3D Internet: The Future of the Web

Hansen Quadros[1], Dr. Mohan Aradhya[2]

[1]PG Student, [2]Assistant Professor,
Department of Master of Computer Applications,
RV College of Engineering, Bangalore.

Abstract: *3D Internet, known also as virtual worlds may be a powerful new way for users to reach consumers, business customers, partners, students and colleagues. The Internet is gradually evolving to become the virtual environment which would facilitate communication, business, and entertainment on a global scale. While this concept seems incremental, in the sense that it merely just adds 3D graphics to the current Web, it is in fact revolutionary as it would provide a complete virtual environment that would facilitate services, interaction, and communication. The experience of interacting with other users or objects in a 3D environment, as compared to screen names or flat images, adds new appeal to the act of socializing and exploring on the Internet. Virtual worlds generate immersive 3D experiences that replicate real life. The paper discusses the understanding of why 3D Internet, what it is, applications of 3D Internet, it's technical implications, advantages & disadvantages, future prospect's, implementation ideas and societal concerns to the acceptance of such a technology.*

Keywords: 3D Internet, Virtual Worlds, SecondLifeURL (SUrl), Depth Perception.

1. Introduction

3D Internet can be called as the integration of the Internet and 3D graphics. The result of such an integration would be interactive and real time 3D graphics all delivered through the web. It is the live simulation of a 2D web page into 3D graphics. Sections of Internet that we use today are under the category of web 2.0 and web 3.0. The next form of Internet takes interaction of users and the 3D experience to a whole new level. This type of experience is often so lively that it is considered as a mix of virtual and augmented reality. 3D Internet can be therefore visualized as virtual worlds. People who are active in these virtual worlds would be more interested and active in the digital world than in real life. It can be termed as the mixed combination of passiveness of television, vastness of web, networking like in the social media and stereoscopic experience of 3D movies. But we can see that the television is a passive source whereas 3D Internet is engaging and interactive. Example of such a virtual world can be "Second Life". The people who are in this world are called as residents. The residents are capable of participating in social events, distance attendance to meetings and educative classes, meeting new people, participate in virtual commerce, trying new products, participate in brand experience which is like the real world. 3D Internet has the live broadcasting property of television combined with the ample content of the Internet. Some disadvantages of the Internet that we use currently can be wastage of time due to mouse movements, less interactive web pages, less Efficient i.e. slow speed of working and ineffective representation of certain images and 3D graphics. Thus, we see that the current technology is highly futile. A replacement or an upgrade is needed in the coming time.

2. Literature Work

The Internet we currently use is filled with web pages [3], graphics and images that have a 2D existence. The time has come to upgrade the Internet [4] itself as technology advancements are growing [5], to a much sophisticated, ubiquitous and interactive network. A good amount of research has already been done on this topic. Research indicates that it is possible to implement 3D Internet [6] but the internet bandwidth, hardware requirements and cost associated with it will make the evolution difficult. The security, advantages, technical obstacles and applications of 3D Internet have been already discussed in many previously published papers [7]. In spite of all this, due to the limitations it has not been achieved yet. It becomes clear from this fact, that there is a need for more research on this topic.

3. Applications

Education: Implementation of 3D Internet in education would make people to have a better understanding of the subject. They can view lectures and experiments in a 3D environment that will help them learn more efficiently than the traditional approach especially considering during the pandemic.

Real Estate: 3D Internet can change the real estate industry drastically. Customers can view the property they are interested in beforehand online with a stereoscopic view. They would get a basic idea and feel of the area and locality that they would be living in even before its complete construction. This will cut down on traveling and ease the selection process of properties to a great extent.

Social Interaction: The current generation users have much more active online social life as compared to real life. The addition of 3D to social networking can revolutionize the digital world. Video calls can be more interactive and appealing to the users. 3D chat spaces can be introduced to social media with interactive emojis. Personal interaction will no more be limited to real world. People who are unable to meet on a regular base can interact online.

Tourism: It is important to choose the perfect destination to spend holidays which would be much easier after the implementation of 3D Internet. Tourists can have a 3D sample view of the desired locations and then later decide which destination they would like to visit. The demo of the place they are about to visit can decide if it's worth investing on the trip.

Entertainment: Online live 3D games, 3D movies, etc. won't be a dream anymore. All this is achievable using 3D Internet. Users won't be compelled to go to a theatre for experiencing a 3D movie. Gamers can enjoy live 3D online games at home and can easily connect with their friends.

E-commerce: Online Shopping would be more realistic and reliable with the adoption of 3D Internet. Concepts like online shopping malls and stores can be implemented so that the users can view their catalogue and visit virtual malls from Internet. The feeling of shopping can be fulfilled by consumers by sitting at home. There will be benefits to both, the buyer and the seller as the necessity to meet at a common trading place will be eliminated completely while the shopping experience will remain intact.

