EXPLORAVISION

"Lose Yourself"

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Abstract

Lose Yourself is a proposed harmony of three main technologies, motion detection, computation, and hologram displays, which together will form a 3D interactive environment. The proposed system will allow the user to reach out and manipulate their environment as if it was a real, tangible world, even though it is all just an illusion. This will allow people to not only become more effective with their computing (math equations can be done by hand for example), but will open up a plethora of gaming opportunities. As it is right now, all three of these technologies are far too young to be viable for the system that we propose, Infrared detection systems are far too expensive, there simply is not the computing power, and holograms are just now getting off the ground. However, all these technologies do require a few key refinements in order to become a reality, which is why this technology does not exist today.

Introduction

Harnessing the power of the third dimension will revolutionize projection technology as we know it. The culmination of infrared motion detection and three-dimensional holograms holds the potential to create an immersive, user-friendly virtual interface. Within twenty years, computer software, gaming experiences, and countless other computer-based technology currently stymied by its two-dimensional limitations will be able to take the next leap, into 3D.

A 3D interactive environment will allow users to reach beyond the typical experience that the mouse and keyboard currently provide. For example, in photo-editing, the user would be able to physically reach out and manipulate the photos as if they were real: they could turn them mid-air, pull on the sides to resize, or paint with an actual paintbrush. In addition, people could hold an email in their hands as if it was a paper copy. Essentially, it will make environments physically tangible, including those that weren't previously.

Present Technology

Infrared radiation is a type of electromagnetic radiation that has a longer wavelength than visible light, but shorter than that of microwaves. Infrared is derived from the Latin *infra,* which means "below", and in conjunction with *red*, infrared literally means "below red", the color of visible light that has the longest wavelength ("The Electromagnetic Spectrum"). Infrared light is used for a variety of purposes, encompassing astronomy, biology, tracking, heating, and climatology. What do TVs, remote controls, and Nintendo Wiis have in common? They all use light emitting diodes, LEDs, to communicate. Currently, infrared is commonly found in LEDs.

The infrared emits a signal that is just below the visible wavelength, can still be received by specialized detectors. Infrared LEDs are extremely useful because they can communicate invisibly to the human eye.

Although most people think of a holograph as a three-dimensional image of an object, it is actually an image created from the interference pattern when two laser light sources shine on an object ("History of Holography"). Current holographic technology incorporates projection. To create a hologram, laboratories use a continuous wave laser, beamed through lenses, mirrors, and beam splitters. Film holders and an isolation table are also used to make exposures. Stability is extremely important during this process because even small movements can vastly distort a hologram. The laser is refracted by the optical equipment to produce the hologram ("How Holographic Environments Will Work").

Nowadays, computers are generally accepted as a wondrous advent to our society. For example, super computers able to calculate many digits of pi. The current record is 206,158,430,000 digits, set by the University of Tokyo ("PI"). People have also developed a high dependence on computers which can be seen in everyday life. Palm pilots, PDAs, mp3 players, video games, and cell phones are essentially specialized computers. In addition, present day computers are extremely capable in their abilities to entertain, compute, communicate, and store data, among other tasks.

History

Our current, sophisticated technology did not develop overnight. Infrared technology was discovered in 1800 when Sir William Herschel, an astronomer, set out to discover which colored lights were responsible for heating objects. Herschel enjoyed building telescopes, and was familiar with lenses and mirrors. He also acknowledged that white light was composed of all the colors in the visible spectrum. Using a prism, a paperboard, and thermometers with blackened bulbs, he created an experiment to measure the temperature of the different colors. A temperature increase was observed during the transition from violet to red light created by the prism. However, Herschel concluded that the hottest temperature was actually beyond red light. He decided to call this new type of light a "calorific ray," as these rays were invisible. This discovery convinced people that there are forms of light which we cannot see with the naked eye ("History of Infrared Technology and Thermal Imagers"). Throughout the last few centuries, infrared technology has greatly evolved and diversified in its applications to modern life.

The ability to create a hologram has fascinated people since the premiere of Star Trek. While working to improve the resolution of an electron microscope in 1947, Dennis Gabor developed the theory of holography. In 1962 Emmett Leith and Juris Upatnieks hypothesize that holography could be used as a 3-D visual medium. In 1962, they read Gabor's paper and decided to duplicate Gabor's technique. The results: a holographic train and bird. These were the first laser transmissions of 3-D objects. These transmission holograms produced images with clarity and realistic depth but further advances were at the time out of reach because they required laser light. In 1968, Dr. Stephen Benton invented white-light transmission holography while researching holographic television. His discovery was revolutionary because it enabled mass production of holograms through embossing, printed by stamping the interference pattern onto plastic ("History of holography").

