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3D-Eyewear for Product Visualization

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Abstract - ***Conventionally, a customer simply walks into an Electronic store, takes a keen look at all the products on display, observes the demo (a trial run) and then buys the product, but in this process, the product kept for trial may be tampered with. In thispaper we have proposed Virtual Shopping approach, which lets the customer get the products' view and trial with a real world experience virtually through an Eyewear. This product will eliminate the need to store and physically display the electronic gadgets at electronic stores thus saving cost of storage, space, shipping, preventing damage to the goods and shipping of products in bulk can be avoided.***

I. INTRODUCTION

Virtual reality is still a developing branch of IT that hasn't harnessed its full potential. Virtual reality is a field of technology that is still lacking advancement. It has still not reached the common man in terms of commercialization. The reason for this is the high cost, less reach and infeasibility. If it is incorporated in our day to day life, it will bring about a remarkable change in terms of the experience, simplicity and productivity in every field right from education to tourism. This topic having aroused the curiosity of many elite engineers is still underdeveloped and unreachable to the common masses owing to the high financial investment it requires. The aim of this project is to bridge this gap and enhance the user experience in a simple application like shopping.

1.1 Virtual Reality

Virtual reality (VR) is a computer-simulated environment that can simulate physical presence in places in the real world or imagined worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback, in medical and gaming applications. One of the best applications of Virtual Reality is a HMD (Head Mounted Display) which is widely used for various purposes.

Fig 1: Head Mounted Display

A head-mounted display or helmet mounted display, both abbreviated HMD, is a display device worn on the head or as part of a helmet or like an eyewear as part of a goggle that has a small display screen in front of both eyes [1]. The images displayed on both the displays are synchronized so as to give the viewer an immersive 3D experience. It is the most common device used in virtual reality.

HMDs differ in whether they can display just a computer generated image (CGI), show live images from the real world or a combination of both. Most HMDs display only a computer-generated image, sometimes referred to as a virtual image. Some HMDs allow a CGI to be superimposed on a real-world view. This is sometimes referred to as augmented reality or mixed reality. Combining real-world view with CGI can be done by projecting the CGI through a partially reflective mirror and viewing the real world directly. This method is often called Optical See-Through. Combining real-world view with CGI can also be done electronically by accepting video from a camera and mixing it electronically with CGI. This method is often called Video See-Through.

1.2 3D - Three dimension

Three-dimensional space is a geometric 3-parameters model of the physical universe in which we exist. These three dimensions can be labeled by a combination of three chosen from the terms length, width, height, depth, and breadth[2]. Any three directions can be chosen, provided that they do not all lie in the same plane. Three-dimensional space has a number of properties that distinguish it from spaces of other dimension numbers. For example, at least three dimensions are required to tie a knot in a piece of string. In computer graphics, the basic definition of 3D space stays the same. Everything about the X, Y, and Z-axis still holds true, but

there's one catch. While real world 3D objects physically exist in three dimensions, in the digital world of computer graphics 3D objects can only be represented mathematically.

1.2.1 3D Modeling

In 3D computer graphics, 3D modeling is the process of developing a mathematical representation of any three-dimensional surface of object (either inanimate or living) via specialized software. The product is called a 3D model. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The model can also be physically created using 3D printing devices. Two important terms are:

a) Binocular Disparity: The key to human depth perception has everything to do with the fact that our eyes each send a slightly different image to the brain. Our brain derives a perception of distance by interpreting the difference in the image from the left and right eye. This is known as binocular disparity.

b) Stereoscopy: To create the illusion of depth, filmmakers have had to develop ways to mimic binocular disparity. The common means for achieving this is to use dual or alternating projection systems in conjunction with polarized glasses that ensure that the left and right eye always receive a slightly different image. This is known as stereoscopy, hence the term stereoscopic 3D.

