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Review of Effective Implementation of Augmented Reality using Internet WebAR

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Abstract: ***The growth of Mobile-based augmented reality is increasing tremendously, with the hardware-based Mobile AR and App-based Mobile AR limitations to cross-platform and need to download the app that can be found in the Mobile AR. Web-primarily based totally AR(WebAR) is a brand new improvement in phases of augmented reality. Presently there are some restrictions with the WebAR due to its compatibility issue, performance issue, and latency issue since the WebAR has recently evolved and needs enhancement to overcome weak computational efficiency which leads to slacken of WebAR applications. M-CORD is a powerful platform that allows to rapidly deriving cellular networks for better computing as well as reduction of latency. M-CORD determines how virtualization, slicing, and mobile edge computing can permit answers to construct out of many disaggregated components.***

Keywords: ***Augmented reality, MAR, Mobile edge computing, WebAR, M-CORD, 5G.***

I. INTRODUCTION

With the development of the emerging technologies of hardware and software, web-based Augmented Reality (WebAR) is taking part in it. Mobile augmented reality has been all around us for a long time. Mobile phones are gaining popularity all around the globe and through convergence with digital cameras, music players, and PDAs; the revolution and advancement have reached another Level [1]. The MAR application can recognize and keeps the track of target image [2]. Users do not need to consider the implementation of recognition and tracking image technology. The potential of AR has just begun to be immersive and there is more opportunity than ever before to create compelling AR experiences [3]. Since AR has more creative performance, deep integration of AR with specific domains might show stronger competing power than general AR [4]**.**WebAR is considered to be an augmented reality experience that can be achieved using a web browser. WebAR enables smartphone users to discover AR technology most easily via the webpage without the burden of installation. WebAR offers simple animations, videos, and a certain degree of interactivity. Also, WebAR supports image target detection. Continuous image transmission owns a large amount of network bandwidth, which not only degrades the performance of core networks but also causes high deployment cost because of the ever-increasing bandwidth requirement [5].WebAR can be experienced on all devices that run Android 6.0 and above and have a gyroscope and accelerometer. So, nearly 75% of android devices can support WebAR**.** In the case of iOS, on the other hand, WebAR can be experienced on iOS 11 and above. Currently, the proposed web AR implementations can be classified primarily as pure front-end solutions using JavaScript at a mobile Web browser, browser-kernel-based extension solutions, or “browser + cloud” solutions. However, all these web AR solutions are also struggling with some problems [6]. The earlier technologies that already been deployed heavily relied on data centers that had to implement all the processor dependent tasks along with its core functionalities [7].The native cross-platform and lightweight features of the Web simplifies the profound services to be accessed by the users, thereby facilitating the large-scale promotion of Web-based applications among every individual. During 2017, the Web AR engaged developers’ attention due to the ever-increasing development of user device and mobile network that has emerged as a bright direction for Mobile AR [8]. A large amount of temporary data can be stored at the edge nodes to alleviate the pressure on the cloud bandwidth [9]. Nowadays, the Web has become one of the most pervasively used and fundamental infrastructures over the Internet [10]. Removing the need to search for and download an app helps in reducing the number of steps required for a user to take between awareness and experience, which is prominently important when the user wants to have the experiences on the browser.

Fig 1. Web-based Augmented Reality

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A. Set Up Needed For Webar

Previously, to experience any Augmented Reality (AR) content, users needed to download an application for specific usage that demanded heavy space also with high computing power. Gradually, as the technology developed there was a need for expansion in various fields. WebAR can be fully immersed in the web although it doesn't need an app. But there are some technical requirements to make a web page thoroughly AR worth. Initially, all the users handling Smartphones must have sensors like gyroscope, accelerometer, and camera. For as much as this can be found on modern Smartphones to run as major aspect of this technology. Moreover, your browser should support WebXR, an API that grants users while examine and explore AR/VR content without installing extra plug-in or software, and have AR Core installed (for Android devices).

