SRUSHTI

HOW WEBVR AND WEBGL HELP BRING VIRTUAL REALITY ONTO YOUR BROWSER -

THE FUTURE AND SCOPE OF **VIRTUAL REALITY** ON THE WEB.

The Add-Ons That Run Technology

Introduction

There is hardly any technology that can be enjoyed as a standalone experience. Televisions require a set top box or wifi, Smartphones need sim cards with high speed internet connectivity and your high end digital camera requires the proper lens to be admirably aesthetic.

The lesser these add ons, the more comfortable we feel. Similarly, the latest buzz in the tech world, Virtual Reality too needs certain requisites to unleash its true potential. Most of the Virtual Reality Experiences are in the form of applications. This means you will have to search and download them into your device before experiencing it. Now, this is a very tedious process. We already know how much storage capacity various applications eat and it is also less charming to open individual applications one by one to experience VR. This is where WebVR arrives as a game changer. WebVR displays 3D models directly into your browser and this allows you to watch virtual reality content without any download! The goal of this open standard platform is to provide VR experiences for everyone, no matter what device they have.

A glance at the history

In 2014, Vladimir Vukićević, the present Director of Engineering for Mozilla, was the first to conceive WebVR and he was also helped by Brandon Jones, Boris Simus and others from the Mozilla team.

Later in 2014, Mozilla launched MozVR.com, a Virtual Reality website that displayed various VR demos along with a VR navigation interface. Very soon, various experimental builds of Google Chrome also started using WebVR that supported virtual reality systems like Google Cardboard, Oculus Rift, HTC Vive and Project Tango. Also in 2014, Google launched an open source web framework

was released in 2015 by Mozilla that enabled the building of VR experiences and websites. On the first of March 2016, the Mozilla Virtual Reality team and Google Chrome announced the release of version 1.0 of WebVR API proposal. The codes were then restructured which bought several improvements to WebVR. 1.1 is the latest tagged version which was last edited on April 5, 2017.

> ‘Chrome experiments for Virtual Reality’, a VR mobile site that showed VR demos for Google Cardboard. ‘A- Frame’

Webgl - The Api That Made It All Possible

Vladimir Vukićević was the creative brain behind another game changing Application Program Interface called the Web Graphics Library (WebGL). This javascript API facilitated the rendering of 3D graphics in any compatible browser without needing any additional plug-ins. WebGL grew in popularity as it became compatible even with mobile platforms including iOS. What made WebGL stand out was its ability to perform tasks which were difficult to carry out using other platforms. One of the best testimonials for this is its ability to render complex lighting and reflective material effects. Its canvas element ensured that it could easily be pooled with other internet technologies. Their mini program ‘shaders’ is also useful to create complex visual effects. Today, you can see the use of WebGL all around you. To point out a simple example, what do you see in medical MRI scans and engineering survey data. Arrangement of complex data in three dimensional spaces, isn't it? If health specialists and engineering supervisors have to club together these data for efficient data visualization, WebGL is what they would seek for. This would help them clearly determine the progress and possible outcomes of various engineering projects and also the health status and conditions of a community. Let us check out how WebGL made a difference to the internet viewing.

The easiest and best tested 3D API

People who deal with 3D applications will know the template and code that has to be setup just so that you can begin to do anything. It is so mind-numbing that even the renowned game programmer John Carmack has complained about it. Here is where WebGL arrives as the superhero savior. With WebGL in place, you absolutely don’t have to worry about makefiles, includes, windows and GLX/GLU etc. Instead, the browser does all that for you. Just get a ‘Canvas’ and content and you are ready to go. The main challenges ahead while programming hardware accelerated graphics are driver issues and incompatibilities. But WebGL has a comprehensive conformance suite that has thousands of tests to make sure WebGL would operate as it should.

Any user can perform these tests and report any issues to the browser vendor. Sometimes, it so happens that a driver update or change in WebGL results in regressive performance.To solve these problems, WebGL also provides a performance regression test suite. It is only one of the very few 3D APIs to provide such a feature.

Interactiveness

Interactiveness is the modern style of communication. People today, crave for a feel of involvement in whatever they watch and this is exactly what WebGL provides. When the internet gets three dimensional, the users are inside the world of content and hence it creates a strong impact in them. So, a user visiting your website can easily explore your product or service from every possible angle. They can even make simulations of their own and determine how the product will operate in different scenarios and conditions. So, remaining in their own rooms, users can examine the product to the tiniest of details. This improves the overall likeability of your product and your chance to convince a customer!

