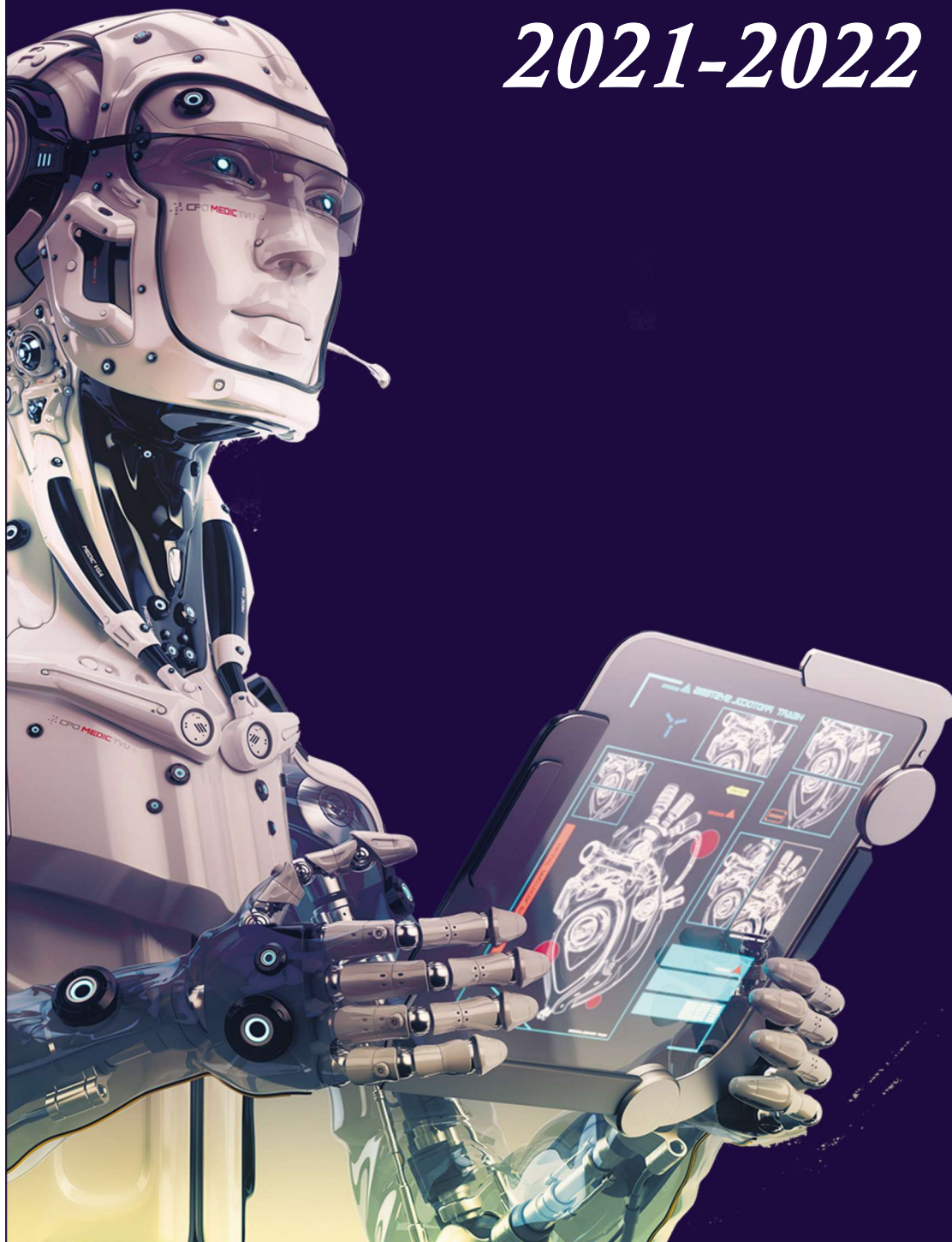


BHARATI VIDYAPEETH'S

Technical Magazine

2021-2022



COMPILATION OF BEST RESEARCH PAPERS

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ANALYSIS OF WEBRTC USING MESH ARCHITECTURE

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ABSTRACT

Throughout the COVID-19 pandemic, WebRTC has grown in popularity and utilization. Remote communications became necessary as a result of quarantines and work from home, initiate billions of people in the usage of video calling. As a result, there has been an increase in the use of WebRTC. In this paper, we take a closer look at the performance of WebRTC in Mesh Network i.e., Multiple Connections and see how it performs, we will also find is WebRTC scalable in a Mesh Network. In this study we have developed and Implemented a Server and Client Application. A WebSocket server is used to implement the server application. The client application shows how to communicate in real time using the WebRTC API.

Keywords: WEBRTC, Mesh Architecture, Performance Evaluation.

I. INTRODUCTION

WebRTC (Web Real Time Communications) is a project that was started by google. In 2011 it made its first initial release. It is a collection of framework and libraries. WebRTC is an open-source communication technology that may be used on both mobile and desktop platforms in browsers and independent apps, WebRTC (Web Real-Time Communication) is a technology that enables Web applications and sites to capture and stream audio, video media, as well as to exchange arbitrary data between browsers without requiring an intermediary. WebRTC can also be used in real-time communications apps with the help of the WebRTC API suite. WebRTC today is available in all modern browsers such as Chrome, Firefox, Brave, Safari, etc. Because WebRTC is largely based on peer-to-peer connections, it may be utilized to create decentralized streaming apps. As a result, when developing apps that operate across numerous devices and make use of audio, video, and graphics, the complexity is reduced.

The WebRTC API is designed around three main concepts:

MediaStream: The MediaStream provides the functionality to access camera, microphone or screen using javascript.

RTCPeerConnection: The RTCPeerConnection takes care of the NAT traversal, Codec processing, SDP negotiation, Media transferring and much more on handling the secure connection between peers.

RTCDataChannel: The RTCDataChannel allows to setup bidirectional data transfer channel between peers.

WebRTC has been utilized to give solutions to distant communication in a variety of domains, including video conferencing, online gaming, and online medical care.

II. LITERATURE REVIEW

WebRTC multi-party architecture:

Multipoint Conferencing Unit (MCU): A star structure is formed by a server and several terminals. Each terminal transmits the audio and video streams to the MCU server to be shared. The MCU server combines the audio and video streams of all terminals in the same room, creates a mixed audio and video stream, and distributes it to each terminal. Each terminal may therefore see and hear the audio and video of other terminals. In reality, the server serves as an audio and visual mixer. This solution puts a lot of strain on the server [4].

In MCU the increasing number of nodes affects the performance of MCU Host. The Network Bandwidth consumption is low.[1]

Selective forwarding unit (SFU): This system also includes a server and several terminals. The SFU, unlike the MCU, does not combine audio and video streams. After audio and video streams is shared by a terminal, streams are routed immediately to other terminals in the room. It's essentially an audio and video transponder and routing system [4].

In the modern WebRTC applications SFU is used because it is highly scalable [2]. It has high operational cost as the CPU load is shifted to server.

P2P Mesh: MESH architecture is easy to implement and widely used architecture in the WebRTC applications. So we are going to deep dive into its architecture and performance.

