# A STUDY ON CUSTOMER AWARNESS TOWARDS BIONIC EYES

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**ABSTRACT**

*Bio technology has become the fastest-growing area of scientific research, with inventions of new devices. Technology has done wonders which help the mankind. Prosthetics use to help overcome handicaps. A training system called brain port is letting people with visual and balance disorders bypass their damaged sensory organs and instead send information to their brain through the tongue. Now, a company called second sight has received FDA approval to begin us. Trials of retinal implant system that gives blind people a degree of vision. A visual prosthesis, often referred to as a bionic eye, is an experimental visual device intended to restore functional vision in those suffering from partial or total blindness. A world renowned Portuguese doctor implanted a bionic eye in a person born blind. Many devices have been developed, usually modeled on the cochlear implant or bionic ear devices, a type of neural prosthesis in use since the mid-1980s. The idea of using electrical current (e.g., electrically stimulating the retina or the visual cortex) to provide sight dates back to the 18th century, discussed by Benjamin Franklin, Tiberius Cavalla and Charles Leroy.*

**Keywords**: *Scientific Research, Overcome Handicaps, Visual Device, Electrical Current.*

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## INTRODUCTION OF THE STUDY

### INTRODUCTION

It comprises a computer chip which is kept in the back of the individual’s eye, linked up using a mini video camera built into glasses that they wear. Images captured by the camera are beamed to the chip, which translates them into impulses that the brain can interpret. Although the images produced by the artificial eye were far from perfect, they could be clear enough to allow someone who is otherwise blind to recognize faces. The breakthrough is likely to benefit patients with the most common cause of blindness, macular degeneration, which affects 500,000 people. This occurs when there is damage to the macula, which is in the central part of the retina where light is focused and changed into nerve signals in the middle of the brain. The implant bypasses the diseased cells in the retina and stimulates the remaining viable cells. Artificial-vision researchers take inspiration from another device, the cochlear implant, which has successfully restored hearing to thousands of deaf people. But the human vision system is far more complicated than that of hearing. The eye is one of the most amazing organs in the body. Scattered light from the object enters through the cornea. The light is projected onto the retina. The retina sends messages to the brain through the optic nerve.

## OBJECTIVES OF THE STUDY

The study has been under taken to analyze area of scientific research towards new vision on Bionic Eye and the other objectives are:

- To find out the correction in the vision.
- To identify the necessity to suffer from long and short sights.
- To know the customer’s perception about it can be implemented easily.
- To measure the customer satisfaction regarding the performance of Bionic Eye.

## RESEARCH METHODOLOGY

Methodology is a way of systematically solving a research problem. It may be understood as a science to studying how research is done scientifically. It explains various steps that are generally adopted by a researcher in studying the research problem.

## DATA SOURCE

The data were collected directly from the customers through the questionnaire: secondary data is also collected from Journals Magazines & Websites.

## STUDY AREA

The area selected for this study is Coimbatore city.

## TOOLS USED

Statistical tools like:

- Simple percentage analysis.
- Chi-square test

# REVIEW OF LITERATURE

**Review of literature** is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Literature reviews use secondary sources, and do not report new or original experimental work. **Let us see the review about satisfaction of Bionic Eye by customers.**

**Godwin (Jan 05, 2015)** - Visual prostheses including artificial retinal devices are a novel and revolutionary approach to the treatment of profound visual loss. The development of the field of visual prosthesis began with cortical prosthetic devices but since then, a variety of devices which target different sites along the visual pathway have been developed with the retinal prosthesis being the most advanced.

