Application System for the After-School Association of America

(Technical Paper)

Current Limitations of Virtual Reality Regarding Human Senses

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

STS Introduction

Virtual reality is no longer a concept from science fiction novels. The advancement of new technology has allowed people to experience virtual reality using a headset that covers a user's eyes and ears, and controllers that interact with motion sensors. Although utilizing a headset and controllers is only one form of virtual reality, there is no alternative method to effectively utilize virtual reality technology in the market. While there are many fields where virtual reality systems could possibly be utilized, gaming is the most commonly used virtual reality area due to limitations of current devices. Virtual reality headsets interact with accompanied controllers and provide an opportunity to experience the virtual world using two human senses: sight and hearing. However, using only two human senses are far different from the real world, which results in a disparity in user experience. (Dempsey, 2016).

A group of researchers, Cipresso et al. (2018) claims that, "…immersion, perception to be present in an environment, and interaction with that environment" are main highlighting features of virtual reality. Although current virtual reality devices with personal computers satisfy basic immersion, limited perception to be present in an environment with two human senses, and limited interaction with the environment by using controllers, current virtual reality systems do not provide a full virtual world experience. The purpose of this STS research is to examine the limitations of current virtual reality systems with regard to human senses to overcome the limitations and suggest possible implementation of future virtual reality systems.

Technical Introduction

The After-School Association of America, also known as ASAA, is a nonpartisan association created to assist schools who provide services to students' after-school activities through various programs. Their mission is to provide financial assistance to schools in an effort

to increase participation of students after normal school hours. They exist to remove financial barriers in the way and transportation issues for students and their parents so more students can participate in and enjoy school activities. “We are a national organization working with schools to prevent gang affiliation by increasing the number of youths supported during out-of-school time”.

A major problem they have faced is a lack of infrastructure. The non-profit is run by the founder Michelle Busby with little to no help. She personally gathers and refines the data she requires from each individual she works with. The company processes applications requesting financial aid for after-school activities. The funding can be used for transportation, staffing, and activity materials and many more. The non-profit receives the capital required to fulfill these application requests from individual donations and grants that the founder personally applies for. Everything, from application data to funding information, is handled by the founder alone. Current solution has a single person trying to manage all of this data. This data is currently collected over the phone and through email. These elicitation methods require a lot of time and energy guiding the user through the process. This data is then stored on a personal computer in a variety of formats. The current system for the organization has no structured way of allowing those who seek funding, the primary users, nor organization administrators to register an account and manage their side of the funding process directly through an interface. Given that there is no way for the users who provide funding donations to register into a user database to continue to provide funds, participating schools cannot submit detailed applications and information for funding sources offered by ASAA. Furthermore, leaders of ASAA cannot manage user accounts created nor process applications with all the necessary materials needed to affirm funding

eligibility in an effective and timely manner. The purpose of this capstone project is to provide a possible solution to ASAA by creating a web application processing tool with data handling.

Technical Topic

Our application system will aggregate all of the data into a single access point that the founder can use to better collect, track, and utilize this data. The incorporation of multiple types of users becomes useful for all parties involved when it comes to ASAA and the schools it works with since all users can manage programs and funding through the interface itself. Our system also guides users through the entire application process by prompting users for all the necessary information and ensuring that the information is sent to the key administrators of the organization. In this way, our system will streamline the entire application process for the user as well as the owner. Overall, our system will be more efficient, safer, and easier. Ultimately, these innovations will encourage more schools and student participants to reach out for assistance in funding to ensure that every school has the opportunity to build successful afterschool programs.

Our system allows users to create applications so that owners and supervisors can approve applications, deny them, or request for more information. Our system puts the entire process in one easy-to-use location. The system will have the ability to have several different user classes for the purposes of providing funds, receiving funds through an application creation portal that allows users (schools and students) to create applications in a simplified manner, and for administrators to approve, deny, or request further action when reviewing applications and managing funds allocated to users who receive funding. The system will integrate a central database with encrypted information for security purposes to easily monitor school and funding data for all parties who use the new user interface. Lastly, our system will also analyze the data

inputted into the database and provide useful statistics for the founder. These statistics will definitively show the effectiveness of After School organization.