III. METHODOLOGY

Experimental Methodology

A WebRTC video conferencing Application was built to test over Local Area Network. The implementation can be divided into two types:

- **Web Application**

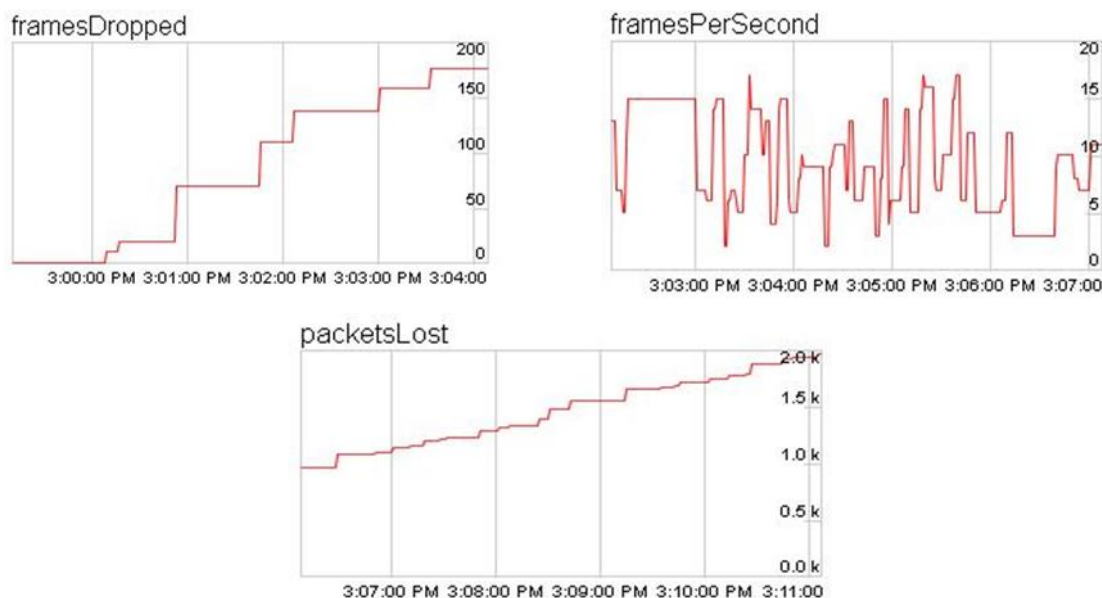
A WebRTC video conference application was build using Nodejs. The connection was made in a Local Area Network. This implementation's main HTML page has been programmed and set up for numerous capabilities such as establishing communication with multiple clients via Chrome, messaging between clients, and so on. Now we'll look at how the signaling offer and response are exchanged utilizing the SDP (Session Description Protocol). Client A first sets the local description using the `setLocalDescription()` method, then uses the `RTCPeerConnection create Offer()` function to transmit the session description to Client B through the signaling server. Second, Client B uses the `setRemoteDescription()` function to set the description that Client A delivered as a remote description. Client B sets the local description using the `setLocalDescription()` method, then runs the `RTCPeerConnection createAnswer()` method and sends this session description to Client A. When Client A receives the Client B session description, it sets it as the remote description using the `setRemoteDescription()` method. For example, after being deployed on a network, the server will enable WebRTC peer-to-peer communication sessions.

- **Signaling**

The WebSocket technology is used in the signaling implementation. It creates four sorts of control messages in our signalling solution: initiator, acquiring media streamer, peerChannel, and exchange SDP. Client A will first make the request to the server, and then, after receiving the control message containing the access media stream, it will request that the server generate the user media. Client A is presently awaiting Client B's response. Client B will send a response signaling message until it is activated, and if it is verified that it is not the initiator, it will receive peer Channel first, followed by access media stream. Both parties can then start building a peer-to-peer connection. The offer and answer messages are transmitted in SDP (Session Description Protocol) format, which includes media type, CODECs, RTP (Real Time Protocol), RTCP (Real Time Control Protocol), and any other properties that may be utilized in a media session.

IV. RESULTS

We have performed the test in a mesh network. When the number of the client increases, the bandwidth and CPU requirements have become a serious issue in a mesh network. The test was performed on a Intel i3 5010U 2.10 GHz System over Local Area Network.



The mesh network used a lot more CPU power and the laptop did not manage to handle more than 4 users in the network. We have experienced exponential frame and packet loss.



The mesh network call worked fine for the first 2-4 members in the group chat, but beyond that, the latency skyrocketed. Due to the mesh architecture, providing audio to each user in the room consumes a significant amount of bandwidth because the sender must distribute the audio stream to each user in the network. As a result, the higher the number of users in a mesh network, the more bandwidth is necessary to transport data across the network. Furthermore, because browsers will be responsible for all encoding and decoding, each user's CPU load will be significantly increased. This explains the high CPU utilization and data rate of the mesh network in this study.

V. DISCUSSION

The mesh network call worked fine for the first 2-4 members in the group chat, but beyond that, the latency skyrocketed. Due to the mesh architecture, providing audio to each user in the room consumes a significant amount of bandwidth because the sender must distribute the audio stream to each user in the network. As a result, the higher the number of users in a mesh network, the more bandwidth is necessary to transport data across the network. Furthermore, because browsers will be responsible for all encoding and decoding, each user's CPU load will be significantly increased. This explains the high CPU utilization and data rate of the mesh network in this study.

VI. CONCLUSION

According to my testing and analysis mesh network works well for client < 5 (depending on the system). For large number of clients going with server-side approach like MCU, SFU is a best option. WebRTC has proved to be a valuable tool. Using a server to share data between peers might be costly. WebRTC Mesh takes care of that for you. It also eliminates the need to download and install different software or hardware each time you wish to join an online conference or participate in a virtual event. For the future we will suggest presenting efficient method for communication over WebRTC Mesh.

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Improving Smart-Glass: Feature Security

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ABSTRACT

During the last years, the developments of the most recent media have revolutionized individuals' behavior staggeringly. notably mobile devices have developed an 'everywhere and invariably on-line' mentality. However, what comes next? Recent developments and forecasts propose the increase of a contemporary technology that is termed 'Wearable increased Reality Devices', wherever Sensible glasses (such as Microsoft Hololens or Google Glass) represent distinguished examples. These technologies supply generous potential for societies and companies, that area unit mentioned throughout this paper. By doing so, this paper provides re- searchers and managers with an applied description of the technology and a discussion of how it differs from existing mobile and augmented reality technologies. Eventually, a discussion of how Sensible glasses will intensify firm price is provided

KEYWORDS

Sensible glasses, increased Reality, Media Evolution, AR, automation Wearables.

INTRODUCTION

The event of information and communication technology, numerous sorts of wearable devices which might replace smartphones area units receiving awareness. A wearable device's area unit is out- lined as "all devices capable of computing which might be worn on the body, as well as for applications that entail computing functions". Wearable devices' area unit planning to be used for numerous functions through the installation of applications accessible on a mobile computer code (OS), thereby providing numerous functionalities in addition to those associated with fashion and fitness. Smart glasses are a kind of wearable device which might be worn on the face, and they meet the initial objective of clearer vision in addition to functioning as a pc. Since Google discharged "Google Glass" in 2012, corporations like Sony, Epson, and Microsoft have launched their own sensible glass product, which gives the specified data to users through a show among the types of external glasses or binoculars (spyglass) . They hold up wireless communication technologies, like Wi-Fi and Bluetooth, and may be accustomed to searching and sharing data in the period through an online association. In addition, by providing a location following performance through the worldwide Positioning System(GPS), it's doable to develop numerous applications that support location statistics. As AN interface for communication between sensible glasses and users, barely a button or a language command process methodology supported by voice recognition is work. By using a camera mounted before the device, it's doable to accumulate images or video information of the encircling surroundings in a period.