# OVERVIEW OF STUDY

Patient tests are planned for this device in 2014 once preclinical testing has been completed. Patients with retinitis pigmentosa will be the first to participate in the studies, followed by age-related macular degeneration. Each prototype consists of a camera, attached to a pair of glasses which sends the signal to the implanted microchip, where it is converted into electrical impulses to stimulate the remaining healthy neurons in the retina. This information is then passed on to the optic nerve and the vision processing centers of the brain The Australian research council awarded bionic vision Australia a $42 million grant in December 2009 and the consortium was officially launched in march 2010. Bionic vision Australia brings together a multidisciplinary team, many of whom have extensive experience developing medical devices such as the cochlear implant common vision problems vision can be affected in a number of ways. Some structures within the eye may not be ideally formed, or may have been damaged, impeding their function. Corrective eyewear and laser eye surgery can address some problems with the light-focusing functions of the eye (such as cataracts, astigmatism and myopia). These problems are usually a result of structural abnormalities within the eye and its component parts. Problems with the light-processing functions of the eye are usually caused by abnormalities of the retina and macula such as retinitis pigmentosa and age-related macular degeneration. They cannot be addressed with corrective eyewear or laser eye surgery and it is these problems that we are seeking to address with a retinal implant. India is now home to the world's largest number of blind people. In 37 million people across the globe 15 million blind people are from India. 75% of these are cases of avoidable blindness. On the other hand, while India needs 2.5 lakhs donated eyes every year, the country's 109 eye banks in which 5 located in Delhi manage to collect a maximum of just 25,000 eyes, 30% of which can't be used. Meanwhile, shortage of donated eyes is becoming a huge problem. In 15 million blind people in India, three million that is 26% of whom are children who suffer due to corneal disorders. But only 10,000 corneal transplants are being done every year because of shortage of donated eye. The bionic eye aims to restore basic visual cues to people suffering from eye diseases such as retinitis pigmentosa, which is a genetic eye condition. a video camera fitted to a pair of glasses will capture and process images. These images are sent wirelessly to a bionic implant at the back of the eye which stimulates dormant optic nerves to generate points of light (phosphenes) that form the basis of images in the brain.

## HISTORY

In 1755, French physician and scientist Charles Leroy discharged the static electricity from a Leyden jar a precursor of modern-day capacitors into a blind patient's body using two wires, one tightened around the head just above the eyes and the other around the leg. The patient, who had been blind for three months as a result of a high fever, described the experience like a flame passing downwards in front of his eyes. This was the first time an electrical device serving as a rudimentary prosthesis successfully restored even a flicker of visual perception.

More than 250 years later, blindness is still one of the most debilitating sensory impairments, affecting close to 40 million people worldwide. Many of these patients can be efficiently treated with surgery or medication, but some pathology cannot be corrected with existing treatments. In particular, when light-receiving photoreceptor cells degenerate, as is the case in retinitis pigmentosa, or when the optic nerve is damaged as a result of glaucoma or head trauma, no surgery or medicine can restore the lost vision.

In such cases, a visual prosthesis may be the only option. Similar to cochlear implants, which stimulate auditory nerve fibers downstream of damaged sensory hair cells to restore hearing, visual prostheses aim to provide patients with visual information by stimulating neurons in the retina, in the optic nerve, or in the brain's visual areas.

While brain prostheses have yet to be tested in people, clinical results with retinal prostheses are demonstrating that the implants can enable blind patients to locate and recognize objects, orient themselves in an unfamiliar environment, and even perform some reading tasks. But the field is young, and major improvements are still necessary to enable highly functional restoration of sight.

## DEVELOPMENT

30 years ago, 54-year-old Dianne Ashworth started going blind when she was diagnosed with a hereditary condition: retinitis pigmentosa. A few decades of scientific progress later, and she was implanted with a bionic eye prototype at the Royal Victorian Eye and Ear Hospital in May. Last month, it was switched on after she fully recovered from her surgery. Ashworth hasn't regained full sight, but for the first time, there's hope: the Australian now see flashes of light and shapes

when researchers deliver electrical pulses to the device. a vision processor so that images can be built using the flashes of light. The next stage of development and testing will include an external camera. The positive result means other patients will be getting the same treatment: two have already had surgery and will have their devices switched on, while three more patients are scheduled to receive implants.

## AWARDS & RECOGNISATION

In 1755, Le Roy tried to cure a patient of his blindness by sending electric current pulses through a wire wound around the head. The blind man perceived vivid flashes of light, but could not be cured. This is considered the first experimental evidence that nerves could be electrically stimulated, 36 years before the description of electrophysiological phenomena by Galvani.

## BIOLOGICAL TECHNOLOGY

The ability to give sight to a blind person via a bionic eye depends on the circumstances surrounding the loss of sight. For retinal prostheses, which are the most prevalent visual prosthetic under development (due to ease of access to the retina among other considerations), patients with vision loss due to degeneration of photoreceptors (retinitis pigmentosa, choroideremia, geographic atrophy macular degeneration) are the best candidate for treatment. Candidates for visual prosthetic implants find the procedure most successful if the optic nerve was developed prior to the onset of blindness. Persons born with blindness may lack a fully developed optical nerve, which typically develops prior to birth,[] though neuroplasticity makes it possible for the nerve, and sight, to develop after implantation.

## TECHNOLOGY CONSIDARATION

Visual prosthetics are being developed as a potentially valuable aid for individuals with visual degradation. Argus II, co-developed at the University of Southern California (USC) Eye Institute[4] and manufactured by Second Sight Medical Products Inc., is now the only such device to have received marketing approval (CE Mark in Europe in 2011). Most other efforts remain investigational; the Retina Implant AG's Alpha IMS won a CE Mark July 2013 and is a significant improvement in resolution. It is not, however, FDA-approved in the US.