Culture: 3D Internet will showcase art forms that don't exist at today's date. Artists can portray and promote their artwork to the whole world in an entirely new fashion. Just as 2D art has many different forms such as paintings, photography, drawings, mixed media, craft, etc. 3D art would create a new genre of creative forms, something which can't be imagined as of now due to the absence of a 3D platform and human brain's limited scope to only 2D imagination.

4. Advantages and Disadvantages

4.1 Advantages

- Facilitates an open communication, leading to enhanced information discovery and delivery.
- Allows employees to discuss ideas, post news, ask questions and share links with ease.
- Provides an opportunity to widen business contacts.
- Targets a wide range of audience, making it a useful and effective recruitment tool.
- Improves client base and business reputation with minimal use of advertising.

4.2 Disadvantages

- Opens up the possibility for hackers to launch spam and virus attacks and commit fraud.
- Increases chances of data or identity theft as the risk of people falling prey to online scams that seem genuine becomes high.

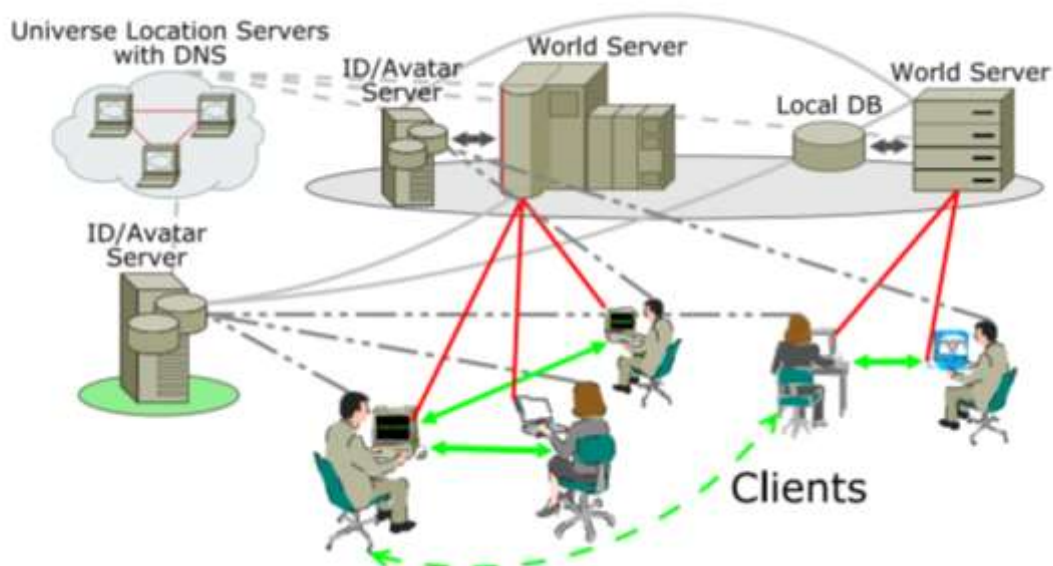## 5. Proposed Implementation

figure 5.1. a graphical depiction of the proposed 3d internet architecture

A simple graphical representation of the proposed 3D Internet architecture is provided in Figure 5.1. Terms such as world, universe, and webplace as 3D counterparts of website, WWW, and subdomain, respectively are adopted here. Each components functionality is described below in brief:

World servers: It provide the user or server-side with the created, dynamic and static contents making up the specific webplace (3D environment) including physics engine, visuals, avatar data, media, and more to client programs. The world server has an important task of coordinating the co-existence of connected users, initiating communication between them, and ensuring in-world consistency in real time. They may also facilitate various services such as instant messaging, e-mail, and more.

ID servers/Avatar: Virtual identity management systems containing identity and avatar information as well as inventory (not only in world graphics but also documents, e-mails, pictures, etc) of registered users and passing these to individual world servers and relevant client programs (owner or owner's friends) while ensuring necessary privacy and security of stored information. ID servers/Avatar can be part of world servers.

Universe location servers: Virtual location management systems are somewhat similar to the current DNS, providing virtual geographical information as well as meta information to connect to the Internet via methods similar to SLurl. They can also act like a distributed directory of the avatar servers, world, and users.