AUGMENTED REALITY SENSIBLE GLASSES

Definition, Conceptual, social control Importance, and Insights

THE MERGING OF 2 WORLDS

Smart Glasses, like Google Glass or Microsoft Hololens, have recently gained increased awareness. Loosely, smart glasses unit a replacement wearable enhanced reality (AR) device that captures and processes a user's physical atmosphere and augments it with virtual components. Recent forecasts predict that smart glasses will significantly influence our media behavior, and analysis institutes propose tremendous growth rates. For example, Technavio (2015) expected growth rates of nearly 200 p.c in the future five years, and Jupiter analysis (2015) forecast-ed 53.2 billion retail revenue of smart glasses by 2019. In line with these forecasts, new startups specializing in smart glasses are primarily unit based. As a final purpose, customers and media discuss the advantages and potential concerns of this technology for individuals, and societies as a whole. There is a massive potential for smart glasses to make prices for purchasers, companies, and societies as a whole, surprisingly little analysis has been written. Not surprisingly, lecturers and managers alike demand early market information to raised understand the mechanisms that drive this promising technology (Rauschnabel et al., 2015a, 2015b, Olsson et al., 2012) in- formation relating to new technologies is significant in the first stages of the diffusion, as this data might increase the chance of created implementation, decrease the chance of product failures, and thus increase diffusion momentum (Attewell, 1992). Likewise, early information can provides a bonus for companies world organization agencies might increase efficiency by victimization smart glasses, and jointly facilitate policymakers that concentrate on laws that cowl the precise characteristics of smart glasses

– e.g., that smart glasses might distract people from driving AN automobile, or that carrying smart glasses

publicly might violate privacy and copyright laws

DEFINITION OF INCREASED REALITY SENSIBLE

Glasses Augmented Reality smart Glasses area unit created public as wearable hyperbolic Reality (AR) devices that area units worn like regular glasses associated merge virtual information with physical information in associate degree particularly user's browse field. smart Glasses area unit typically worn like glasses, or area unit devices mounted on regular glasses. several technologies (e.g, camera, GPS, microphones etc.) capture physical information and augmented them with virtual information which can be gathered from world wide web and/or hold on the smart glasses memory, primarily accomplished through location, facial, object, facial, and image-based recognition technologies. This virtual information is then shown in large amounts on a show, which, in brief, may be a plastic screen before a user's eye(s). A user can see everything offline then the virtual then the real-world through these displays outstanding samples of smart glasses area unit Microsoft Hololens or Google Glass.

SORTS OF SENSIBLE GLASSES

1. Google glass: Google Glass may even be a hands-free device that is used for smarter and quicker active work. Google Glass was developed by Google X providing the ability in Google dedicated to technological advancements like driver less cars. Features of Google Glass :The Touchpad is available on the aspect of Google Glass that enables users to manage the device simply by swiping through a timeline-like interface that is displayed on the screen. Swipe back can permit you to know the present events like weather, and swipe forward can show you past events like updates, phone calls, and photos.
 - The adventurer version of Google Glass makes use of a liquid on chemical element, field-sequential color system, diode light show on that.
 - Google Glass is actually used beside a smartphone and one its main uses is to show notifications in acceptable and fast means.
2. Vuzix Blade: Vuzix Blade may be a skinny AR smart Glasses that is supercharged by Industry leading waveguide optics. Vuzix blade balances academic degree enterprise and customers demands. It's principally built for keeping records in trade operations and is supposed to be comfortable all day. it'll boost the accuracy and efficiency following the step by step directions at the work. It consists of academic degree High Definition Camera, Noise canceling mic, full-color, wireless WLAN, actinic radiation protection lenses, twin tactual feedback, polyglot voice management and micro SD enlargement.
3. North Focals North Focals when its launching became a triple crown AR product inside the market. they're on the market with an eminent look and incorporate most of the options that the opposite computer code of an increased Reality product has in it. It acts rather sort of a smartwatch wherever it will perform associate degree extension of your phone by sanctifying and should access Alexa and auto responding to the text messages. it's like magic with North's Focals. they seem like each alternative traditional glass that is an incredible feature it contains. The closest contender of Focal is Vuzix Blade. you will be ready to perform each activity in Focal by using a Loop in it which can be a separate accent that comes beside it. it's primarily a hoop that contains a pointed finish with a joystick on the best aspect of it. it's totally tiny that no-one cannot notice it on your finger and you may move the joystick for looking through various columns inside the interface and would possibly

faucet it for capital punishment actions.

APPLICATION OF GOOD GLASSES TECHNOLOGY

Location Services: Using increased reality for location-based services aids multiple edges from the user's purpose of reading. we'll overlay digital information which will contain digitized animations, photos and alternative information over real and physical houses. it's accustomed collect increased reality technology with location-based sensors, geometer and GPS, you will be able to truly use its power. Few examples

- Wikitude
- Google Translate

Gaming: AR is functioning nicely among the recreation trade and it's been around America for years. it's all concerning overlaying computer generated pictures giving a real read. increased Reality apps that work from interactive maps that superimposed the virtual panoptical for large multiplayer skirmishes. variety of absolutely the best used increased Reality apps area unit :

- Sketch AR
- Pokémon Go
- Google Translate

In 3D cinemas users wear glasses. By substituting those glasses with good glasses the cinema expertise for the audience would be improved. It is also used for video game cinema expertise. The users may confirm what they are seeing is betting on their head position. Another massive market could be virtual and augmented reality games. Particularly increased reality games may reach a broader audience than those that play games these days as a result of they'll not be contending outside and be supported by interaction with others to boost virtual objects.

Commerce: Commercial billboards and advertisements posters may be shown with video. A show advertisement's poster may be intensified with a trailer of the show if the user is wearing appropriate glasses. good glasses technology with identity verification computer code may facilitate staff acknowledge the shoppers and show their statistics. Customers enter into stores with good glasses to show all the knowledge concerning the product and it conjointly facilitates them to navigate what they need within the store faster. This information may be accustomed to confirm the worth of the number of clients visited into these houses.

Sports: During most sports one does not have much time to devote to a computer and it's not possible to use one's hands to act with the device. The information that is helpful for a private doing sports would be performance mensuration, performance comparison, per- haps navigation, notifications concerning weather or messages so forth. the data area unit usually presented the user while not distressful the sports activity through the site. The good glasses may even be accustomed to take photos or video throughout sports activated by a speech command.

Education: Virtual reality glasses may be accustomed to teach history by permitting the scholars to look at historical sites not solely through textbooks however during a virtual 3D world within which they may move around freely. Thes

glasses are accustomed to produce simulations for coaching. The examples are going to be enclosed like driving simulations, flight simulations and conjointly military coaching training preparation grooming or surgery training. It's beneficial to be hot in those activities during a safe environment.

LITERATURE SURVEY

Google glass is an optical head mounted display developed by Google in Google x laboratory in California to use the android os. It records the cinema, video confluence between them in edge contact, map, and certain information. In[4] the author has come up with an edge of this fashion is that it both interfaces the re- quest to the computer and informs the informal mate as to the wear and tear and gash’s use of the appliance. In[5] the author has defied the provocation and concluded that 4th and 5th generation digital eye glass will prove farther fruit-bearing than other automation as the difficulty of the explanation of cinema in camera, objects out from the range of shaft light are also clear. Author has made an approach with a plan of using a digital eye with wearable computing which will grease the author. In display technology Steve Mann to delving the counting visual memory. Shimpali Deshpande has checked the automation used and has got the check of the automation used in Google glass.