## ARGUS RETINAL PROSTHESIS

Argus retinal prosthesis:

Mark Humayun, who joined the faculty of the Keck School of Medicine of USC Department of Ophthalmology in 2001; Eugene Dejuan, now at the University of California San Francisco; engineer Howard D. Phillips; bio-electronics engineer Wentai Liu, now at University of California Los Angeles; and Robert Greenberg, now of Second Sight, were the original inventors of the active epi-retinal prosthesis and demonstrated proof of principle in acute patient investigations at Johns Hopkins University in the early 1990s. In the late 1990s the company Second Sight was formed by Greenberg along with medical device entrepreneur, Alfred E. Mann, Their first-generation implant had 16 electrodes and was implanted in six subjects by Humayun at University of Southern California between 2002 and 2004. In 2007, the company began a trial of its second-generation, 60-electrode implant, dubbed the Argus II, in the US and in Europe. In total 30 subjects participated in the studies spanning 10 sites in four countries. In the spring of 2011, based on the results of the clinical study which were published in 2012, Argus II was approved for commercial use in Europe, and Second Sight launched the product later that same year. The Argus II was approved by the United States FDA on 14 February 2013. Three US government funding agencies (National Eye Institute, Department of Energy, and National Science Foundation) have supported the work at Second Sight, USC, UCSC, Caltech, and other research labs.

## Microsystem-based visual prosthesis (MIVP)

Designed by Claude Veraart at the University of Louvain, this is a spiral cuff electrode around the optic nerve at the back of the eye. It is connected to a stimulator implanted in a small depression in the skull. The stimulator receives signals from an externally worn camera, which are translated into electrical signals that stimulate the optic nerve directly.[15]

## IMPLANTABLE MINIATURE TELESCOPE

Although not truly an active prosthesis, an Implantable Miniature Telescope is one type of visual implant that has met with some success in the treatment of end-stage age-related macular degeneration.[16][17][18] This type of device is implanted in the eye's posterior chamber and works by increasing (by about three times) the size of the image projected onto the retina in order to overcome a centrally located scotoma or blind spot.[17][18]

Created by VisionCare Ophthalmic Technologies in conjunction with the CentraSight Treatment Program, the telescope is about the size of a pea and is implanted behind the iris of one eye. Images are projected onto healthy areas of the central retina, outside the degenerated macula, and is enlarged to reduce the effect the blind spot has on central vision. 2.2x or 2.7x magnification strengths make it possible to see or discern the central vision object of interest while the other eye is used for peripheral vision because the eye that has the implant will have limited peripheral vision as a side effect. Unlike a telescope which would be hand-held, the implant moves with the eye which is the main advantage. Patients using the device may however still need glasses for optimal vision and for close work. Before surgery, patients should first try out a hand-held telescope to see if they would benefit from image enlargement. One of the main drawbacks is that it cannot be used for patients who have had cataract surgery as the intraocular lens would obstruct insertion of the telescope. It also requires a large incision in the cornea to insert.[19]

## Tübingen MPDA Project Alpha IMS

A Southern German team led by the University Eye Hospital in Tübingen, was formed in 1995 by Eberhart Zrenner to develop a subretinal prosthesis. The chip is located behind the retina and utilizes microphotodiode arrays (MPDA) which collect incident light and transform it into electrical current stimulating the retinal ganglion cells. As natural photoreceptorsare far more efficient than photodiodes, visible light is not powerful enough to stimulate the MPDA. Therefore, an external power supply is used to enhance the stimulation current. The German team commenced in vivo experiments in 2000, when evoked cortical potentials were measured from Yucatán micropigs and rabbits. At 14 months post implantation, the implant and retina surrounding it were examined and there were no noticeable changes to anatomical integrity. The implants were successful in producing evoked cortical potentials in half of the animals tested. The thresholds identified in this study were similar to those required in epiretinal stimulation. The latest reports from this group concern the results of a clinical pilot study on 11 participants suffering from RP. Some blind patients were able to read letters, recognize unknown objects, localize a plate, a cup and cutlery. The results were to be presented in detail in 2011 in the Proceedings of the Royal Society B.[20] In 2010 a new multicenter Study has been started using a fully implantable device with 1500 Electrodes Alpha IMS (produced by Retina Implant AG, Reutlingen, Germany), 10 patients included so far; first results have been presented at ARVO 2011. The first UK implantations took place in March 2012 and were led by Robert MacLaren at the University of Oxford and Tim Jackson at King's College Hospital in London.[21][22] David Wong also implanted the Tübingen device in a patient in Hong Kong.[23] In all cases previously blind patients had some degree of sight restored, confirming that despite the complexity of surgery, the device can be implanted successfully at other specialist centers around the World.

