

Virtual Reality & its Applications

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Abstract— Virtual Reality (VR) is a technology which allows a user to interact with a computer simulated environment. The simulated world may be the copy of a real world or a completely imaginary world. Using VR, a person can experience various points in history with customized reality. With VR, a person can experience simulations of situations which may be dangerous for them to attempt in real life, but with safety in the virtual world. The development of immersive VR devices has gained significantly in the recent years, with the advancement in computer graphics, motion tracking and processing power technologies, the goal is to make the user feel that the simulated environment is indistinguishable from the real world and thereby ensuring any task performed in the virtual world can be performed in the real world with high accuracy and confidence.

requirements thereby patching up any bugs or defects that the user may encounter.

5. **Safety** – Any risks or injuries that the user may face in the virtual world is purely virtual and they are completely safe in real life.

In this paper, a few well-known applications will be discussed along with their pros and cons.

2. EXISTING

As the various technologies used in developing a virtual reality project improve, more and more applications are coming into market. By using the latest tools and technology, I have listed three key applications of VR which show promising growth and demand by the users namely, Virtual Reality for Real Estate (VR4E), VRChat, VTrainer

2.1 Virtual Reality for Real Estate (VR4E)

This application aims to create a virtual environment for the construction, alteration and prototyping of a property for sale. The real estate developers can interact with their software developers to make immediate changes to the property for the potential buyers to view and customize for them allowing greater freedom when choosing.

The benefits of this application are:

1. Property can be customized as per the customer's feedback.
2. High accuracy of representing the virtual objects to real world counterparts.
3. Cost saved to developer as changes can be made rapidly instead of physically creating a structure and destroying it.

Potential improvements can be made with:

1. UI for object marking by user
2. Liaising between agents and property developers using VR4E

2.2 VTrainer

This application aims to create a virtual environment which represents a real working site with accurate representations of tools and objects to be used by an employee. Once the environment is set, the employee follows their routine task in the virtual world and an examiner can view the employee's movements, tasks

Keywords—Virtual reality, VR gaming, VR applications.

1. INTRODUCTION

Using VR, the users can experience the simulated environment with customized reality upon equipping a compatible headset. They may experience simulations of situations which can be dangerous for them to attempt in real life, safely in the virtual world due to the advancement of technology in the fields of processing power, computer graphics and motion tracking allowing them to accurately perform actions that they would perform in real life in such a scenario.

The implications of this technology allow for great usage in various fields such as medical, research and development, teaching, etc and includes various benefits:

1. **Low cost of setup** – A simple head mounted display (HUD) is enough to simulate the virtual environment and immerse the user.
2. **Less environmental pollution** – As the environment is virtual, it can be created, destroyed, recreated with the only source of carbon footprint being the electricity consumed to power the devices.
3. **Ease of access** – Users can experience the content indoors as long as the necessary equipment is available.
4. **Accuracy** – The computer-generated simulation can be fine tweaked as per the developer's

performed and accuracy while relaying information back to the user.

The benefits of this application are:

1. Dangerous training situations such as oil leak and thermal plant checks can be safely performed.
2. Live manipulation of the virtual environment can dynamically test the employee.

The downsides of this application are:

1. Highly expensive to map real world objects to virtual environment with accurate precision.
2. Continuous investment to develop the virtual environment as per the user specifications.

2.3 VRChat

This application aims to fill the gap of virtual social networking by allowing users to create their own virtual worlds within the application hosted online thereby allowing users to roam throughout the virtual reality world. The users can create their own avatars using Unity3D software and communicate with other users in the virtual world. HTC invested USD \$4 million for further development of VRChat in 2017.

The benefits of this application are:

1. Allows users to use their creativity and imagination to create various virtual worlds.
2. Gives amputees the feeling of walking through the world.
3. Users can communicate with people from around the world.

The downsides of this application are:

1. Needs high investment for the developers to maintain and improve servers.
2. Improving the virtual environments is highly time consuming.

3. Architecture / Design

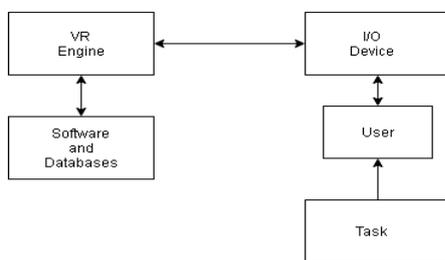


Fig - 1: Architecture of the system.