Fig. 1. Privacy Issues with Wearable Device.[1]

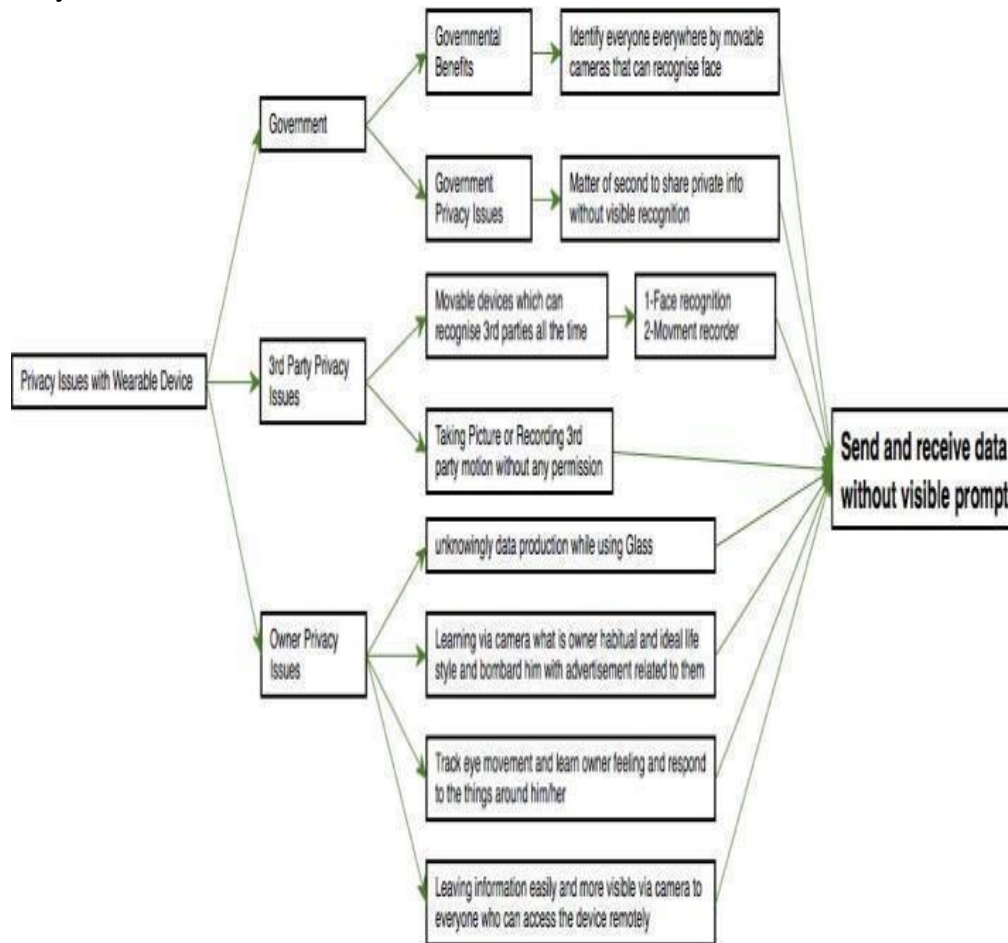
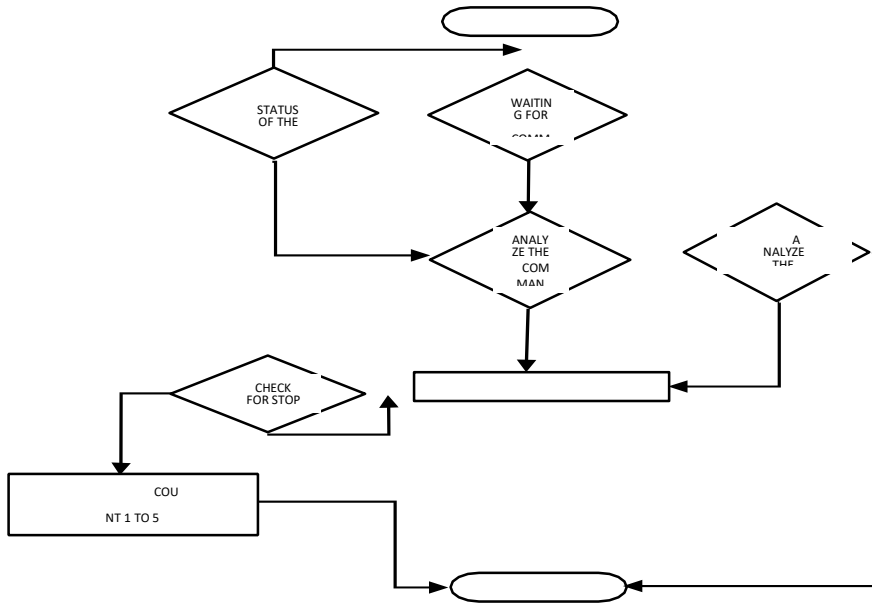


Fig. 2. Showing Notification line for 5 seconds during and after taking picture or video with Glass[1]



ACKNOWLEDGEMENT

We’d like to express my special thanks of gratefulness to my companion Prof. Nidhi Panghal who gave me the golden chance to write this important paper on the content perfecting smart glass point and security, which also helped us in doing a lot of research and we came to know about so numerous new effects & technology , we are really thankful to them.

CONCLUSION

In this paper we studied about the smart glasses technology and their types. Then we also presented the varied Flow chart briefly. Thereafter we have also presented the applications of the smart glasses technology systematically. From these studies it’s clear that there are many more interesting applications which can be easily implemented with smart glasses than with traditional computing devices.

It is to be expected that there will be large investments into research and development of smart glasses because the industry, education businesses can enjoy smart glasses and there is also a high consumer for them soon in coming years. Nevertheless the model is obtainable today are very promising and it’d happen that smart glasses are visiting be a component of our future standard of living for current generation

DISADVANTAGES

May take a toll on vision:

Google warns potential Glass users they will feel eye strain or develop a headache when wearing the device rather like when wearing normal glasses. Google also warns people who've had Lasik surgery to check with their doctor about the potential negative impact Glass may wear on their eyes. And if your age is under 13 years old, wearing Glass could harm developing vision. Could be a distraction:

A new study has found that cups may curtail your natural sight. This can be extremely dangerous because it should create blind spots that undermine safety while you engage in everyday tasks like driving or walking. The study compared wearing Google Glass with regular glasses and determined there's a "clinically meaningful" loss of vision within the upper-right quadrant which could potentially cause an accident. Not everyone is on board : The screenland recently banned Google Glass from being allowed inside theaters and other businesses could imitate. The potential of being recorded without knowing so has made many folks skeptical of Glass wearers and you will be shunned for embracing the technology. You will also face ridicule from others who simply "don't like" Google Glass research and development of smart glasses because the industry, education businesses can enjoy smart glasses and there is also a high consumer for them soon in coming years. Nevertheless the model is obtainable today are very promising and it'd happen that smart glasses are visiting be a component of our future standard of living for current generation.

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Progressive Web Apps vs Responsive Web Apps

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Abstract: *In this research paper, we will investigate the browser compatibility of PWA features and compare and analyse the performance and memory consumption of PWA features compared to responsive web apps. In 2015, the term Progressive Web Applications was coined to describe an application that takes advantage of all the features of a progressive app. Some of the key features include offline support, an app-like user interface, and secure connectivity. Since then, case studies of PWA implementations have shown optimistic promises to improve web page performance, time spent on websites, user engagement, and more. The report is to compare PWAs and RWAs and analyse some of the impacts of PWAs. The results show that many of PWA's features are not yet supported by some major browsers. Performance benchmarks have shown that the https connection required for the PWA slows down all PWA performance metrics on the first visit. With repeated access, some PWA features such as speed indexing are better than RWA. PWA storage consumption has more than doubled its RWA size. In conclusion, there may be a workaround even if some features are not directly supported by the browser. If https is not optimized on the web server, the PWA will be slower than a RWA. Different browsers have different storage limits for PWA caches.*

Keywords: Pattern Recognition, Security, Algorithms

I. INTRODUCTION

The world is moving towards smartphone applications and total activity on mobile phone through web browsing or through app is almost close to 67% which the recent survey had identified. Most of the time the user had been spend in browsing the site through the web browser of smartphone. The interface of most of website are not auto responsive in mobile web browser, the user doesn't feel good about the contents while browsing the application. Even though the mobile browser are trying to become full fleshed software platform, Still as of today the mobile web application struggles to provide eye pleasing and satisfactory experience to the user because of lack of strong network connection across the various area.

Therefore, Progressive Web Apps(PWA) is a new technology designed and developed by Google to overcome the limitation of mobile browsing and native applications. PWA can be launched by clicking on an icon on the home screen of the device just like how one goes with native apps [1],[2],[3]. PWA's get instantly loaded on screen regardless what kind of network connectivity is available in area they support the splash screen through push notifications [1],[2],[3].