STS Topic

According to statistics gathered by International Data Corporation (2019), the expected world-wide market size for virtual reality is approximately 16.8 billion U.S. dollars, and is further expected to grow to 160 billion dollars by 2023. The virtual reality market is rapidly growing, and will not stop growing in near future according to the data. Such increase in market size demonstrates importance of virtual reality technology in the near future

After investigating the different user experiences between physical reality and virtual reality, a group of researchers, Fraser et al. (2000), suggested several limitations that cause the difference. According to the researchers, possible problems in virtual reality include network delays, haptic feedback, and limited field-of-view. They claim that negated problems in virtual reality indeed cause broader effects on users with their usage of virtual world. Another group of researchers, Durlach et al. (1995), performed detailed research on requirements of virtual reality, such as psychological requirements, visual channel, audio channel, haptic interface, position tracking and mapping, motion sensor, computer hardware and software, networks, and other interface components in order to implement virtual reality. All these requirements are related to, or have been used to build a current virtual reality system with two human senses: sight and hearing.

There are many factors that differentiate virtual reality and the real world. Among all those factors, human senses are considered the most important factors. If people could taste the same in the virtual world, people would no longer have to go out and pay to visit Michelin Star restaurants. However, limitations of current technology do not allow other senses such as smell,

taste, and touch to be utilized in the virtual world. Once a virtual world utilizes all five senses, a boundary between the real world and virtual reality would collapse, and cause a paradigm shift.

Hearing and sight implementation for virtual reality is far from perfect at the moment. Audio channel on virtual reality headset only sends a digital two channel signal and visual screen just sends image displayed on the pixel. There is also no known information regarding virtual reality and future technologies to implement five senses other than hearing and sight. According to Thomas Kuhn (1962), paradigm shifts are not considered revolution, but rather as addition to the knowledge. Once a new technology is established in relation to brain computer interface that controls five senses, there would be a major paradigm shift for virtual reality. For this reason, paradigm shift is going to be the main framework for this STS research paper.

Research Question and Methods

What are the major limitations in implementing basic human senses such as touch, smell, and taste in the current field of virtual reality systems?

For this research, I will first perform historical case study analysis in order to examine current and pre-existing virtual reality systems that work with sight and hearing. Although virtual reality is a fairly new field of study, there has been rapid advancement of technology in the past 10 years, and some of the equipment is already on the market. For this reason, finding out current technology that utilizes hearing and sight in current virtual reality systems is necessary to find out limitations of the current virtual reality system. In that regard, Oculus Rift and HTC Vive are main products that demonstrate current virtual reality technology. I will use detailed specifications of such products along with research papers that explain current virtual reality technology for case study analysis.

Furthermore, I will utilize wicked problem framing in order to find out what bottlenecks current virtual reality systems. I will suggest possible solutions by tweaking pre-existing non-virtual reality related tools such as a cochlear implant that provides a sense of hearing to deaf people. Technology in other fields could be a hint to overcome current limitations of virtual reality, and cochlear implant is one of the examples that I use with wicked problem framing.

Conclusion

With rapid growth of the virtual reality market, virtual reality technology will be part of daily life in the near future. For this reason, limitations of the current virtual reality system in relation to human senses are thoroughly examined to find out a possible solution. As stated earlier, the current virtual reality system only utilizes sight and hearing. In order to overcome such limitations, technology in other science fields will be revisited to give clear vision on how virtual reality would turn out in the future. I expect to find limitations of current virtual reality technology and a possible solution to activate other human senses. Expected outcome may not be practical, because the human brain is still an uncharted territory.

For the technical project, capstone team is creating a web application to automate the application process for After School Association of America, and expect to deliver a full product that satisfies all the required functionalities.

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