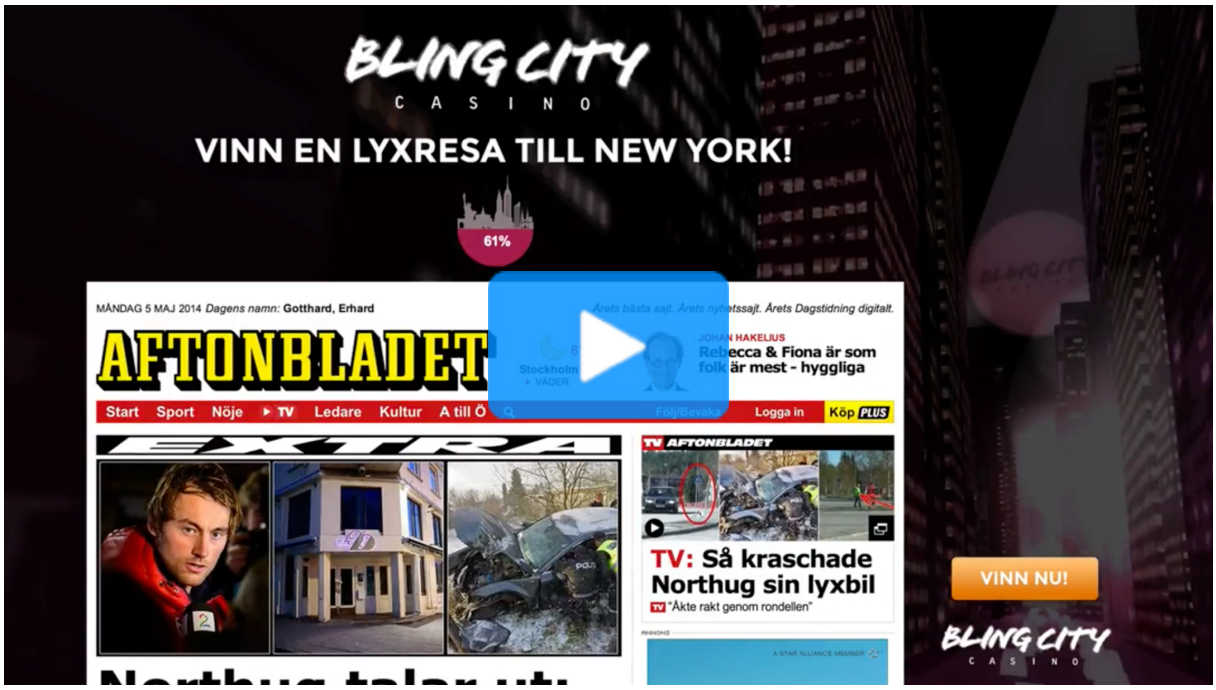
Performance

WebGL is a program that is actually written with performance in mind and thus it is extremely fast and makes use of hardware acceleration. It is also based on OpenGL, a tried and tested interface for generating 3D applications. Since it is an open specification it is also not controlled by a single vendor. Since the Javascript is single threaded and CPU bound, while drawing reflective materials and complex lighting, the load can be shifted to the GPU in your device.

Range Of Applications

Online Advertising

The use of WebGL is spread across wide variety of domains. One of its major impact caters to online advertising as they can create ads so visually rich that it will entice the viewers. How many times have we closed or skipped a boring advertisement online? Instead, what if we get an ad with improved interactivity and rich 3D graphics. In 2014, Goo technologies introduced a new ad creation tool called Goo Create and they were the first ones to create a WebGL powered online ad which allowed the users to move through a three dimensional scene. The ad was created for a casino named BlingCity and it appeared on the frontpage of Sweden's largest newspaper - Aftonbladet. The users could move through the 3D scene that is implanted along the complete perimeter of Aftonbladet front page.



SOURCE : GOO PRESENTS: WORLD'S FIRST RICH 3D AD

E Learning

WebGL can easily be implemented into Storyline courses and this will significantly benefit courses dealing with specific object or devices. WebGL can be implemented in the form of exploration exercises, first person walkabouts and multimedia rooms which will allow the user to interact in a three dimensional environment.