PWA are an open-source initiative that uses the most up-to-date web capabilities to offer app-like capabilities to users, without them having to download an app. They are more reliable even in the flaky network, have a faster response time to the user's interaction, and are more engaging to users as compared to the responsive websites.

PWA's are dependent, takes up less storage space and updates just like a web page- so that the users can see the update functionality which may include such as Bluetooth, webcam, microphone and other hardware sensors [1],[3].

Responsive Web Apps(RWA) is a name given to the set of techniques applied at the level of the layout, so that it allows a website to adapt itself to any device or width of screen. Another name used to describe this set of techniques is "Adaptive Web Apps". According to Harry Roberts and Paul Gordon, this name would match more since "the website really adapts to the device, rather than responding continuously to changes in its environment" [4]. Users always seeking for better experiences at your site no matter what types of devices they have been used and what type of network they have been but they expect better experiences. You need to be set certain strategy which meets users' expectations, unrealistic they may be. Responsive webs make a strategy which completes the expectations of people while working well on devices but not sufficient enough [4].

Section II written on Literature Survey of PWA and RWA. In Section III, Methodology mentioned comparison of PWA and RWA followed by Section IV. Result and Section V Conclusion.

II. LITRATURE SURVEY

For a few years it looked like the old, dirty mobile Web was going to die. Adaptive and responsive design came to make full websites look good on mobile with rich and immersive experiences. The “mobile” bit was going to be stripped out and all we were left with was the Web, in all its glory, from any device we decide to access it. But it now looks like the mobile Web is making a comeback. Instead of breaking down barriers between the mobile Web and the full Web, a group of technology companies is working to try and make the mobile version of the Web faster. Native Apps on mobiles are fast whereas the mobile websites are comparatively slow.

In 2016, this particular problem of Web and native App was prime conversation during all the discussion and conference. Researcher around the world was planning to launch a new way of programming which will help fill this gap of Web and Native Apps. Putting by a summary, PWA launches as a new tab in browser and progress similar to like “app” where most of the people are used for native app. We can have various pin points so that one can go to home screen or an application from the app drawer by using notifications and also by using offline access. PWA are just like native app in terms of security and full touch responses.

PWA repair this problem with new internet APIs, new design concepts, and new buzzwords. Progressive Web Apps offers the functions we have come to expect native app for cell browser. It makes use of standards-primarily based technologies and runs in a comfortable field accessible to everybody at the web. In spite of the availability of a totally advanced mobile web app, it's nevertheless hard to provide fun and satisfying user experience, especially because of lack of strong network connection in many distinctive regions/fields. Consequently, Google designed and developed PWA as a new technology to triumph over boundaries of cell browsers and native programs.

RWA are a holistic approach to improving user experience across devices. Since the release of the iPhone in 2007, there has been an explosion of devices capable of displaying web pages. The mobile app technology has a come long way from running only on specific devices to those that are compatible with all platforms. The case with progressive and responsive app is no different that are now being widely used apps by businesses. Both progressive and responsive web apps have their own merits and demerits so choosing one or the other might be challenging for your business requirements [6].

III. METHODOLOGY

Comparison of PWA and RWA is represented in Table 1, the fields of comparison are as follow :-

1. Push Notification - Push notifications are small, pop-up messages sent to a user’s device by a mobile app that appear even when the app isn’t open. These notifications are designed to grab attention and can convey reminders, updates, promotions, and more
2. Adaptive - Adaptive web design (AWD) promotes the creation of multiple versions of a web page to better fit the user's device, as opposed to a single static page which loads (and looks) the same on all devices or a single page which reorders and resize content responsively based on the device/screen size/browser of the user.
3. Add To Home Screen - Add to Home screen (or A2HS for short) is a feature available in modern browsers that allows a user to "install" a web app, ie. add a shortcut to their Home screen representing their favourite web app (or site) so they can subsequently access it with a single tap.
4. High Loading Speed - Page speed is a measurement of how fast the content on your page loads. Page speed is often confused with "site speed," which is actually the page speed for a sample of page views on a site. Page speed can be described in either "page load time" (the time it takes to fully display the content on a specific page) or "time to first byte" (how long it takes for your browser to receive the first byte of information from the web server).

Table 1 is comparison between PWA and RWA.

TABLE I

Field	PWA	RWA
Push Notifications	Just like in an application, every push notification is specific to the users.	On the contrary, RWA does now no longer offer the consumer with the ease to subscribe and get notifications.
Adaptive	The responsive design of PWA is efficient and capable to run on any device.	In the case of RWA, you want to increase separate code for diverse gadgets and systems making it highly-priced and tricky.

Add To Home Screen	With simply the house display icon, PWAs will stay immediately at the smartphone display.	The comfort of including the app to the house display screen is absent in RWAs.
Convenience	In continuation to the above point, PWAs are more convenient than RWAs	RWAs lack the features and connectivity criteria, compromising the user experience.
High Loading Speed	PWAs provided over RWAs is their amazing speed. The mechanism and the usage of 'App Shell' makes the process faster.	RWAs do not use 'App Shell' which makes the loading and running of data on mobile phones a longer and tiring process.
Advantages	1.Budget-Friendly 2.Easy to Maintain 3.Smaller and Lighter 3.Offline Support	1.Development at lower costs 2.Lower maintenance needs 3.Higher conversion rates 4.Improved search engine optimization as quality content

IV. RESULT

Responsive web apps are a comprehensive approach to deliver a better customer experience on various devices. When mobile devices became popular, responsive web design was the first logical move to make websites more useful for mobile users. It has also rapidly become a fundamental necessity for new websites, and almost most of the web designers have adopted it to provide a seamless digital experience to the end-users.

Responsive web apps could not deliver additional features like offline service, push notifications, or other native app-like functionality that users anticipate from their smartphones. These features are necessary from the marketing perspective to bring user engagement and conversions. This, in turn, enforced businesses to move towards progressive web applications to transform RWA to PWA.

The web page is just the beginning of PWAs, and where it's separated from responsive web apps is in its functionality. The more user involves in the functionality layer of progressive web apps the more it feels like native apps and easily differentiate responsive web.

PWAs are dynamic and can be personalized according to user's needs like push notification, option to enable locations, camera access and even the ability to add the mobile experience to the home screen. User don't have to download PWAs, with Google's full support of PWAs, they're accessible through the google or add home screen icon directly through Android.

V. CONCLUSION

We have compared progressive web apps, responsive web apps they have their own advantages and disadvantages. However, determining which application suits the requirements is important. If a consistent mobile experience is required, then progressive web apps are the ideal choice, and trying to improve site speed and accessibility for most users, responsive web apps may be a better option.

The performance uplift achieved with service workers as mentioned in section 2, combined with additional app-like features such as push notifications, add to home screen, all prove to make PWA the suitable candidate for being the next evolution of the Web. As of now, the PWA movement is already widely encouraged by almost all of the big companies, including Microsoft with their push of PWA adoptions in Windows 10/11. It won't be long now before we see a future full of Progressive Web App

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Hybrid Approach for Scraping HTML within JSON Structure

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Abstract: *Web scraping is a technique for extracting unstructured information from a website and storing it in a structured format. Scraping is an important approach for autonomously retrieving third-party data. For example, If you want to see all of the available transportation on a specific day, you may have to scrape travel websites to gather the information you need. In this research paper, we are attempting to scrape a website that has a JSON structure but also includes an HTML format that must be scraped along with the JSON data. Doing scraping with RegEx for HTML and JSON extraction is a technique for collecting data from these types of websites. To scrape JSON data, we must first get a JSON response and scrape data using key value pairs and then use RegEx to retrieve information from HTML contained within that JSON structure.*

Keywords: JSON, RegEx, Web scraping, Hybrid scraping, scrapy, HTML scraping, Data extraction

I. INTRODUCTION

The technique of obtaining data from web pages is known as web scraping. Some online data is offered in a format that makes it easier to collect and use information, such as downloadable comma-separated values (CSV) datasets that can subsequently be imported into a spreadsheet or loaded into a data analysis tool. Data is frequently not easily available for reuse, regardless of the fact that it is publicly available. It could be in a PDF, a table on a website, or scattered across numerous web pages. Web scraping is used for a variety of purposes, including market research, sales, advertising, finance, and ecommerce. It is frequently used to learn more about your competitors.