1.2.2 3D models

Any representation of an object in digital space is called a 3D model. If you took a look at the raw information that comprises a basic 3D model, it would simply be a collection of data points that mark thousands or millions of different coordinates in Cartesian space[3]. 3D models represent a 3D object using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. Being a collection of data (points and other information), 3D models can be created by hand, algorithmically (procedural modeling), or scanned.

3D models are widely used anywhere in 3D graphics. Actually, their use predates the widespread use of 3D graphics on personal computers. Many computer games used pre-rendered images of 3D models as sprites before computers could render them in real-time.

1.3 Visualization

Visualization is any technique for creating images, diagrams, or animations to communicate a message [4]. Visualization through visual imagery has been an effective way to communicate both abstract and concrete ideas since the dawn of man.

Visualization today has ever-expanding applications in science, education, engineering (e.g., product visualization), interactive multimedia, medicine, etc. Typical of a visualization application is the field of computer graphics. The invention of computer graphics may be the most important development in visualization since the invention of central perspective in the Renaissance period. The development of animation also helped advance visualization.TV also offers scientific visualizations when it shows computer drawn and animated reconstructions of road or airplane accidents.Dynamic forms of visualization, such as educational animation or timelines, have the potential to enhance learning about systems that change over time.

Product Visualization

Product visualization involves visualization software technology for the viewing and manipulation of 3D models, technical drawing and other related documentation of manufactured components and large assemblies of products. It is a key part of product lifecycle management. Product visualization software typically provides high levels of photorealism so that a product can be viewed before it is actually manufactured. This supports functions ranging from design and styling to sales and marketing. Originally technical drawings were made by hand, but with the rise of advanced computer graphics the drawing board has been replaced by computer-aided design (CAD).This project uses product visualization in the sense that it displays to the customer any electronic gadget that he wants to see along with the specifications, cost and 3D view in an immersive manner.

II. *LITERATURE REVIEW*

2.1 Oculus Rift

The Oculus Rift is an upcoming virtual reality head-mounted display. Developer kits are in the process of being shipped out by Oculus VR. As a head-mounted display (HMD) designer at the University of Southern California Institute for Creative Technologies, Palmer Luckey , inventor of oculus rift earned a reputation for having the largest personal collection of HMDs in the world, and is a longtime moderator in Meant to be Seen 3D's discussion forums. [5] A consumer-oriented 'Oculus Rift 2.0' is in development, which will be aimed at a general market and feature improved components.

2.2. Head-Mounted Display for Diving Computer Platform

This paper describes a light weight, 300 m water resistant, graphical head-mounted matrix display (HMD), [6]which is connected to a wrist worn diving computer and that gives an exact copy of the diving computer screen. This system lacks haptic sensors that will actually make the user feel that he is diving in water. Thus, this system is limited only to the visuals of diving as displayed to the user.

2.3. Clinical Implementation of a Head-Mounted Display of Patient Vital Signs

Head-mounted displays (HMDs) can superimpose a patient's vital signs over the anesthesiologist's field of view in the operating room. [7] Prior simulator-based studies have found that anesthesiologists wearing an HMD spend more time looking towards the patient and less time looking towards the monitors compared to standard monitoring. We

review potential approaches for interfacing an HMD with clinical monitoring equipment at the Royal Adelaide Hospital, and describe the technical solution we implemented. There should be absolutely no or zero error probability as life of patients are at stake.

2.4. High resolution, wide view angle head mounted display using eye movement tracking: system structure and evaluation experiments

This paper describes a head mounted display (HMD) which can present visual images with high reality using the characteristics of the human eye [8].The HMD has received considerable attention as vision presentation equipment for virtual reality or tele-robotics. However conventional HMDs have problems that those images are narrow view angle and low resolution, because those displays have a fixed number of scanning lines. In order to improve it, an eye movement tracking type HMD (EMT-HMD) was proposed.