4. METHODOLOGY

All virtual reality applications in general follows the above architecture. The user is connected through a HUD i.e. the VR display and has access to its controls through a joystick, these are the I/O devices. Every task the user performs is relayed by the HUD and joystick sensors along with the user's spatial coordinates to the VR Engine which then

performs the required calculations after obtaining necessary inputs from the I/O device and connected database. The result is then relayed back to the I/O device which can display the result to the user or use haptic feedback to inform the user.

5. RESULTS

As seen from the previous applications, there is a large scope of research and development in the field of VR to allow greater realism of the simulated environment.

Due to the increasing demand of portable VR devices, the following graph shows the resultant market of VR device by platform per year:

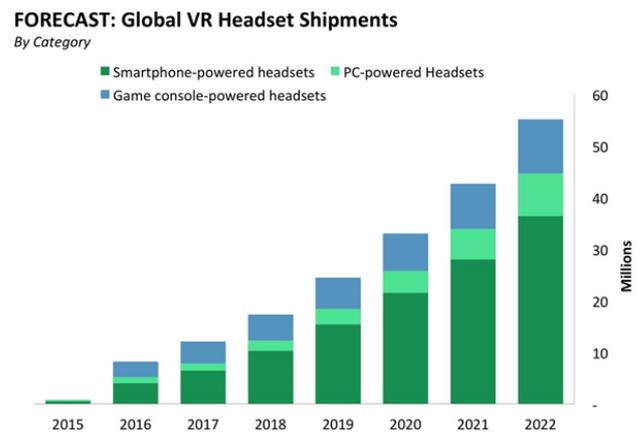


Fig - 2 : Global VR Headset Shipping

As seen above, the demand has been rapidly and is expected to further grow as more and more affordable devices are available to the users.

Steam, a platform created by Valve which hosts VR games has seen great usage over the years

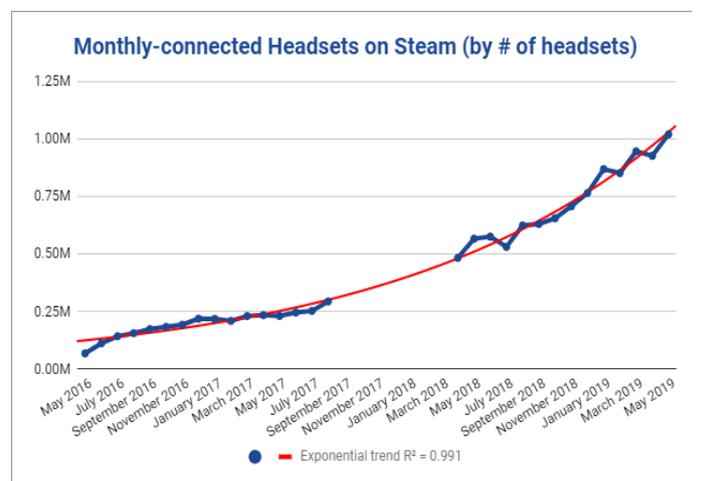


Fig - 3: Headset connections to Steam platform

The above graph shows the number of headsets connected to the platform over the course of 3 years (2016-2019) and

can be seen as a great rise and is projected to increase further.

In 2019, the total revenue from VR device sales was US\$ 22.8 billion across all platforms with individually PC taking US\$ 8.4 billion, mobile based taking US\$ 5.8 billion and console based taking US\$ 8.4 billion in total.

The technology is rapidly advancing and has greater usage for regular users as technology is becoming cheaper due to its advancements such as cheaper GPU and CPU units

6. CONCLUSIONS

This paper discusses about the various applications of virtual reality, its trends and its scope for improvement. The aim of the virtual reality simulated environments are to be as realistic as feasibly possible while ensuring the users' movements are accurately portrayed and recreated in the virtual environment.

By using virtual reality technology, we are ensuring there is less pollution in various forms when comparing with performing the same task in the present standard manner. We are also ensuring that the health and safety of the individual is not compromised as they can perform virtual tasks without the risk of injury when compared to performing the same task in the standard manner.

Cost is saved in all tasks as this can be rerun and modified as per the user requirements without a complete reconstruction being necessary

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