Various frameworks can be found like, AR.js, ARtoolkit, Argon.js, Awe.js, Three.ar.js, and X3DOM these are the Javascript libraries that can be used to write code for providing a valuable approach to web-based AR via the web browser, also these Javascript libraries can run on any mobile browser with WebGL and WebRTC technique. The WebAR supported browsers are Apple Safari, Google Chrome, Microsoft Edge, Mozilla Firefox, Mozilla WebXr Viewer, and Servo. Google is recently into developing WebARonARKit and WebARonARCore, which are experimental apps for iOS and Android that allows developers to create AR experiences using web technologies. Mozilla has also declared its mixed-reality program. Mozilla is working on WebXR (https://github.com/mozilla/webxr-api), which focuses on making it easy for web developers to create web applications that adapt to the capabilities of each platform.

B. What Makes Webar Fell Real?

Through years much advancement has been made and we can conclude that the requirements for putting up the WebAR are as:

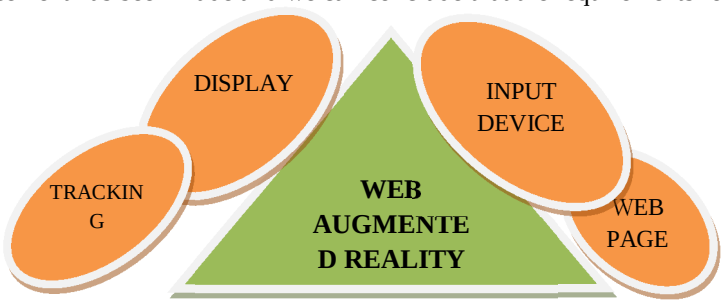

Fig 2. The basic necessity of WebAR

To have full usage of Web-based Augmented Reality via the Smartphone, with the use of a URL that opens up in a browser following are required: Motion tracking sensors must be integrated inside the user's Smartphone like Accelerometer for enabling the detection and changes in orientation for allowing the screen to rotate, Gyroscope helps the accelerometer and helps the digital assets to respond correctly. The Display of the content includes a camera that supplies a live feed of the surrounding real world upon which AR content is displayed. Input Device techniques include a speech recognition system that translates a user's spoken words into computer instructions or gesture recognition. And a web URL for providing access to a web browser.

II. LITERATURE SURVEY

A. Mayank Krishnatre , Punyatoya Soumya Darshinee, Meenu Kumari, (2014) concluded an application is made to simply capture the image/face from the real world while positioning the camera to the person or any object to make the underlying platform identify/observe it, fetch the information from the database and superimpose it on the camera screen. Two major problems were implemented in the design i.e. the retrieval process and efficiency of the recognition algorithm.

B. Qingfeng Zhang et al. (2014) a generic framework which includes three parts: MAR application customizer, MAR server, and MAR observer, a versatile observer which is run on the smart mobile device to see the AR effect produced by the MAR application, a MAR server that provides network and data service for the MAR application, and a MAR application customizer which is used by developers to tailor their desired applications.

C. Mark Billinghurst, Adrian Clark, and Gun Lee (2015) Use of AR in various fields and its implementation with better solutions. The productivity of AR with use in more businesses will help the users to take advantage of virtual content in the real world and have a user-friendly experience with new emerging technologies, as if they're there with you, in your own space. AR has placed new ways for devices to be helpful throughout the day by letting the user experience digital content in the same way as experienced by the world.

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D. Haibin Ling (2017) explored the factors of AR to be used by the users in various standards. Having its usage in the field of various fields can become more convenient to develop techniques. With placing and positioning of assets makes the objects stationary even when the user moves. Rise of main developments such as simultaneous location and mapping (SLAM). This has provided key guidance for fusing virtual information into reality.