2.5. Calibration of head-mounted displays for augmented reality applications

The authors have developed "augmented reality" technology, consisting of a see-through head-mounted display, a robust, accurate position/orientation sensor, and their supporting electronics and software [9]. Their primary goal is to apply this technology to touch labor manufacturing processes, enabling a factory worker to view index markings or instructions as if they were painted on the surface of a work piece.

III. *PROPOSED SYSTEM*

This system eliminates the need of the customer to physically walk into the electronic store and select the gadget that he wishes to buy it provides the customer with an eyewear which is to be simply worn that will show all the details , specifications and costs of the gadgets for easy selection and purchase .

The proposed application of 3D eye wear includes display of all the household and electronic gadgets. Its and output device or immersive view. This will be worn merely like a pair of goggles. The customer will simply have to move his finger on the touchpad of the laptop or tablet which will sense the movement of the finger in up down, right, left directions and the products respective view will be displayed in the eye wear. It will also provide the customer with detailed specifications and trial run of the product virtually as given the implication that the product is physically present in front of him. The device can also be made wireless using Bluetooth or internet connection. The device can be made more compact and portable. Also an operating system and inbuilt memory into the device can be incorporated. This proposed system is cost effective and feasible for commercialization more over the current use of such device is limited only to entertainment education and tourism.

Scope of our System

1) Building or acquiring the hardware components – The eyewear can be built from scratch using separate components. If this fails, a head mounted display without a motion and head tracker can also be purchased from the market.

2) Building 3D models of washing machines, cameras, ACs, etc and adding details to make them look realistic - This can be done using android 3D modeling so that in the future it can be used in smart phones too. If more realism is desired, a panoramic video can be shot and mounted using Studio Max or 3D Max software.

3) Saving them in the database along with their assigned specifications and cost

4) Retrieving the models from the database as per customer selection - OpenGL and WebGL are the frameworks that can be used to host these 3D models and display them on the mobile screen which is 2D.The customer may go through series of choices in terms of brand and product using an application.

5) Displaying 3D view of the models as per customer's movement of finger on the touchpad of the Ipad or Mobile screen

3.1 Goals of 3D Eyewear

Existing Eyewear devices like HMD are not cost effective and infeasible for commercialization. Thus this device aims at inexpensive commercialization.

The current use of such devices is limited only to entertainment, education and tourism. This device is built for product visualization. This is an innovative way for customers to view and experience their product before they buy it. It will save the cost of shipping, storage, manhandling of expensive electronic gadgets.

3.2 Advantages of 3D Eyewear

Customer gets a 3D immersive view of the product from all sides. Since this device is merely used as an output device, it will not have flickering and time lag problems. All electronic gadgets ranging from washing machines to cameras and cell phones can be stored and their information can be retrieved from the database swiftly as per customer selection. Shipping of expensive and bulky products in order to display them in the store can be avoided.

The storage of the same in the store's inventory can be limited. Manhandling of the products which may lead to accidental breakage can be prevented ease of use for the customer as he simply has to put on the devices like a pair of glasses and select which gadget he wants to see.

Also this system facilitates lossless transmission of data from mobile device to eyewear thus increasing its usability.

3.3Limitations of 3D eyewear

- It is bulky to use as the size is slightly bigger than the conventional goggles.
- It has to be wired to a Laptop or an I-pad.
- Lacks its own memory and OS.

- If this device is mass produced, it is not cost effective.
- It takes time for 3D models to be generated from the pictures.
- Since itsclient server architecture, it takes time for new models to be updated in the database