SOURCE : WEBGL EXPERIMENT FOR AN E-LEARNING TOOL FOR THE UNIVERSITY OF ZURICH, SWITZERLAND

Von Waldkirch, a creative agency, designed an online museum for the department of Islamic Art History of the University of Zurich using WebGL and it is one of the earliest examples in this regard.

Web Games

This is another prominent area influenced by WebGL. Instead of downloading and running games on their devices, gamers can now simply browse into a website and experience the power of three dimensional gaming. One such example is the CycleBlob game based on the lightcycles scene from the movie TRON. The game requires the skill set of the ordinary snake game but on a much more complex 3D surface!

Others

There are plenty more examples of amazing WebGL works. ‘Just a Reflector’, an interactive video created by Google Data Arts Team and Unit 9, Ultranoir Nouvelle Vague website and Fractal Lab by Tom Beddard are some of the other examples.

SOURCE : FRACTAL LAB - INTERACTIVE WEBGL FRACTAL EXPLORER

WEBGL AND WEBVR

The ability of WebGL to render powerful 3D graphics in any compatible browser is what helps bring Virtual Reality into the web. With adequate camera settings and device interactions, the WebVR API introduces new interfaces that helps web applications present content in virtual reality by using WebGL. The steps in WebVR begins with a request of available VR devices. Once the user has selected the desired device, the program checks if the device completely support the presentation modes the application require. Then, the application advertises VR functionality to the user. User's action will confirm that he wants to enter the VR mode which is followed by a request for VR session. Then, the program starts a render loop that generates graphical frames to be displayed on the device. The program will continue to produce the frames until the viewer decides to exit.

MAJOR PROJECTS

Janus VR

Founded by James McCrea and Karan Singh in the Christmas Month of 2014, JanusVR creates software that provides the convergence of AR and VR. The name Janus is derived out of the Roman God of passages and JanusVR focuses on extending web content into multi dimensional spaces that are interconnected by portals. Their platform comprises of several suites. They are;

Janusvr - a standalone web creating and browsing tool to generate rich web content. Existing content can be viewed, transformed and reinterpreted in an interactive manner within the suite.

Web.janusvr - This is JanusVR in a WebGL form. They can be viewed through existing web browsers with support for mobile VR hardware.
Presence.janusvr - This open source server forms the social and collaborative foundation of JanusVR.

Janusvr markup + javascript - Here the content in JanusVR is build on existing web markup and protocols augmented by an XML like markup and javascript.

Export.janusvr - They help to export content from modeling, animation and gaming softwares like Unity, Unreal, Blender, Maya etc.

Vesta.janusvr - This is a free web hosting and content sharing community.

A-Frame

A-Frame is mainly maintained by Mozilla and WebVR community and it is an open source web framework that focuses on creating Virtual Reality Experiences. This is an entity component system framework for the cross browser JavaScript library Three.js and using this, developers can generate 3D and WebVR scenes with the help of HTML.

Its entity component system ensures that every object in a scene is seen as an entity. Here, entities are common placeholder objects.

Components are constructible and reusable modules that can be incorporated into entities to define appearance, behavior and functionality. Since it is based on HTML all online Integrated development environments support A-Frame. A-Frame has been in use for several applications and purposes. Some of the finest examples are;

Fear of the Sky - A 360 degree video made by human rights organization Amnesty International together with Syrian media activists that portrays the havoc caused by barrel bombs in Syria. This WebVR website takes the viewer through the ill fated streets of Aleppo city to provide a very moving and disturbing immersive experience. The website also depicts the brave acts of civilian volunteers known as White Helmets, from the Syrian Civil Defence teams who were the first to arrive at the scene following the blast. The site hopes to show the world the haunting impact war has had on both civilians and infrastructure of the country.

Journey to Mars - As the name indicates, this project is a virtual reality experience created by Washington Post to take a user across the landscape of Mars. The project is viewable across any platform or device, with or without a VR headset. A user can also listen to interviews with Jim Green, NASA Planetary scientist, explore Earth's distance to Mars and NASA's new spacesuit, learn about SpaceX SLS rocket that is used to ship cargo and people to MARS and navigate using a game controller, keyboard arrow keys or by simply tilting their mobile phones.

iStaging Live Tour - A- Frame is used in istaging, a startup that provides immersive visualization experiences that help people transcend time and space. They mainly deal with real estate properties and premises and helps people to interact with places and objects as if they are there in person.

