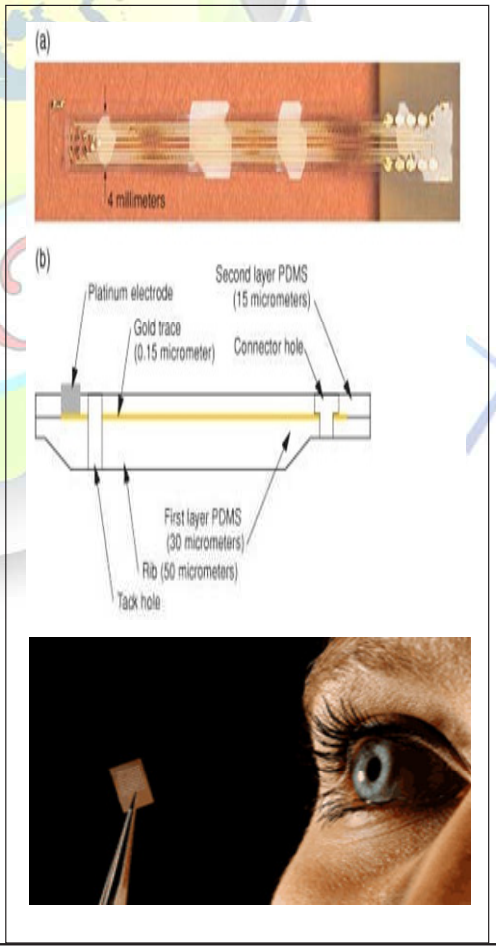
3) Nanotubes and Nanobatteries

Nano Vision Chip System

- Age related retinal diseases like macular dysfunction, retinitis pigmentosa can be averted using nano tubes.
- Normally, when light rays or images are focused by the lens of the eye onto the retina, light-sensitive cells called "rods" and "cones" convert the light into electrical impulses that travel to the brain and are interpreted as images of the world around us. "[The retina] actually does some of the image processing, and then sends this information to the brain, and so we see.
- The Nano Vision Chip System consists of

1. A low Power CMOS camera mounted on a spectacle.
2. A Image processing device
3. Transmission device
4. Signal conditioner
5. Electrode array



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Extra Ocular (Outside the *Eye)*

The Images are received by the CMOS camera

The microprocessor based image processor processes the images thus received. The processing may be either digital image processing or neural based image processing.

The signal so obtained is PWM encoded and modulated using ASKS.

4) MEMS

(MEMS-) based adaptive optics phoropter.

At the point when light enters the eye, almost 127 million poles and cones, which are the photoreceptors in the retina, start a progression of electrical signals so fast that the pictures the eye gets give off an impression of being consistently refreshed in a consistent procedure. A breakdown right now procedure can prompt vision impedance or loss of sight. Another optical gadget, called the Micro Electro Mechanical Systems–(MEMS-) based versatile optics phoropter (MAOP), will significantly improve this procedure. It permits clinicians to coordinate a PC determined estimation of visual perception with a patient's reaction to the objective picture. Patients can quickly perceive how items will look—and the clinician can alter the remedy—before they are fitted for contacts or experience medical procedure.As a result, patients will experience better vision correction outcomes, especially with custom contact lenses or laser refractive surgery. A microelectrode cluster created for a retinal prosthesis gadget. The terminals are inserted in silicone-based substrate polydimethylsiloxane (PDMS). PDMS is a promising material for the microelectrode exhibit, giving adaptability, strength, and biocompatibility for long haul implantation.

The cluster will fill in as the interface between an electronic imaging framework and the eye, giving electrical incitement typically created by the photoreceptors that convert visual signs to electrical signs transmitted to the optic nerves. The terminal cluster is inserted in a silicone-based substrate, polydimethyl-siloxane (PDMS).

a) A prototype of polydimethylsiloxane (PDMS) array used in testing. (b) Cross-section of an eight-electrode PDMS device shows conductive lead and electrode metallization contained

between two layers of PDMS. Reinforcement ribs facilitate handling of the thin PDMS device. A tack hole is used to pin the device to the retina.

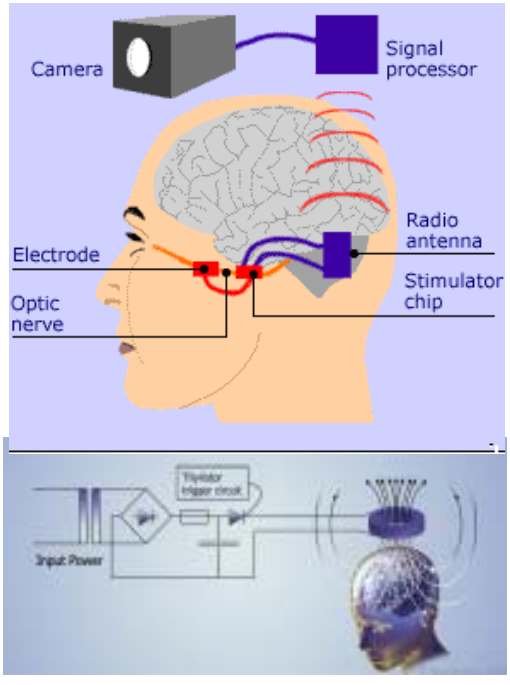
The device is designed to be epiretinal; that is, it will be placed on the surface of the retina inside the eye. The implant will overlap the center of the eye's visual field, which is the area affected in macular degeneration. [4] discussed that Biomedical and anatomical data are made simple to acquire because of progress accomplished in computerizing picture division. More research and work on it has improved more viability to the extent the subject is concerned. A few tech- niques are utilized for therapeutic picture division, for example, Clustering strategies, Thresholding technique, Classifier, Region Growing, Deformable Model, Markov Random Model and so forth.

camera attached to eyeglasses will capture a video signal that will be processed and transmitted inside the eye using a radio-frequency (rf) link. The rf link is composed of an external rf coil that will either be part of the eyeglass apparatus or will rest on the eyeball like a contact lens. Another rf coil inside the eye will pick up the signal and transmit it to electronics that will format the signal for stimulating the electrode array. The power for the circuitry, or microchip system, will be provided inductively through transcutaneous coupling. That is, a coil attached to a battery on the side of the eyeglasses will inductively generate power in a coil parallel to it under the skin

"They won't be able to drive cars, at least in the near future, because instead of millions of pixels, they'll see approximately a thousand."

FUTURE APPLICATIONS

1. As now, only black and white images are seen by this AVS system, research is being carried to visualize colored images by using optical fiber technology.
2. Research is being carried to replace the electrode implantation with ray or wave devices
3. Reduction of electrodes to 4, by operating into optic nerve directly. It involves usage of stimulator chip, radio antenna and signal processor.
4. Electrical signaling, osmotic pumping, and molecular detection.
5. In the future the whole setup (excluding the camera) in NVCS can be nano fabricated on single chip thereby making it more feasible and sophisticated.



CONCLUSION

- This invention is not only the fruit of one branch of science; it involves the participation of different branches of science.
- This concludes every professional relating to a branch of science should have a interesting view towards other branches of science also.
- "Wishing a remarkable progress in the development of this artificial vision system, such that each and every blind person today, is never a blind tommorow."
- Striving to eliminate the word **"BLIND"** from our vocabulary. "A thousand points of light' no longer a metaphor".

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