IV. *SYSTEM DESIGN*

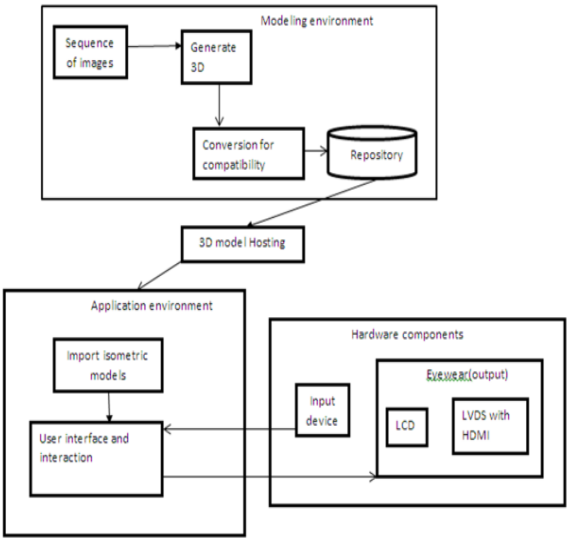

Fig 3.1: System design of 3D Eyewear

4.1. Modeling Environment

Modeling Environment is where the components related to the task of building 3D models are present. The Modeling Environment is a model-integrated program synthesis tool for creating domain-specific models of large-scale systems. ME allows users to define new modeling languages using UML-based meta models. It was developed by the Institute for Software Integrated Systems at Vanderbilt University. It is a part of the META Tool Suite and the Make program.

4.1.1Generate 3D models

Generation of 3D models by Clicking images of an Object from all possible angles to Autodesk servers where they crunch the data and return a mesh model to the user. In 3D computer graphics, 3D modeling is the process of developing a mathematical representation of any three-dimensional surface of object (either inanimate or living) via specialized. The product is called a 3D model. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The model can also be physically created using 3D printing devices.

4.1.2 Repository

Repository commonly refers to a location for storage, often for safety or preservation. There the 3D model objects are stored in .3dp format. A repository is a central place in which an aggregation of data is kept and maintained in an organized way, usually in computer storage. A repository may be just the aggregation of data itself into some accessible place of storage or it may also imply some ability to selectively extract data.

4.1.3 Conversion for Compatibility

The 3D object will be in .3dp which can be easily converted into .obj format so that it will be compatible with android devices. Data conversion is the conversion of computer data from one format to another. Throughout a computer environment, data is encoded in a variety of ways. For example, computer hardware is built on the basis of certain standards, which requires that data contains, for example, parity bit checks. Similarly, the operating system is predicated on certain standards for data and file handling. Furthermore, each computer program handles data in a different manner. Whenever any one of these variable is changed, data must be converted in some way before it can be used by a different computer, operating system or program.

4.2. Application environment

Application environment is where all the components that handle the task related to the applications are present. It consists of the frameworks, libraries, and services along with associated APIs necessary for the runtime execution of programs developed with those APIs. The application environments have dependencies on all underlying layers of system software.

4.2.1 Import Isometric models

This Component will import the isometric model of the 3D models from the repository

4.2.2 User Interface and Interaction

The user interface, in the industrial design field of human–machine interaction, is the space where interaction between humans and machines occurs. The goal of this interaction is effective operation and control of the machine on the user's end, and feedback from the machine, which aids the operator in making operational decisions. Examples of this broad concept of user interfaces include the interactive aspects of computer operating systems, hand tools, heavy machinery operator controls, and process controls. The design considerations applicable when creating user interfaces are related to or involve such disciplines as ergonomics and psychology.

4.3. Input Devices

In computing, an input device is any peripheral (piece of computer hardware equipment) used to provide data and control signals to an information processing system such as a computer or other information appliance. Examples of input devices include keyboards, mouse, scanners, digital cameras and joysticks.Herena mobile deviceis used in order to view the 3D models and also look at different sides of the product.

4.4. EyeWear

A head-mounted display or helmet mounted display, both abbreviated HMD, is a display device, worn on the head or as part of a helmet, that has a small display optic in front of one (monocular HMD) or each eye (binocular HMD). A typical HMD has either one or two small displays with lenses and semi-transparent mirrors embedded in a helmet, eye-glasses (also known as data glasses) or visor. The display units are miniaturized and may include CRT, LCDs, Liquid crystal on silicon (LCos), or OLED. Some vendors employ multiple micro-displays to increase total resolution and field of view.