Shopify VR - Shopify, the renowned Canadian e-commerce company made use of A-Frame to launch their VR project where users could explore their store in an immersive 360 degree experience.

Blend4Web

This is another open source framework used to author and display interactive three dimensional computer graphics in the internet. The content rendering of this framework makes use of WebGL, Web Audio, WebVR and other web standards. They have plenty of components that can be seen in a typical game engine such as positional audio system, physics engine, animation system and an abstraction layer for game logic programming. Eight different kinds of animation can be performed on a single object, which includes skeletal and per-vertex animation. The forward/backward plays, its speed, size, initial velocity, count etc can be changed through the API. There are some remarkable features too like foliage wind interaction and simulation of water, atmosphere and sunlight.

Experience Curiosity - The most famous use of Blend4Web is 'Experience Curiosity', an interactive web application launched by NASA. The project was launched to celebrate the third anniversary of the landing of Curiosity Rover, a car sized robotic rover that is exploring the Gale Crater on Mars. Experience Curiosity allowed the users to operate the rover, control its cameras and robotic arm and also to recreate some of the major events of the robotic space probe mission- Mars Science Laboratory. The project was presented at the beginning of WebGL section during the Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH) in 2015.

Tallink - The Estonian shipping company Tallink created an immersive three dimensional presentation of its fast ro-ro/passenger ferry MS Megastar using Blend4Web. The project allowed visitors to explore the complete details of the ship that is powered by three 12 cylinder Wärtsilä 12V50DF and two 6-cylinder Wärtsilä 6L50DF four-stroke dual-fuel generating sets.

PlayCanvas

This is an open source interactive 3D game application engine that also has a proprietary cloud hosted creation platform that helps in simultaneous editing from multiple computers through a platform that is predominantly browser based. This interface is capable of strong body physics simulation and also handles three dimensional audio and animations. PlayCanvas has earned the support of giants

like Mozilla, Activision and ARM. It is their collaborative real time editor that facilitates editing project from multiple developers simultaneously.

Moana: Wayfinding with Code - Using PlayCanvas, Disney developed an educational game for the Hour of Code program of the non profit organization code.org that aims at introducing computer science to school students. The game 'Moana: Wayfinding with Code" was based on the theme of the movie Moana. Through the game, students have to help navigate Moana and Maui, two of the main characters in the film using codes. When the pirates attack them, students have to use their own coding skills to elude the attack. Using WebGL based real time graphics, Disney bought the mesmerizing world of Moana right on to the browser.

SOURCE : MOANA: WAYFINDING WITH CODE I DISNEY

Shuffle Cats Mini - Another use of PlayCanvas came when the social games company King Digital Entertainment Plc, developed 'Shuffle Cats Mini' as a launch title for Facebook Instant Games. PlayCanvas claims that the Facebook Instant Games is a perfect platform for their HTML based fast, lightweight and shareable games.

After the Flood - By teaming up with Mozilla, PlayCanvas created 'After the Flood', a demo to present the avant garde features of WebGL 2.0. The project illustrated many of the innovative features of WebGL 2.0 such as 3D textures that is used to generate procedural clouds, hardware PCF for better shadow

filtering at minimum cost, Alpha to Coverage to render antialiased foliage, Transform feedback to animate leaf particles on GPU, Asynchronous asset streaming to get the demo load faster, Runtime lightmap baking to create realistic shadows that render fast and much more.

SOURCE : AFTER THE FLOOD

Sketchfab

Sketchfab is a website that is used to publish, share and discover 3D and VR content online. Using WebGL and WebVR technologies, they display 3D content on the internet that can be viewed on any browser or VR headset. Sketchfab's main attraction, the 3D and VR model viewer allows users to roam freely around or inside the three dimensional scenario using mouse, touch manipulation or even in Virtual Reality. Additionally, viewers can also play and control 3D animations. Another peculiar aspect about the interface is that, the 3D viewer available on their website can be used in external websites such as Facebook, Wordpress or Twitter too! Using the program, users can browse, rate and download user created 3D models that are public. Their 3D model library can be browsed within Virtual Reality. The program was selected for Mozilla's WebFWD accelerator program in 2012 and the very next year it made its way into TechStars Class in New York City. Other notable recognitions include, Top eight at Pioneers Festival 2012 and Best "Lightweight" startup at the Europas Awards 2013.