Scraping a website to extract information for reuse can be done in a number of ways. In its most basic form, this can be accomplished by copying and pasting snippets from a web page; but, if there is a big amount of data to be extracted, or if it is dispersed across a large number of pages, this may be impractical. Instead, specific tools and techniques can be used to automate this process by specifying which sites to visit, what information to look for, and whether data extraction should stop when a page's end is reached or continue following hyperlinks and continue the process recursively. Web scraping can also be automated to determine if the procedure should be repeated at regular intervals and to catch data changes. Web scraping can be done in two ways: one by visiting www via HTTP via a web browser, and the other by using a bot or web crawler.

Scraping the website, on the other hand, is unique, and every website has its own manner of populating data on the page. HTML, API calls, and XML formats are only a few possibilities. But what if the data on the website is populated using a variety of formats? In the research paper, there is one case that is examined. It is a unique way in which a HTML is embedded within the API call. The data will be extracted via the API, and the HTML data will be retrieved. To scrape this type of website, we'll use Python to extract data using key value pairs, followed by RegEx to parse HTML data that is present as a value in one of the keys.

1.1 Abbreviations and Acronyms

	Abbreviations and Acronyms
API	Application Programming Interface
RegEx	Regular Expression
HTML	Hypertext Markup Language
XML	Extensible Markup Language
DOM	Document Object Model
JSON	JavaScript Object Notation

II. LITERATURE REVIEW

Before we get started on the paper, let's go through basic web scraping strategies.

A. HTML Parsing

- The HTML parser is a tool for processing structured markup. It creates the HTMLParser class, which is responsible for parsing HTML files.
- JavaScript is used to parse HTML pages that are either linear or nested. It is a method for resource extraction, screen scraping, and text extraction that is quick and reliable.

B. DOM Parsing

- The Document Object Model is a style structure and content specification for XML files.
- Scrapers employ DOM parsers to gain a detailed look at the structure of a web page. They can also employ a DOM parser to extract nodes holding information, and subsequently scrape web pages using a tool like XPath.
- The full web page or simply parts of it can be extracted using the Firefox or Internet Explorer browsers.

C. XPATH

- A query language for XML documents is XML Path Language. Because of its tree-like structure, XPath may be used to browse XML documents by choosing nodes using various parameters.
- To scrape a complete web page, XPath can be combined with DOM parsing.
- XPath is a technology that selects nodes or node-sets in an XML text using path expressions.
- Even though it is not a programming language, it allows you to define an expression that points to a specific HTML element or tag attribute without having to manually crawl over any element lists.

D. Text pattern matching (RegEx)

- RegEx is a pattern matching mechanism that matches certain patterns based on provided combinations which can be used as filters to obtain the desired output.
- RegEx may validate any character combination, including special characters such as line breaks.
- Regular Expressions are a type of expression that can be used in any programming language.

III. METHODOLOGY

Obtaining web resources and then extracting necessary information from the acquired data are the two consecutive processes in the process of scraping data from the Internet. A web scraping method begins by composing an HTTP request to obtain resources from a certain website. This request can take the form of a URL with a GET request or a POST request in an HTTP response. The requested resource will be retrieved from the website and then sent back to the given web scraping engine once the request has been successfully received and processed by the targeted website.

With the usage of an API, a website can sometimes make it easier for a user to have direct access to their data. This essentially means that the business has created a set of specialized URLs that deliver this information in its purest form that is without any presentation formatting. This unprocessed data is frequently in JSON format, which we may read and retrieve using Python. When it comes to websites that don't provide API data, all we have to do is scrape the information using HTML. The majority of web scraping is done with HTML. There are several methods for scraping data which includes DOM parsing, XPath, RegEx, and CSS selectors. In almost all circumstances, a small sample from a huge file is all that is necessary for example pricing information from an ecommerce page. As a result, looking through an HTML document for the correct information is an important aspect of scraping.

In this research we will look at one scenario in which the response contains JSON data as well as HTML data embedded within that JSON format

```

data : {
  arrTime: "1400"
  bagFilterCheckboxes: "no_baggage"
  comfortFilterCheckboxes: ["sms_ticket"]
  depTime: "0600"
  html: "\t\n\n<div
id=\"185d740221d8ca92ba61208dfef74e51\" \ndata-route-currency=\"CZK\"
data-route-name=\"<i class='mapshow icon'></i>\ndata-reserve=\"\"
\data-arrival-time-stations=\"\"
\data-arrival-stations=\"\" \ndata-departure-time-stations=\"\"
\data-departure-stations=\"\" \ndata-max_seats=\"10\"
\data-info-step=\"0\" \ndata-free_seats=\"1\" \ndata-allow-transfer=\"0\"
data-price_filtr=\"695.52\" data-distance=\"28800\" data-rating=\"4\"
data-bonus=\"42\" data-transporter=\"Cc21b3b6dd13591c404399a36a5dfcb4bC\"
data-deptime_filtr=\"0600\" data-arrtime_filtr=\"1400\"</div>\"
linkFilterCheckboxes: "hasNoLink"
price: "695.52"
rating: 4
transporterFilterCheckboxes: "Cc21b3b6dd13591c404399a36a5dfcb4bC"
}

```

Fig. 1. Reference Code to demonstrate html content present inside Json structure.

“Fig. 1” is an example of a one-of-a-kind scenario in which we have JSON data that we obtained from an API, and one of the parameters contains the html of that website. As you can see in the diagram, JSON data is made up of key-value pairs, much like a Python dictionary. In fact, we’ll put it into a python dictionary object so that we can scan through it and retrieve the information we need.

In this case, RegEx is used to scrape the HTML content included within the JSON format. Regular expressions work by being given a pattern to work with. After that, the content is matched to the pattern, and an output is generated. [4]RegEx has been used in software for a variety of purposes, including JavaScript validation in forms, text encoding in a specific pattern for development purposes, and decrypting encoded portions in database entries. Despite these evident advantages, using RegEx requires users to have a thorough understanding of its physics in order to execute it efficiently.

The process flow for implementing the solution is outlined below in “Fig. 2”.

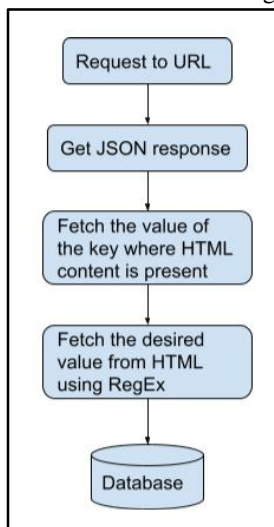


Fig. 2. Flow chart

Following are the steps to scrape the website having “Fig. 1” as a pattern to populate its data:

Step 1: We will be using the scrapy framework and for that we have to install scrapy and further start a new project named DemoScraper.

```
> pip install scrapy  
> scrapy startproject DemoScrapper
```

Step 2: Below is a simple spider named "demo" that was generated within the DemoScrapper project. We pass the URL of the website to be scraped into the scraper, and the request is then yielded by adding the appropriate parameters which are required to scrape the website and further the request is passed to the parse function. We will be importing the "re" library so that we can scrape the HTML present inside the JSON structure.

```
import scrapy  
import re  
class DemoScrapper(scrapy.Spider): name = "demo"  
def start_requests(self): urls = [  
'https://demowebsite.com/script/',  
]  
for url in urls:  
yield scrapy.Request(url=url, callback=self.parse)  
def parse(self, response): page = response.body
```

Step 3: Inside the parse function, the main scraping starts. So as to scrape the JSON structure, load that data first and for that we will be doing the following.

```
data = json.loads(page)
```

Step 4: After loading the data we will fetch the required values which are present in JSON as mentioned in "Fig. 1". For example below we are fetching value for price and rating.

```
price = data['price'] rating = data['rating']
```

Step 5: To scrape the HTML part, we will be storing HTML data into variable.

```
html_data = data['html']
```

Step 6: RegEx will then be used to scrape HTML data. For example, we'll scrape a value called "data-distance" from HTML. Syntax to scrape using RegEx is as follows.