Clients: Browser like viewer program running on user's computers with extensive networking, caching, and 3D rendering capabilities. Additional components of the 3D Internet would include webplaces (replacing websites) and 3D object creation or editing software's, i.e. easy-to-use 3D modelling and design programs such as Sketch-Up and standardized mark-up languages and communication protocols. Emergence of new upgraded software and tools in addition to the ones mentioned should naturally be expected.
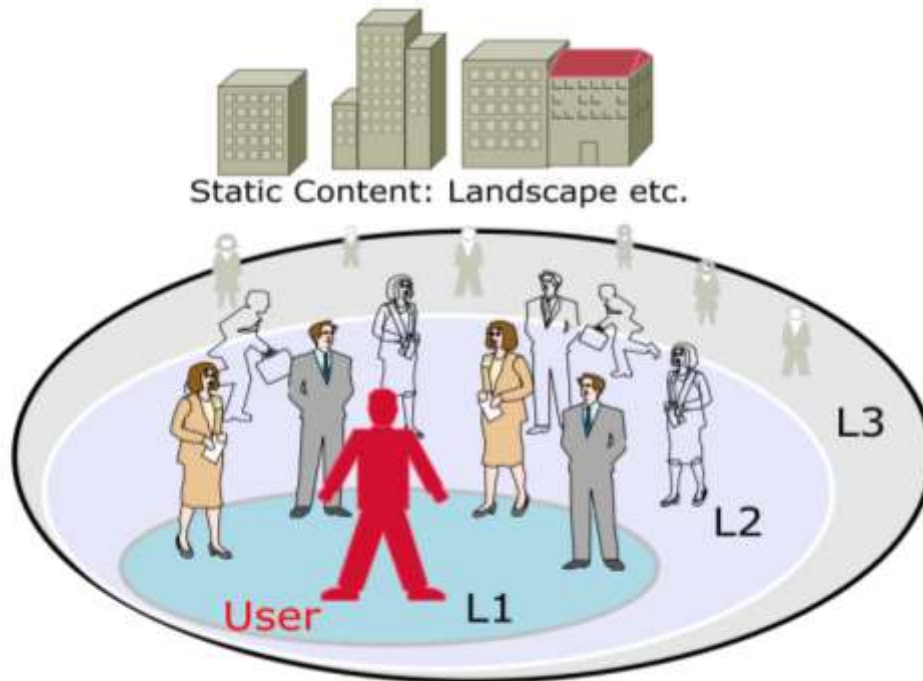

Figure 5.2. a proposed p2p communication scheme on a world in the 3d internet

As the 3D Internet will increase the dependence on graphics and interactivity, it will be important to note that the latency that clients observe when interacting with servers is minimized. Therefore, the network has to be designed in an intelligent way to overcome these challenges. The approach proposed to reduce the server load and ensure easy scalability of the 3D Internet infrastructure is a hybrid peer-to-peer (P2P). It consists of mainly three types of communications: client to server (C2S), server to server (S2S) and client to client (C2C) each with different latencies and bandwidth requirements. C2S communications (see Figure 5.1 red lines) will be bandwidth limited, frequently updated, and synchronous. Gathering location and activity data as well as the use of in-world services will spend substantial number of resources both at the client and world servers. The client - ID server/avatar C2S communications (dash-dotted gray lines) are less frequent and asynchronous. Optimization wise some portion of this communications can be pushed to the backbone by facilitating S2S links between world servers and ID (solid gray lines) triggered by clients and through intelligent caching. Additional S2S communications can also take place on the backbones. The S2S in the case of universe location servers (dotted gray lines) are expected to have relatively lower load. Improving server independent C2C (P2P) communication is one of the major solution to the scalability problems.

One example is the avatars information in the same space, which can be communicated in a more effective way if exchanged directly between the avatar's hosts, instead of communicating through a central server. When the user moves around other avatars, they can send their information as well as of other avatars within the range in a P2P fashion as depicted in Figure 5.2. For example, the avatars who are in the circle L1 can send information about all the avatars who are in L2 and they in turn about L3 as a dynamic intelligent caching scheme.

6. Methods of Implementation

6.1 Software Approach

Depth Perception and Artificial Intelligence: Depth perception allows for conversion of 2D images into 3D using algorithm. A browser which is smart enough to understand the difference between two colours, difference between the depth of two objects with the help of sensors. Such a browser is capable enough to understand if a still image is being displayed, if the objects in it are near the observer or away from it. For example, when we see the motion of a running animal on screen, the still image of this

animal is on the basis of the x and y co-ordinates. Now the same motion of the same running animal on a browser capable of perceiving depth, it can estimate the z coordinate of the running animal and display it appropriately. Due to which the user viewing this running animal can experience a 3D effect on screen. Artificial intelligence will be required for the latter implementation. This parameter will decide the extent to which the users on the client side may experience the 3D effect. The hardware required to implement such ideas may need some good research. Such a browser would give the developers and website creators new functionalities that can be adjusted as desired, to deliver their content matching the exact level of 3D effect required to make their content even more interactive and entertaining.