Kokowa

Kokowa is a WebVR and 3D publication platform that is extremely simple and easy to use. Within a matter of minutes, users can add 3D objects, upload images, notate and build a three dimensional world which can then be shared with anyone. The fun element of Kokowa is that you don't need any previous knowledge of 3D models to get started. They already have readymade figures and environments to help you create magnificent 3D worlds. Also, they keep on adding new figures and environments every week! The interface is wholly web-based and thus you can use it on any device. In Kokowa, every project begins like an empty box onto which you can drag and drop the objects of your choice. In a typical scenario, you will need a host of sophisticated technical skills to create a Virtual Reality environment such as the 3D modelling and the coding for that modelling. But, with Kokowa that burden is significantly reduced.

Vizor

Vizor is another such platform that enables free creation of Virtual Reality content on the internet. Using Vizor, you can discover amazing immersive and 3D content on your phone or web browsers. Just like in other easy to use interfaces, you don't have to be a game developer to start creating content. With their visual editor, any layman can create and share their Virtual Reality experiences.

Beloola

This is a social WebVR platform that helps people with similar interests to get together in the same virtual space. Any individual or a company can create distinctive 3D space, combine all the web content from different platforms and communicate with others in real time.

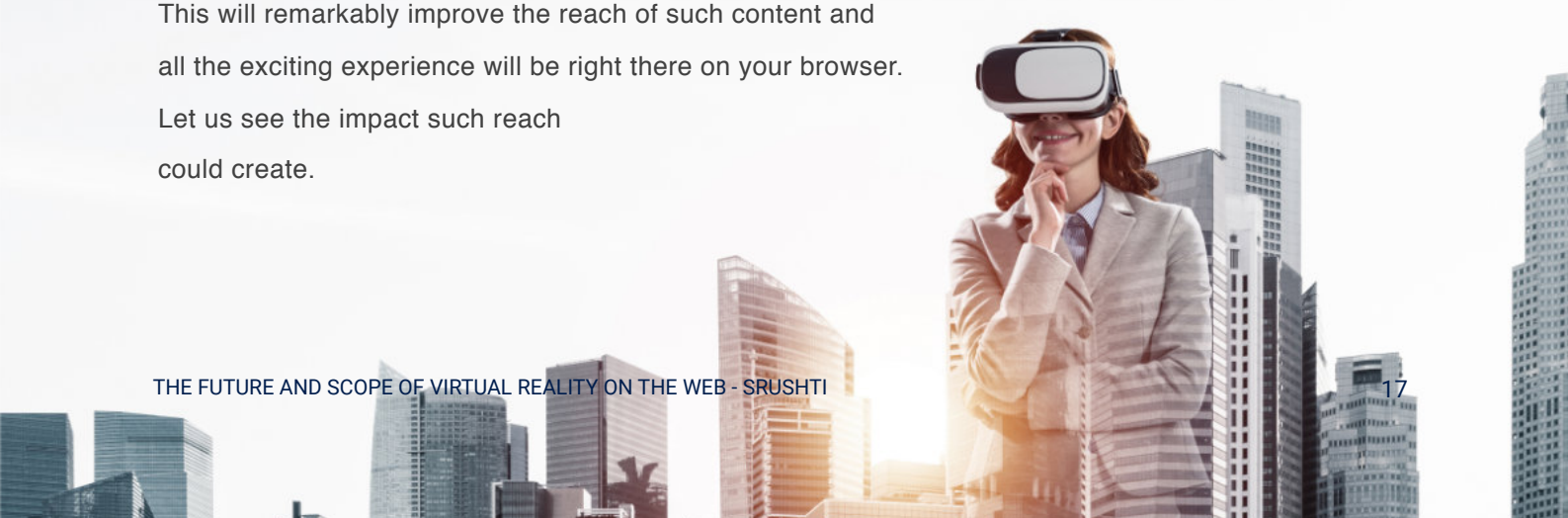
beloola

The Future

Remember the old days when cell phone accessibility was quite limited. The very thought that you could carry a communication device on your pocket was amazing. And once it became immensely popular, it opened up a whole new world of possibilities. We know it is not mere communication that happens today in cell phones. The entire world is in the palm of your hands and just one click away. Not quite sure if people three or four decades back would have foreseen this possibility. Similarly, Virtual Reality seems to be the next big revolution that awaits us and once it becomes widely popular in the web, it could truly elevate our lifestyle. Like in any case, one cannot accurately foresee the changes that they will bring upon us but we surely can make some assumptions based on the present trends.