## HARVARD/MIT RETINAL IMPLANT

Joseph Rizzo and John Wyatt at the Massachusetts Eye and Ear Infirmary and MIT began researching the feasibility of a retinal prosthesis in 1989, and performed a number of proof-of-concept epiretinal stimulation trials on blind volunteers between 1998 and 2000. They have since developed a subretinal stimulator, an array of electrodes, that is placed beneath the retina in the subretinal space and receives image signals beamed from a camera mounted on a pair of glasses. The stimulator chip decodes the picture information beamed from the camera and stimulates retinal ganglion cells accordingly. Their second generation prosthesis collects data and sends it to the implant through RF fields from transmitter coils that are mounted on the glasses. A secondary receiver coil is sutured around the iris.[24]

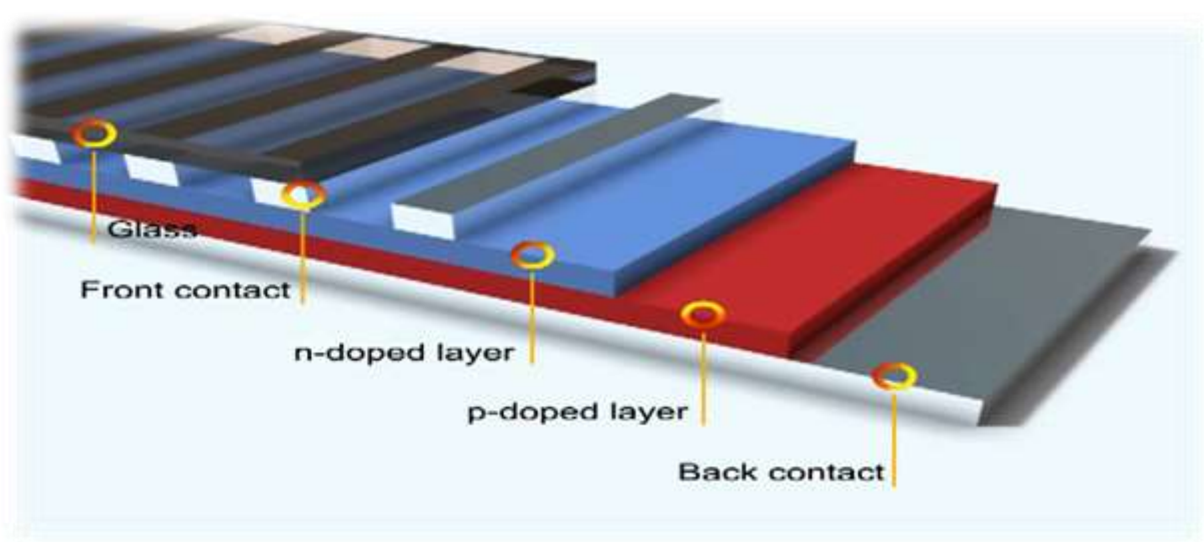
## ARTIFICIAL SILICON RETINA (ASR)

The brothers Alan Chow and Vincent Chow have developed a microchip containing 3500 photodiodes, which detect light and convert it into electrical impulses, which stimulate healthy retinal ganglion cells. The ASR requires no externally worn devices.[15]

The original Optobionics Corp. stopped operations, but Chow acquired the Optobionics name, the ASR implants and will be reorganizing a new company under the same name. The ASR microchip is a 2mm in diameter silicon chip (same concept as computer chips) containing ~5,000 microscopic solar cells called "microphotodiodes" that each have their own stimulating electrode. .

## PHOTOVOLTAIC RETINAL PROSTHESIS

Daniel Palanker and his group at Stanford University have developed a photovoltaic system for visual prosthesis[26] that includes a subretinal photodiode array and an infrared image projection system mounted on video goggles. Information from the video camera is processed in a pocket PC and displayed on pulsed near-infrared (IR, 850–915 nm) video goggles. IR image is projected onto the retina via natural eye optics, and activates photodiodes in the subretinal implant that convert light into pulsed bi-phasic electric current in each pixel.[27]Charge injection can be further increased using a common bias voltage provided by a radiofrequency-driven implantable power supply Proximity between electrodes and neural cells necessary for high resolution stimulation can be achieved utilizing the effect of retinal migration.