E. Pei Ren, Xiuquan Qiao, Junliang Chen, and Schahram Dustdar. (2018) the success of WebAR contributed to the following aspects proposed a mobile edge computing(MEC) based collaborative Web AR solution allowing for the separation of the logical and computational tasks which in turn give lightweight WebAR solution along with bandwidth benefit. Also, image transmission introduces external latency and power consumption to the device. WebAR services made possible through the use of Docker which makes the deployment more flexible. By the study, this can be concluded that the MEC framework provides better solutions since it is closer to the users, Along with an increase in the bandwidth

F. Xiuquan Qiao Pei Ren, Schahram Dustda, and Junliang Chen (2018) found out that the impact of MEC has enabled in this technique as it provides more efficient servicing of the follow-up web AR requests. The ORB image matching algorithm is applied to image matching processes. The resource packaging layer is responsible for the WebAR resources at the remote cloud side. Experiment results in an increase in frames per second, a reduction in latency, and an increase in power consumption. Discussed challenges and future directions for 3G/4G and 5G networks, which can be helpful to demonstrate more flexible and efficient technologies in the WebAR framework

G. Kathiravan Srinivasan, Nitesh Kumar Agrawal, Aswani Kumar Cherukuri, Jennifer Pounjeba, (2018**)** explained about the explained how M-CORD helps in reducing the CAPEX and OPEX which in turn allows the service providers to more efficient services at the same costs without having to worry about the additional costs which are responsible for enhancing QoE. Also, with the increase in the bandwidth requirements removes the barrier within the network to make use of less power.

H. Xiuquan Qiao, Pei Ren, Schahram Dustdar , Huadong Ma, and Junliang Chen (2019) the study shows how impactful AR service is run on a MEC platform. As it has advantages of pose tracking and increases in the bandwidth by the migration of the services to the mobile devices and edge servers. The amplification of the contrast WebAR approaches been made, especially the adaptive and extensible combined distributed solution which approve the osmotic computing paradigm to provide Web AR services.

I. Haoran Yan and Xiuquan Qiao. (2019) with the use of Docker container technology in its architecture, designed to deliver the high computing tasks, storage quickly. Devices access the edge server using the API.

J. Xiuquan Qiao et al. (2019) the paper conducted the emerging technology 5G with the MEC, D2D communication for WebAR. The D2D communication of the 5G networks at the RAN results in the improvement of latency as well as FPS. Network slicing helped in maintaining the resources across the network.

III. RESEACH GAPS

Various studies have been implemented and their drawback leads to the use of efficient advancements in the network to eliminate the limitations within our current networks are:

Table 1. Preview of gap study

AUTHOR	NAME OF RESEARCH TOPIC	GAPS FOUNDED
Pei Ren et al.	A new era for web AR with mobile edge computing.	The analysis of the study showed that the author has used MEC based WebAR framework whose implementation while uploading images to the edge server adds to some extra amount of time.
Xiuquan Qiao et al.	Web AR: A Promising Future for Mobile Augmented Reality—State of the Art, Challenges, and Insights	By summarizing the study this has been found out that different WebAR implementation approaches were discussed in the paper that provided opportunities to apply and deliver WebAR applications
Haroran Yan and Xiuquan Qiao	Research and Implementation of Edge Computing in Web AR	Through the analysis of this paper corresponding result can be seen such as the implementation of the SURF algorithm which is lesser significant and efficient than the ORB algorithm in the image matching technique.

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The numerous research gaps get identified based on previous studies of web-based augmented reality, which when given a few more modification in the network may lead to tackle these shortcomings, focusing on the improvement in the network will eliminate many limitations within our current network and provide the reliable infrastructure necessary to render 2D/3D content to its full usage.

IV. PROBLEM FORMULATION

Since WebAR is still in its early stage, there's a lot more work to be done in the future. As the foremost and important drawback is the latency found during the usage of AR experience in the web pages. The pure front-end solutions lack computational efficiency, and the browser-kernel-based extension solutions are still in their infancy and have not yet been adopted on a larger scale. Also, the cloud-computing paradigm greatly extends the computing ability of the terminal devices and provides an opportunity for the promotion of web AR applications on users' end-devices with limited hardware resources.
Real-time target recognition and automatic tracking of objects are often used in AR, which requires powerful computing capabilities and ultra-low latency. Thus, the following measures need to be taken to counter the future problems of the rapid growth of data in WebAR.