Human life would be much duller if Konrad Zuse had not built the first programmable computer in 1936. And in 1951, John Presper Eckert & John W. Mauchly built the first commercial computer. IBM, the International Business Machines, enters the computer market in 1953, eventually creating the first successful high level programming language. In 1962, the first computer game was created, and 1969 marked the first year of the Internet. In the 1970s, computers witnessed a revolution as networking, microprocessors, and floppy disks were developed (“The History of Computers“). During the 1990s, computer programmers feared that systems would not know to change from 99 to 00 (“1999 to 2000”). For convenience and in the interest of expenses, computers stored the year as the last two digits. However, based on that storage, computers might confuse 1900 with 2000. People hypothesized that the possible glitch, known as Y2K, would cause billions of damages to data and files. However, algorithms remained faithful, and Y2K passed without much of a hitch (“Y2K Information”).

As one can see, these technologies have undergone many amazing changes and developments since their inception. Because of their innovation and practicality, future computers, projection, and infrared must comprise of the necessary implementations that "Lose Yourself" will require to become an efficient and useful 3D simulator.

Future Technology and Breakthroughs

Our team envisions a combination of three future technologies, the first is astoundingly powerful computers, the second is highly sensitive motion capture, and the third is safe and accurate 3D projection technology, which are all out of reach now, but will be possible within the next twenty years.

In the past twenty years, the average amount of memory in a Desktop Computer has increased by a factor of 10 every four years, and following this trend, by 2028 computer's will have access to over 7 petabytes ("Will computers Become Self-Aware?") of RAM. The number of transistors on an individual CPU is expected to continue on its path of doubling every two years (Moore's law), which also means the average CPU will contain ~1E15 transistors by 2028, which is important because processing power correlates with the number of transistors. If these numbers seem remarkable, it is because they are. The envisioned technology of the future is purely astounding. These monumental increases in calculation and storage capability will allow these computers to observe a 3D environment, interpret the environment, and then change it as necessary, all in less than a nanosecond. In order to develop these super computers of the future, major computer component companies (Intel, AMD, Corsair, IBM, etc ...) will simply need to continue innovating at the rate they have been for the past 40 years. The main scientific process for computer development that needs future improvement is lithography, which describes the method that used to print transistors onto a CPU's die. As CPU manufacturers move from the current cutting edge 45nm process to a 32nm process, Photolithography will have to be phased out in favor of more advanced processes such as Nanoimprint lithography. In fact, "experimental study indicates that the ultimate resolution of nanoimprint lithography could be sub-10 nm" (Chou), which indicates that these super-computing CPUs are indeed possible. Another major breakthrough needed to occur is moving from serial hardware systems to parallel hardware systems, which will allow processor speeds to continue to increase, even though the theoretical physical limit will have been met ("What is Parallel Computing?"); as a result, computing power will continue to increase, possibly at an even faster rate. This is a breakthrough because most computer companies will be resistant to making the drastic changes to their hardware and software that switching from a serial architecture to a parallel architecture takes. In the future, one can expect computers that can process data instantly. But, that still leaves the question of where the data for these computers comes from. How will the computer be able to see every little movement that the user makes? In the future, we believe that infrared motion detection will have matured almost to perfection. We envision a simple device that consists of two gloves and a pair of glasses, all of which contain IR emitters, similar to today's motion detection devices. However, instead of the traditional systems, we plan to use six complete IR detector arrays, made up of thousands of IR detectors, which will have become cheap enough to be viable. The system is very simple in that the gloves and headpiece will both emit IR light, which the thousands of detectors will all detect in 2D. Then, the processing of the six "isometric" views will enable 3D interpretation. In order to make this idea a reality, some scientific processes will have to be refined. The most obvious of all are the production techniques for IR emmiters (LEDs) and detectors. Currently a standard 36KHz IR detector costs about 20 cents ("TFM5360 IR Photo Module"), but to have thousands of detectors in order to detect every single movement, it is imperative that this cost goes down to fractions of a cent. Emitters currently cost about the same per LED ("TFM5360 IR Photo Module"), but would not have to be refined too much more to become viable. The singular breakthrough required in detection would involve the manufacture of IR Detectors, vastly more powerful IR detector manufacturing methods, which the army currently possesses for IR seeking missiles, ("Infrared Countermeasures Systems") this technology would need to move to the private sector, which could take anywhere from a couple of years to decades. Another method would be to use IR cameras, but the necessary scientific breakthroughs required for IR camera systems to become cheap enough for deployment are too numerous for our intents and purposes and most notably, they are a far more difficult to achieve than only the one required for mass IR detector arrays.