## BIONIC VISION AUSTRALIA

An Australian team led by Professor Anthony Burkitt is developing two retinal prostheses. The Wide-View device combines novel technologies with materials that have been successfully used in other clinical implants. This approach incorporates a microchip with 98 stimulating electrodes and aims to provide increased mobility for patients to help them move safely in their environment. This implant will be placed in the suprachoroidal space. Researchers expect the first patient tests to begin with this device in 2013.

The Bionic Vision Australia consortium is concurrently developing the High-Acuity device, which incorporates a number of new technologies to bring together a microchip and an implant with 1024 electrodes. The device aims to provide functional central vision to assist with tasks such as face recognition and reading large print. This high-acuity implant will be inserted epiretinally. Patient tests are planned for this device in 2014 once preclinical testing has been completed.

Patients with retinitis pigmentosa will be the first to participate in the studies, followed by age-related macular degeneration. Each prototype consists of a camera, attached to a pair of glasses which sends the signal to the implanted microchip, where it is converted into electrical impulses to stimulate the remaining healthy neurons in the retina. This information is then passed on to the optic nerve and the vision processing centres of the brain.

The Australian Research Council awarded Bionic Vision Australia a $42 million grant in December 2009 and the consortium was officially launched in March 2010. Bionic Vision Australia brings together a multidisciplinary team, many of whom have extensive experience developing medical devices such as the cochlear implant (or 'bionic ear').[29]

## DOBELLE EYE

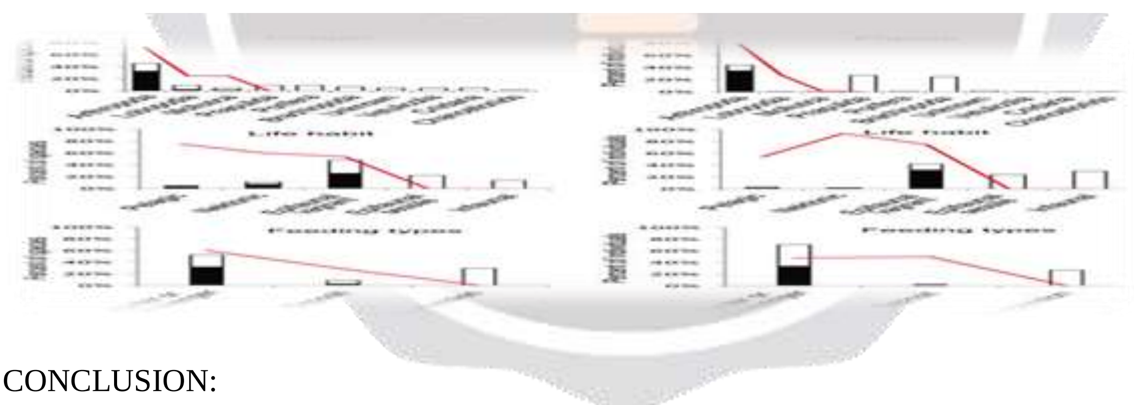
Main article: William H. Dobelle

Similar in function to the Harvard/MIT device, except the stimulator chip sits in the primary visual cortex, rather than on the retina. Many subjects have been implanted with a high success rate and limited negative effects. Still in the developmental phase, upon the death of

Dobelle, selling the eye for profit was ruled against in favor of donating it to a publicly funded research team.[15][30]

## INTRACORTICAL VISUAL PROSTHESIS

The Laboratory of Neural Prosthetics at Illinois Institute Of Technology (IIT), Chicago, is developing a visual prosthetic using intracortical electrode arrays. While similar in principle to the Dobelle system, the use of intracortical electrodes allow for greatly increased spatial resolution in the stimulation signals (more electrodes per unit area). In addition, a wireless telemetry system is being developed[31] to eliminate the need for transcranial wires. Arrays of activated iridium oxide film (AIROF)-coated electrodes will be implanted in the visual cortex, located on the occipital lobe of the brain. External hardware will capture images, process them, and generate instructions which will then be transmitted to implanted circuitry via a telemetry link. The circuitry will decode the instructions and stimulate the electrodes, in turn stimulating the visual cortex. The group is developing a wearable external image capture and processing system to accompany the implanted circuitry. Studies on animals and psychophysical studies on humans are being conducted to test the feasibility of a human volunteer implant.



CONCLUSION:

Bionics is still developing as I write. There has been a lot done already and there is more to be done to improve the way we use it. There are ways that the researchers are looking to improve the amount of things we can do with a bionic arm. Looking back the following quote as become very true "bionics came

***REFERENCE :*** *Jahn, M. (1975) Six Million Dollar Man – Wine, Women and War, W H Allen, London.*