Vast Distribution That Brings Literally Everything Onto Your Web

The primary challenge concerning the world of VR is how to get people come back to their headsets. The solution from VR industry has been this : Bring content to headsets through applications. We know this is not a smooth process. Search, download, install, accept terms and conditions, grant access and finally run it. By the time the application is ready, you somehow find yourself in a dislodged state of mind. This is 21st century and instant solution is the mantra everywhere. This is why WebVR holds a lot of promise. They bring Virtual Reality Content to where the audience is. You spend considerable amount of time everyday in sites such as Facebook, Twitter, Linkedin, Wordpress and even Google search. What if you could experience Virtual Reality there.
This will remarkably improve the reach of such content and all the exciting experience will be right there on your browser. Let us see the impact such reach could create.



Business and Shopping

Imagine you have to buy a car. There are already manufacturers that provide a Virtual Reality test drive experience through their apps. But it will be a tedious process for you to download the application of each manufacturer and undergo a virtual reality test drive. Instead, in the future, you could simply visit the website of each manufacturer and experience a VR drive. The experience will be so real that you will totally feel like you are inside the vehicle. With one gesture or click, you could bring a virtual salesman who would answer all your queries. You will also be able to pinpoint to your location and determine how the car would perform in your road and traffic! One who knows the most is the best buyer. When Virtual Reality becomes a common phenomenon in the internet, you will never make another wrong purchase!

Telecommunications

Do you know that spoken words only account for a very small percentage of the complete communication. This was the main challenge that communication mediums that relied solely on the tone of voice faced. Sometimes you could be mistaken for being arrogant and at times people would simply fail to ascertain your state of mind. With the introduction of video calling platforms like Skype, things changed. But still, the person at the other end cannot really figure out your exact feelings of the moment. This could soon change in the near future. With the growth of VR and human computer interfaces, you could connect with literally anyone in the world, as if the person is right in front of you and share your feelings as well! Yes, today, it is smoothening to read a message and to have a live video conversation with the one you love. But, the reality is still that the other person is miles away. But, when VR comes to web, you can interact with your loved ones as if they are with you. Imagine the kind of comfortness you will leave. No matter how far one travels, with Virtual Reality, they are always with you! The possibilities are simply enormous. Together with human computer interfaces, the other person can clearly understand your feeling at the moment and react accordingly. So, if you say you love her and it is actually faking it, watch out! You could be in for some trouble. Oh and do not lie to your boss that you are sick. You could be caught red handed.

Education

The kind of education we can offer plays a pivotal role in improving the future of entire mankind. Students today have one massive advantage that they are familiar with technology. Smartphones and internet are nothing new to them and this is exactly why they will smoothly adapt to virtual reality once it becomes a very common technology. And once that happens, teaching and learning will never be the same. For example, to teach astronomy, teachers could easily take students to a virtual tour around planets, stars and other celestial objects. “Tell me and I will forget, Show me and I will remember, Involve me and I will understand” said Confucius, the ancient Chinese philosopher. There is no better explanation on how VR can influence students! With the kind of interactivity on offer, students will even be able to change the position of stars and planets and understand the subsequent effect it will have in the universe. They can even follow comets and meteorites and see where they fall. To learn history, students can take a virtual tour to any period and experience the lifestyle of that era. They can even clearly see how the human race evolved this far and the rise and fall of civilizations. You have learned about the great Niagara Falls or the leaning tower of Pizza. What if you could actually take a virtual tour there! Additionally, colleges and universities can have combined sessions with other universities anywhere in the world. Students and teachers from anywhere in the world can join together to maximise the creativity in learning. So, sitting in an Indian classroom, you might be able to interact with American professors and students as if they are right next to you. In other words, the future education will be full of play and fun.

Healthcare

There is absolutely no doubt that technology has played a great role in improving the total life expectancy of human beings. As Virtual Reality arrives at the web, this is only supposed to improve. Most of us are prone to one thing or the other. Some fear height, some fear animals while some fear crowd. We would have had troubles in our daily life because of these fears too. They may even stand as a barrier for smooth socializing. What if you could conquer these fears by dealing with them in a virtual world. This will soon be a possibility. VR has already started doing wonders in the field of healthcare. Doctors at Nicklaus Children’s Hospital Miami, saved an infant who was born with only one lung and half her heart by mapping her heart in VR to efficiently plan a surgery.