- 1) Function used: re.search()
- 2) Parameters: Matching RegEx string & Data to match.
- 3) Group the function according to your requirement.

```
distance = re.search('data-distance="(.*?)"',html_data).group(1)
```

Step 6: Finally we will store the data into the database.

IV. CONCLUSION

In this study, we used one unique website as an illustration of how the hybrid strategy can be employed. Other types of websites may necessitate the use of two or more scraping strategies.

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Systematic Study and Proposed Future Trends on VR and AR

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Abstract : Augmented reality (AR) and virtual reality (VR) are reality technologies that either improve or replace a real- world experience with a virtual one. Augmented reality (AR) enhances your environment by adding digital features to a live view, usually via a smartphone camera. Virtual reality (VR) is a fully immersive experience in which a virtual environment replaces the real one. While both virtual reality and augmented reality are in- tended to provide the user with a simulated environment, each notion is distinct and has diverse applications. Because of its potential to build informative overlays that add relevant, real- world scenarios, augmented reality is increasingly being employed by businesses, in addition to entertainment scenarios.

IndexTerms – Virtual Reality-VR, Augmented Reality-AR, Trends, Challenges.

I. INTRODUCTION

Virtual Reality (VR) and Augmented Reality (AR) are both terms for interactive digital experiences. The costs of using these technologies have dropped dramatically in recent years, and in the case of augmented reality, most smartphone users already have the necessary hardware in their pockets. Smartphones aren't the only devices that can use augmented reality, but they do make it possible. Without incurring the costs of unnecessary equipment purchases, you can design specialized apps. AR can be used on tablets, computers, smart glasses, sensors, cameras, range finders, and other regularly used and traditionally isolated equipment. This conflation of data on a superimposed layer allows the user to accomplish more, in a safer and more efficient manner than ever before.

II. LITERATURE REVIEW

A) *Virtual Reality (VR):*

A computer-generated environment with scenes and objects that looks realistic and make you feel like you are immersed in your surroundings. This environment is recognized through a device called a virtual reality headset or helmet. With VR, you can immerse yourself in video games as if you were one of the characters, learn how to perform heart surgery, and improve the quality of your sports training to maximize performance. This may seem very futuristic, but its origins are not as recent as we think. In fact, many believe that one of the first virtual reality devices is called Sensorama. It's a machine with a built-in sheet that plays 3D movies, emits scents, generates vibrations, and makes the experience as vibrant as possible. The invention dates back to the mid-1950s. The next few years of technological and software development have led to progressive developments in both device and interface design. The most famous component of virtual reality is the head- mounted display (HMD). Humans are visual creatures, and display technology is often the biggest difference between immersive virtual reality systems and traditional user inter- faces. For example, an automated virtual CAVE environment actively displays virtual content on a room-sized screen. While fun for college and large lab people, consumer and industrial wearables are in the Archetypal Old West. With a variety of new hardware and software options, the future of wearables is expanding, but still unknown. While concepts such as the HTC Vive Pro Eye, Oculus Quest, and Playstation VR are leading the way, some players such as Google, Apple, Samsung, and Lenovo can surprise the industry with new levels of impressiveness and ease of use. HMDs are in the limelight when it comes to virtual reality technology, as it's easy to buy a helmet-sized device that works on the living room, office, or factory floor, no matter who comes to the top. A compelling virtual reality application needs more than graphics. Listening and seeing are the center of a person's sense of space. In fact, people react faster to auditory cues than to visual cues. Accurate ambient noise and spatial characteristics are essential to creating a truly immersive virtual reality experience. These give the virtual world a strong presence.

B) Augmented Reality (AR):

An experience for designers to enhance parts of the user's physical world with computer-generated inputs. Designers create inputs ranging from sound to video, to graphics to GPS overlays and more in digital content which responds in real time to changes in the user's environment, typically movement. AR is one of the biggest technology trends right now, and it's only going to get bigger as AR ready smart- phones and other devices become more accessible around the world. AR let us see the real-life environment right in front of us trees swaying in the park, dogs chasing balls, kids playing soccer with a digital augmentation overlaid on it. With advances in AR technology, these examples are not that different from what might already be available for your smartphone. Augmented reality is, in fact, readily available and being used in a myriad of ways including as Snapchat lenses, in apps that help you find your car in a crowded parking lot, and in variety of shopping apps that let you try on clothes without even leaving home. The most famous example of AR technology is the Pokemon Go mobile app, which was released in 2016 and quickly created an unavoidable sensation. In the game, players find and capture Pokemon characters that appear on real-world sidewalks, fountains, or in their bathrooms. Games aside, in our daily lives there are as many AR uses as Pokemon GO's Pikachu. Here are some examples:

- The augmented navigation system uses augmented reality to overlay the route on the actual road view.
- During a soccer match, broadcasters use AR to draw lines on the field to show and analyze movements.
- Furniture and household goods giant IKEA offers an AR app (called IKEA Place) that lets you see what furniture looks like and fits in your space.
- Army fighter pilots display an AR projection of altitude, speed, and other data on the helmet visor. So you don't have to waste your concentration to look down.
- Neurosurgeons may use AR projections of the 3D brain to assist with surgery.
- At historic sites like Pompeii in Italy, AR can bring the past to life by projecting views of ancient civilizations on top of today's ruins.
- Ground personnel at Singapore Airport will wear AR glasses to check information about cargo containers and reduce loading time.

III. EXISTING SYSTEM**A) Differences of Virtual with Augmented Reality:**

Despite being a generation that originated many years ago, many human beings are nevertheless unexpected with the idea of Virtual Reality. It is likewise pretty not unusual place to confuse the time period Virtual Reality with augmented reality. The predominant distinction among the two is that VR builds the sector wherein we immerse ourselves via a particular headset. It is completely immersive and the whole lot we see is a part of an surroundings artificially built via pixels, sounds, etc. On the opposite hand, in augmented reality (AR), our personal international turns into the framework inside which gadgets, pixels or comparable are placed. Everything we see is in a actual surroundings and it is able to now no longer be strictly important to put on a headset. The clearest and maximum mainstream instance of this idea is Poke'mon Go. However, there's additionally a aggregate of each realities referred to as combined reality. This hybrid generation makes it possible, for instance, to look digital gadgets within side the actual international and construct an enjoy wherein the bodily and the virtual are nearly indistinguishable.

B) Comparison of VR—AR:

Virtual Reality and Augmented Reality are facets of the equal coin. You ought to consider Augmented Reality as VR with one foot within side the actual international: Augmented Reality simulates synthetic gadgets within side the actual surroundings; Virtual Reality creates a synthetic surroundings to inhabit. In Augmented Reality, the laptop makes use of sensors and algorithms to decide the placement and orientation of a digital digicam. AR generation then renders the 3-D photos as they could seem from the perspective of the digital digicam, superimposing the laptop-generated pixels over a user's view of the actual international. In Virtual Reality, the laptop makes use of comparable sensors and math. However, in place of finding a actual digital digicam inside a bodily surroundings, the placement of the user's eyes are positioned within side the simulated surroundings. If the user's head turns, the photos react accordingly. Rather than compositing digital gadgets and a actual scene, VR generation creates a convincing, interactive international for the user.