A. Have a low latency, to keep the final total latency as low as possible with the network up-gradation.
B. Have sufficient bandwidth, for handling the data required by the user to increase the efficiency.
C. Be reliable, to have a prominent back-up solution if the link goes off or when the link is not available to the users.

Input and output processing on the end device of the users makes it more efficient as while processing AR content on the devices will remove the lag and provide adequate performance.

V. PROPOSED METHODOLOGY

A. How Work is to be Done

The proposed study implements the infrastructure of M-CORD with the WebAR to increase the bandwidth demand along with the reduction in the latency and increase in service expectations. As the main problem lies within the computation and Latency of the web browser producing AR experience to the users.

1) The M-CORD framework is basically built on the CORD infrastructure platform, which is an open-source solution that makes use of open-source software, and provide the efficient solutions and better performance with a reduction in latency and increase in bandwidth.
2) Support for mobile services at the network edge (MEC). M-CORD uses network edge it allows Service Providers to push all the core functionalities to the edge, while they have to dispense CORD across their edge and central clouds, through extending core services across multiple clouds..
3) The access network allows for the connection of devices to the Radio access network, which in turn provokes the core network slicing on M-CORD. The virtualized RAN makes the connection with the central office of the M-CORD which specifies the services that can be dynamically scaled. So, when the user points the camera and the video streams up it will recognize the image using the M-CORD the delay time will be now lesser than in the MEC and the computation performance will also increase. Also, the deployed network closer to the user eliminates the lag in the network.
4) The network framework utilizing CORD infrastructure will have more reliability than a normal network or a basic network.

The three key components of the M-CORD are as follows:
a) Disaggregated/Virtualized RAN
b) Disaggregated/Virtualized Core
c) Mobile Edge Services

M-CORD architecture is composed of commodity hardware and opens source components to deliver a disaggregated/virtualized RAN and Core. In a traditional mobile architecture, services are processed at the centralized core. This leads to overload on the backhaul, transport and core, inefficient use of network resources, deteriorated Quality of Experience for the end-users, and traffic. By contrast, in an M-CORD infrastructure, services are processed at the mobile edge this enables network efficiency and the ability to provide enhanced services that are customized to end-users.

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B. Flow Chart

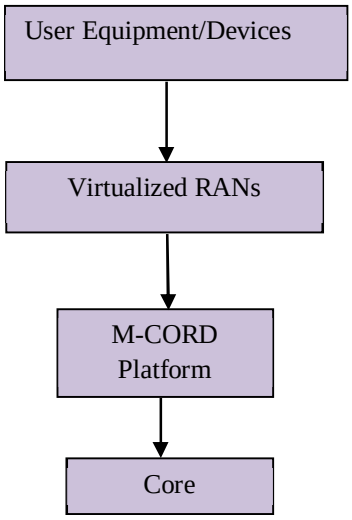

Fig 3. Overview of the System

VI. FUTURE WORK

Web-based augmented reality is still an emerging technology and a lot of innovation in this technology can engage developers and designers. However, there is still a lot of work needed to be completed to further stimulate WebAR. A combination of 5G with M-CORD in the utilization of WebAR will provide enhanced download and upload speeds, as well as moderately lower latency compared to 4G/3G with latency falling off from 10 milliseconds to 1 millisecond. Marketing is an industry that will have the highest growth rate with the implementation of WebAR.

VII. CONCLUSION

The Mobile - Central office re-architected as a datacenter (M-CORD) is an innovative advancement within the network to provide the solution that maintains the perfect balance between coverage, latency and cost by gaining the concepts of SDN, NFV, and cloud technologies. The large association of computing, and storage resources placed closer to the users helps in delivering the augmented reality content with more readiness and veracity and eliminates human observable lag in the network.