Similarly, Dr. Shafi Ahmed of the Royal London Hospital, performed a surgery that was screened live through VR. This is a great way to train medical professionals as they would get a real time experience from the best of doctors around the world. Very soon, you could visit the hospital website and have a consultation by remaining in your own room. How many times have you heard someone say, a person could have been saved if it was possible to take him to another country for a better treatment. Well, with Virtual Reality on web and human computer interface showing a lot of promise, you could visit any doctor in the world from the comfort of your living room and grant yourself the best possible treatment. There will even be Virtual robots or assistants that doctors would allocate for you to remind you about your medications and exercise. Training medical students will also get cheaper, safer and effective. They can perform their experiments on a virtual patient and can even practise the steps to be followed on emergency situations. For example, they can be allocated a critical virtual situation where they have to act quick to save a patient from falling to a coma. This would help them remain alert and effective during such a real life situation.

Engineering and Construction

There is a new highway being constructed in your city. How would you like to visit the website and take a virtual trip around the highway. You could even choose your vehicle and take a virtual drive and experience the nature of the highway even before it finishes the construction! You will also know how your city connects to other cities through the highway and what sort of traffic you can expect at different hours of the day. Similarly, if you have booked an apartment and is yet to move in, you could visit the company website and get a total feel of the ongoing work. Thereby, you can have a clear idea about when you can move in. If you have any queries regarding the kind of quality of materials used in construction, with a single click, a virtual assistant will be able to help you. You will even be able to raise your concerns and make sure that they are heard. Even while purchasing an apartment that is yet to go on construction, you could actually examine a 3D realistic model of the house you are planning to buy. You will know how the apartment looks like when it is completed and you can even see how the apartment fares during extreme seasonal variations. For Engineers, they can create a realistic three dimensional prototype of their designs and this will enable them to improve their efficiency. They can instantly figure out how their design would look like in the final product and make changes accordingly.

For example, if they are designing a car or a motorbike, they can instantly see if any machine, device or part is a misfit. Engineers can be anywhere in the world and they can work together creatively. Supervisors too can easily control any large number of groups and they can receive feedbacks from experts anywhere in the world.

Explore Unknown and Unreachable Worlds

As we have already seen, VR on internet can bring seemingly unreachable worlds right into our living room. In other words, a planet that is light years away is not that away from you anymore! In the future, when you are bored you could take a virtual tour to Mars. Or to the surface of the Moon! You will even be able to get live pictures and hence you can see what is happening in a different planet at the very same time. The Universe will be right in front of you!

Entertainment

For long, you have controlled other characters and objects in a game. Now, what if you yourself have to kick the baddies or race a car to win the game. What if you are the protagonist in the game you play and you get a real feel of the gaming world you are in. This could well be the thrill gamers soon experience. In case of multi player games, you could go on a mission or race with real people in a 3D virtual environment. You can get a real feel of the super mario worlds or the need for speed racing tracks. Yeah, it will be cool to go on a GTA like story world and kiss the random babe you see on street, isn't it? But make sure you won't get busted! Similarly, you have seen footages that show how certain risky scenes were filmed in a movie. Very soon, you could just browse on to their website to know how the filming was actually done and experience what the film crew experienced. That is, you might be able to run along with Tom Cruise or fight alongside Christian Bale! Quite often, you are awed by the pictures that you see on Internet stating how a certain scene was before visual effects and how it turned out after visual effects. Well, you could soon live through the entire process and see how the transformation happened, right in front of your eyes!

Conclusion

Internet was one giant revolution that massively changed the entire nature of world we live. It is impossible to imagine how the world would respond if Internet shuts down today. Such has been its impact. Since the widespread popularity of Internet, many creative brains have excited us with technologies that run on Internet. Virtual Reality is the latest one among them and it is considered to be the next game changer. With every passing year, Virtual Reality is expanding its potential and the add ons to experience it is reducing as well. Very soon, VR will be a common entity in the world wide web and it could be accessed as simple as you use Google today. “The internet is becoming the town square for the global village of tomorrow” said Bill Gates once. With WebVR on the rise, one would have to admit that he is right. Again.

“If you need help with an upcoming project,
do write to us on hello@srushticreative.com and we’d be glad to help!”

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