IV. FUTURE TRENDS OF VR AND AR



Fig 4.1 : Future Trends of VR and AR

4.1 2022 Virtual Reality Trends

1) **An increase in business apps:**

If you think virtual reality is just a tool for games, think again in 2022. Yes, virtual reality remains a dominant force in the gaming sector, but it is also a valuable tool for businesses around the world. Training, remote collaboration, tests, and prototyping are among the most common uses of VR in the workplace, but there are lots of more innovative applications. Thousands of these solutions are currently in development, and virtual reality's impact will be enormous.

2) **Increased user acceptance:**

Users have typically been unwilling to utilise and invest in VR due to misconceptions about the technology, lack of availability, and expense. But things have swiftly changed. Today, virtual reality has a reputation for being cutting-edge and fashionable, as well as quite valuable for enterprises. According to a survey of workers who were asked which technologies they would prefer to utilise at work, the majority favoured immersive technology.

3) **Significant hardware upgrades:**

If you've been following the VR headset market, you've definitely observed how products have become more affordable, powerful, and comfortable to use. The most popular headgear right now (Oculus Quest 2), for example, is only USD 299. This trend will continue in 2022, with models like Pimax's "Reality 12K" and Panasonic's MeganeX releasing and shaking up the market with their impressive specifications. Another major advancement is the HTC Vive wrist tracker, which will be released soon and will not restrict hand movements while offering accurate tracking.

4) **Development has never been easier:**

Businesses have found it relatively simple to develop VR products, and this year could be even easier. For one thing, the number of development businesses is increasing year after year, making working with a top VR company for app design quite easy and affordable. Additionally, because the leading tools they employ (Unity and Unreal engines) are releasing crucial new capabilities for VR, creators may work faster and more effectively. Unreal Engine 5, for example, now supports OpenXR, a standard for simultaneously developing apps for different VR platforms. As a result, a corporation can use several headsets with the same software solution.

5) **Additional VR-specific services:**

We've discussed how virtual reality is assisting organisations in improving their internal operations, but it's also crucial to note how it is assisting them in making money. In example, a whole new market of virtual reality services for consumers and enterprises is emerging, with early adopters making significant profits. One of these forerunners is the fitness company Liteboxer, which offers a premium virtual reality boxing simulator.

4.2 Trends in VR Headset Design



Fig 4.2.1 : Present VR Headset Design

- Made with Polythene Plastic of different grades.
- Encapsulated body and two-piece clip design.
- No face Padding.
- Does not have CPU and GPU Chipset.
- Simulated renders are only viewable within the headset.
- Audio and Camera hardware is missing.
- Connectivity using Bluetooth pairing.



Fig 4.2.2 : Future VR Headset Design

- Made with environment friendly materials.
- Fibre glass body and one-piece design.
- Added face padding for comfortable and intact fit.
- Added AI CPU chipset with Integrated GPU for quicker responsive time and immersive response.
- Contains nano neodymium magnets with stereo immersive sound dual drivers and ANC Support.
- Contains micro AI camera for realtime scanning and AR rendering of surroundings.

- Connectivity using Bluetooth, Wi-Fi and NFC.

4.3 The Big VR Story of 2022 is Metaverse

While our list of trends gives you a good idea of what's going on in the industry, there is one trend we didn't mention that deserves more attention: the Metaverse. In July 2021, Mark Zuckerberg, the CEO of Facebook, announced the development of the Metaverse and renamed his firm to Meta. Hundreds of large brands (including Microsoft, Disney, and Tencent) declared their participation in the Metaverse in the months that followed. If you're unfamiliar with the Metaverse, it's a virtual environment accessed through virtual reality where users can work, play, and engage in many of the same activities as they do in real life. While old VR apps were isolated programmes that users had to stop before starting a new one, the Metaverse connects all apps and services, allowing for a seamless and uninterrupted experience.

While the Metaverse was created in the year 2021, 2022 should be the year when it truly begins to flourish and take shape. On the one hand, Meta is collaborating with hundreds of other businesses to build a single global Metaverse. On the other hand, hundreds of businesses are investigating the notion and developing their own Metaverse — a network of connected VR apps for internal usage. One of the first advantages discovered for the Metaverse is improved collaboration. Users are given digital avatars and can collaborate more realistically. Furthermore, the digital world is an excellent environment for visualizing knowledge and learning, as well as exploring complex themes and objects. We should also remark how well it simulates numerous job and living scenarios, as well as items and services for sale.

4.4 Who will Benefit from Virtual Reality in the Future?

So we know where virtual reality is headed in the short term, but what about in the long run? We want to look into the far future of virtual reality and make some predictions based on industry trends – how will it be used in 10-15 years?

- **Tracking the entire body:** Virtual reality apps currently track our heads and possibly our hands (if controllers or gloves are used). We may see full-body tracking in the future, with people donning a special suit or just wearing sensors attached to their clothing. VR simulators will not only examine users' knowledge, but also the precision of their movements, which could be highly useful in safety training (e.g. operating with heavy equipment).
- **Immersive films:** In the future, virtual reality headsets and glasses may be used to replace or supplement television sets and movie theatres. People will be able to enjoy their desired entertainment directly in front of their eyes without having to travel or purchase a large screen for their home. Making movies more immersive could help the entertainment industry contribute to this trend. They could allow individuals to see events from multiple perspectives and possibly affect character choices. With their *Bandersnatch* film, Netflix experimented with this format (though not in VR).
- **Intelligent personal assistants:** Virtual assistants (e.g. Siri, "Ok Google") currently aid us on our phones, but VR has the potential to further develop them. These helpers will take on a more human-like appearance and behaviour. These assistants could accompany people through their regular jobs and activities if they wear VR glasses. The implications for all businesses are huge: if AI is advanced enough, these systems may teach knowledge, provide customer support, and even help monitor work quality.
- **Physical activity playpens:** One of the existing VR limitations is that apps must be designed for very careful and limited user movement (unseen hazards should not cause the user to move too much). However, in ten years, everyone may have a playpen where they could use VR while still physically moving around — running, crouching, jumping, and so on — without risking their health. This would be big for the gaming and fitness industries, who would jump at the possibility to provide their customers with a far more interesting experience.

V. CHALLENGES FOR AR | VR INDUSTRY

- **Affordability**
The high price is discouraging regular and ordinary usage.
- **No or very little demand from the customer side**
For companies venturing into and adopting virtual reality, there is virtually no competition in the market. This discourages the development of VR and AR systems and its acceleration in adoption. Mostly, the technology is adopted by tech enthusiasts and early adopters. This is improving even as adoption move beyond gaming and entertainment. There is also lacking viable business models. Companies are lacking viable cost-effective business models and strong industry standards and vision to drive the industry are lacking.
- **Technology is unproven**
Not just content-wise, but there is a low application of technology in real life with only a handful of total users globally. There is also a handful of AR—VR content platforms and not as much of VR content is available. That said, many people don't care about VR because they do not use it on a day-to-day basis. Many people have no idea of AR—VR and what it is capable of, and AR—VR is not reaching the target audience money-wise. There are only a few demonstrations and examples of use-cases.

- **Customers lacking options**

Low adoption means there are not many headsets or AR—VR systems out there, and this then limits customer options, especially in the high-end device categories.

- **Health concerns**

Virtual reality is not proven to have serious long term health effects but the studies containing proof for any benefits are few. The technology also requires improving for customers to stop experiencing temporary side-effects such as blurred vision, nausea, headache, and queasiness.

VI. CONCLUSION

In terms of what each technology aims to achieve, virtual reality and augmented reality are inverse mirrors of one another. Virtual reality digitally recreates a real-life setting, while augmented reality overlays virtual elements in the real world.

Virtual Reality and Augmented Reality are on their way to becoming popular. Things are already changing, and we will soon be living in a world that is more virtual than real.

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