4.5. LVDS with HDMI input

HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from a HDMI-compliant device ("the source device") to a compatible computer monitor, video projector,digital television, or digital audio device. HDMI is a digital replacement for existing analog video standards.

V. APPLICATIONS

5.1. Training and simulation

A key application for HMDs is training and simulation, allowing to virtually place a trainee in a situation that is either too expensive or too dangerous to replicate in real-life. Training with HMDs cover a wide range of applications from driving, welding and spray painting, flight and vehicle simulators, dismounted soldier training, medical procedure training and more.[10]

5.2. Engineering, science and medicine :

Engineers and scientists use HMDs to provide stereoscopic views of CAD schematics. These systems are also used in the maintenance of complex systems, as they can give a technician what is effectively "x-ray vision" by combining computer graphics such as system diagrams and imagery with the technician's natural vision.[11]

5.3. Gaming and video:

Low cost HMD devices are available for use with 3D games and entertainment applications [12].One of the first commercially available HMDs was the Forte VFX-1 which was announced at CES in 1994.

5.4 Sports :

A HMD system has been developed for Formula One drivers by Kopin Corp. and the BMW Group. According to BMW, "The HMD is part of an advanced telemetry system approved for installation by the Formula One racing committee… to communicate to the driver wirelessly from the heart of the race pit."[13]

2.4. Aviation and Tactical / ground :

Ruggedized HMDs are increasingly being integrated into the cockpits of modern helicopters and fighter aircraft . Military, police and firefighters use HMDs to display tactical information such as maps or thermal imaging data while viewing the real scene. Recent applications have included the use of HMD for paratroopers.[14]

VI. CONCLUSION

3D eyewear system helps to eliminate storage, transportation, maintenance costs and provides the user with a 3D immersive view of the electronic gadgets thus providing the user with clear and high quality model of the product. The 3D models displayed have high resolution and the power consumed is low.

Also this system facilitates lossless transmission of data from mobile device to eyewear thus increasing its usability. As technology advances and less expensive solutions are found out, this system can achieve change the way product visualization currently occurs.

Further enhancements that can be made are by making device wireless using Bluetooth or internet connection also incorporating an operating system and inbuilt memory into the device.

VII. REFERENCES

1. Published in: Display Technology, Journal of (Volume: 7, Issue: 4 Date of Publication: April 2011)
2. http://www.bbc.co.uk/news/technology-19085967
3. http://en.wikipedia.org/wiki/3D
4. http://variety.com/2009/digital/news/filmmakers-like-s3d-s-emotional-wallop-1118008671/
5. http://3d.about.com/od/3d-101-The-Basics/a/3d-Defined-What-Is-3d.html
6. Published in:Robot and Human Communication, 1995. RO-MAN'95 TOKYO, Proceedings 4th IEEE International Workshop
7. Published in: Wearable Computers, 2009. ISWC '09. International Symposium on Date of Conference: 4-7 Sept. 2009
8. Published in:Systems, Man, and Cybernetics, 1994. Humans, Information and Technology., 1994 IEEE International Conference on (Volume:1)
9. Published in: Consumer Electronics, 2005. ICCE. 2005 Digest of Technical Papers. International Conference Date of Conference: 8-12 Jan. 2005
10. http://www.slideshare.net/ArhamJain/top-10-ecommerce-websites-in-indi
11. http://www.google.co.in/url?2FteachingHeadMountedDisplays.ppt
12. http://www.math.yorku.ca/SCS/Gallery/milestone/milestone
13. http://www.google.co.in/?gws_rd=cr#fp=e7e24efeddcda2ea&q=3d+product+visualization+software
14. Published in:3DTV Conference: The True Vision - Capture, Transmission of 3D Video (3DTV-CON), 2010