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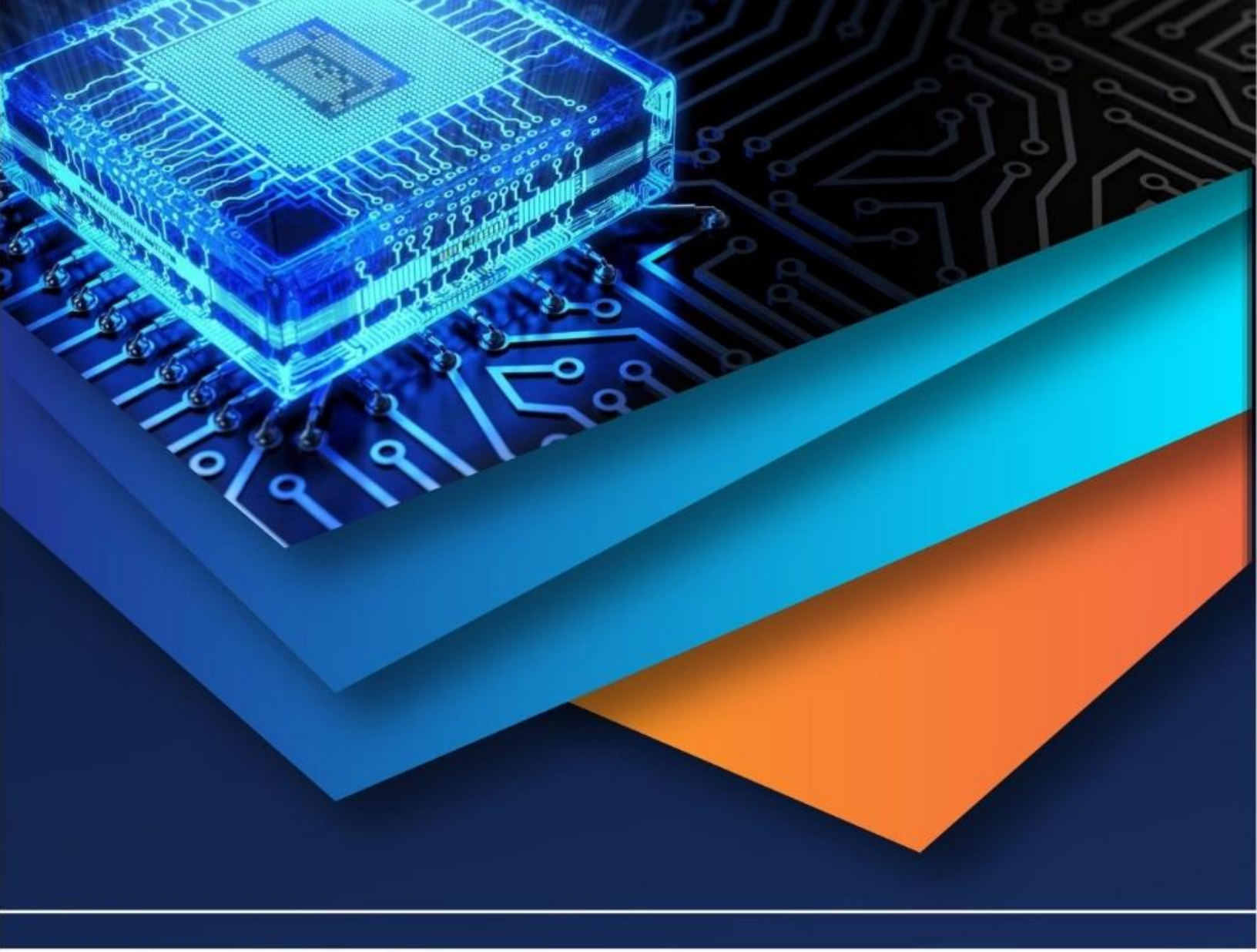

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