WebGL: Generating 3D graphics on Internet has become a reality by using WebGL which stands for Web graphics library. It is a JavaScript library for displaying interactive 2d and 3d content on compatible web browsers without the use of any plugins. It has been developed from OpenGL ES (Embedded Systems) 2.0. WebGL is capable of transforming static visual variables of shape, texture, size, colour, orientations, value and overall presentation of information into a 3D virtual space providing rich 3d graphics experience on the browser end. WebGL provides a mind blowing experience and function as a great data visualization tool that turns any normal data into a compelling virtual story.

6.2 Hardware Approach

3D lens: The benefits of this concept will be similar to that of a normal lens over a 3D glass. But this concept still requires more advanced research.

Hololens: It is Microsoft's take on augmented reality [2], which they call as "mixed reality". Using advanced optics, multiple sensors, and holographic processing that melds seamlessly with the environment. These holograms that are displayed can be used to display information, blend with the real world, or even simulate a virtual world.

Anaglyph Glasses: It consists of glasses of chromatically opposite colours like a combination of cyan and red. When used as a pair of glasses with different colours on either side they send two separate images to the viewer to create a stereoscopic image.

Polarized Glasses: 3D visuals are achieved by projecting two images simultaneously, one horizontally and other vertically polarized which causes a 3D effect.

Shutter Glasses: Stereoscopic image can also be created by blocking the view of one eye at a time and repeating this at very fast rates.

7. Technical Necessities and Obstacles

7.1 Internet Speed

Internet Speed is one of the primary obstacles for the full implementation of 3D Internet. These are in terms of limitation of bandwidth and access to a stable connection. As 3D Internet requires delivery of high end graphics and models, the requirement of high and stable bandwidth is mandatory. The report by "Speedtest Global Index" from 2021 [1] shows that the world average Internet speed is 12.5 M bit/s. This report shows that there are less countries with high speed Internet while others lack the necessary speed for 3D Internet. Therefore, even if some countries do have good speed, most of them would not be able to support 3D Internet due to which complete implementation of this technology is difficult.

7.2 Hardware

The current Internet which we use is in 2D form and thus requires a normal screen. When we transition from 2D to 3D Internet, we will also have to move from the traditional screens to the ones that are compatible to render 3D graphics. We will also require different separate tools to view these 3D images. Rendering of such high end models also requires high usage of RAM and GPU. Therefore, upgrading to this technology means an overall upgrade of the present system around the world.

7.3 Cost

As we see in the above two points, it can be easily concluded that the cost involved in the overall implementation of 3D Internet is high, which may discourage the masses.

8. Sustainability and Societal Concerns

The concept of 3D Internet once achieved in terms of implementation and management is going to attract many users out there who want a better experience while exploring the internet. The question here arises is when the future technological advancements are going to meet the technology requirements of 3D Internet. Technology is a domain that keeps on growing at a rapid phase which would in turn require a good sustainable solution or else the technology accomplishment achieved would be surpassed by something much better. But as 3D Internet is in demand not only by normal users but also by corporate businesses to see a better growth, there is a chance that this technology is not very far away from becoming a possibility. It will become the mainstream means of exploring the Internet while 2D Internet which is currently in use would be used by users who do not have access to the high tech developed hardware and technological advancements required for accessing 3D Internet.

3D Internet being a demanding technology nevertheless it's experience and business growth that it would bring to normal users and corporate businesses would have some societal concerns. Some such concerns are security as users would make use of devices and sensors like projectors and cameras which are easily hacked by hackers unless there is some kind of advanced growth in the security domain. Another concern would be to the environment as 3D Internet requires heavy processing power on the

hardware performance which means servers would require heavy inputs of energy and at the same time need adequate cooling. But this societal concern can again be solved by advancements in producing green energy and optimal performance of servers set up.

9. Conclusion

In this pepper we have discussed the general idea, future prospects, benefits, implementation methods and restrictions involved in revolutionizing the present quality of Internet to make 3D internet a possibility. We can see that 3D Internet is going to be the next mainstream as it will surely change the way how we perceive Internet today. The advantages and applications clearly surpass the cost associated with the implementation of this technology. The need of an intelligent and ubiquitous Internet for enthusiastic users can surely be fulfilled by 3D Internet. Businessmen and investors are aware of the true potential of the user friendly, interactive, productive and addictive market side of it. But due to many obstacles like hardware, internet bandwidth, cost factors and lack of research it isn't easy to implement. Currently the society has the capability to evolve the digital world to a much more versatile and intriguing version but it does need a lot of research and the required financial support for becoming a reality. It is also observed that businesses are aware of the 3D Internet's potential as the hype surrounding metaverses is taken into consideration as an indicator of interest for this technology. Finally, to make the 3D Internet a reality it is important and necessary to start and continue multidisciplinary research.

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