The last major technology envisioned is 3D holographic display. As of right now, nearly all hologram systems act by beaming lasers onto a holographic film and constructively interfering, which would not be suitable for our purposes. However, recent research has indicated preliminary success with creating in air points of light (“Three Dimensional Images in the Air”) without the use of this film, literally letting the lasers interfere air. The problem is that these current systems are extremely limited in that they can only create one or two light colors and in only some shapes, which does not fulfill our goals. In the next twenty years, a number of scientific processes would have to be revised. The first is that scientists would need to continue their attempts at new combinations of lasers, at different angles, and varying magnitudes until all colors have been produced in a fashion similar to the AIST's current research. The second major factor is safety, because who knows what would happen if one of these beams strayed into someone's eye? In order to make the beams safe, we propose a system which automatically recognizes the subject's head using the goggles mentioned earlier and simply does not project within a few centimeters of the head. Only the first criteria requires a true breakthrough because scientists are going to have to work very hard in order to come up with the correct methods and combinations, via basically trial and error, especially since the field is still quite young. Overall, the hologram aspect of the environment is least likely to be available by 2028, but hologram technology has progressed significantly in the last ten years, so there is no reason to believe that it will suddenly stop, especially when true 3D holograms are only at fingertip’s length today.

Consequences

There are an infinite number of improvements that interactive projection technology could give to us. The potential in this technology lies in its graphic and interactive abilities. The promise of an environment projected not only at the user, but around them too, lends virtual experiences an added quality of immersion. Depending on what environment is projected, different uses could be found for each specific environment. The possibilities are endless: real-time communication, photoshop and other sorts of software could be more physical, gaming could capture the player, holograms of objects and items could aid in ease of shopping, landscape environments could be used for relaxation, and on and on. Of course it will take years to refine and perfect the graphics and interactive algorithms, but once achieved, the stuff of science fiction could become reality.

Similar to any breakthrough technologies, doubt and fear will permeate through the initial cries of achievement. The darker side of this technology can be found in current disputes over virtual interactive environments such as those seen with video games and the Internet. The ease of which someone can access and remain in a completely immersive environment seems reminiscent of hours spent playing video games or lost in the Internet. In South Korea, government-sponsored institutions have been placed with the purpose of combating what is termed "video game addiction". "Video game addiction" can mean either an addiction to the Internet or to games on console as well. A notorious case in 2005 occurred in a South Korean Internet cafe, or "PC Bang" as the locals call it (“Spot On: Korea reacts to increase in game addiction.”), Lee Seung Seop had recently been fired from his job and ended a relationship with his girlfriend so in the midst of his misfortune, he visited a PC Bang to escape from the harsh reality of his life. After 50 near-consecutive hours of playing "World of Warcraft", he finally collapsed of heart failure from lack of proper food, drink, and rest. Of course cases such as this are rare, but concerns of addicts' detachment from reality are still in question and will probably remain so into the next twenty years. Government sanctions in Asia concerning gaming could bring rise to similar actions that could take place in the US as well.

There are also health concerns still under much consideration and study about exposure to infrared light. Infrared light is part of a spectrum of light labeled as "non-ionising". Unlike its "ionizing" cousins it is not potent enough to remove electrons from an atom, which creates the hazard of free radicals in biological material ("Are Mobile Telephone Communication Antennas a Health Hazard?"). Free radicals, as is commonly known, are full of energy and can physically influence other atoms in biological material. "Non-ionising" light only causes the electrons to vibrate and generate heat. Some claim that infrared light, used in carefully measured doses, could be beneficial to health; Dr. Riley Spitler has been researching light therapy for several years and investigating its healthful properties "the wavelength of light that is the most beneficial to the body…seems to lie within the far infrared spectrum." ("Reversing The Aging Process - an Enlightened Doctor's Discovery."). Rare cases involve the use of infrared light in curing cancer, healing bones, and in conjunction with weight loss, although all incidences are generally inconclusive. ("Far Infared Radiation (FIR) and Health.") On the other hand, there have been found trace links between infrared light exposure and an increased susceptibility to cancer (especially childhood leukemia). Therefore the health effects concerning the physical immersion within the projection environment are currently unknown and disputed; only future research could determine what levels of exposure could cause adverse or beneficial health effects.

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