AUGMENTED REALITY MUSEUM

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Abstract- Augmented Reality, a field of computer science is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information. The primary value of augmented reality is the manner in which components of the digital world blend into a person's perception of the real world, not as a simple display of data, but through the integration of immersive sensations, which are perceived as natural parts of an environment. It is considered by many as a subfield of the broader concept of Mixed Reality, it could alter dramatically the way we interact not only with computers but also with the real environment surrounding us, as well as with other human beings. It has been so far used for applications linked with military training, medicine, maintenance, architecture and urban planning, tourism, and. In comparison, Web-based AR (Web AR) implementation can provide a pervasive Mobile AR experience to users. This Paper based on Augmented Reality technologies allows museum visitors to interact with the content in an intuitive and exciting manner. It gives further insight into how to use AR as a learning tool as part of a museum experience. It focuses on AR through smartphones, where the world is measured through the phone's sensors and the virtual content is displayed on the device's screen. Our project introduces you to how web based augmented reality can create a platform that let's the user use it's phone camera to entertain and educate itself by watching artifacts or monuments of the museum virtually. Using augmented reality we have enhanced natural environments of the museum or situations and offer perceptually enriched experiences which will make the surrounding real world more interactive bringing the ease into user's hands. The discussion emerging from this study aims to aid the development and design of AR applications at museum settings, by giving curators better understanding of design options in AR spaces. Qualitative results suggest that In-world space benefits learning.

Keywords*: Augmented Reality, museum, Google, learning, perfection, immersive sensation, artifacts, monuments, virtual, application, education, interactivity.*

1. Introduction

- Augmented Reality (AR) is a technology to merge virtual content with the physical world. It ranges from the real environment to a virtual environment.

It is a technology that imposes layers of virtual content on the real environment, enables a smartphone or tablet user to aim the device at a designated point and watch a still scene come into life. The ubiquity of mobile devices use has provided the public great opportunities to get familiar with AR applications in various spheres. For museums, the appeal of AR is clear – the technology allows rich media content such as graphics, animations, and videos to be layered upon real environments, which provides a way for museums to bring collections to life.

The phenomenal growth of augmented reality over the past decade has attracted significant research and development efforts from many public and private sectors. By seamlessly integrating virtual contents with the real world, AR makes it possible to provide users with a sensory experience beyond reality [3]. AR has offered tangible benefits in many areas, such as entertainment, advertisement, education, navigation, maintenance, and so on . For example, Lenskart let's users interact with wearable products which helps them increase their sales. Augmented Reality can alter the perception of our presence in the world [3]. AR, which transposes our presence in the world to elsewhere, allows users to be present in the world and simply

"augments" our perception of the world by adding the ability to provide users with contextually relevant information beyond our current perceived state of presence [3].

Mixed Reality environments are characterized by the combination of the real with the virtua. If the real world occupies the left of the continuum, the virtual world stands on the other end. It combines elements of the surrounding, real world, in an augmented virtuality to overlay virtual objects in a view of the real world, it can be observed by means of a video or see-through display (Augmented Reality). It is therefore pertinent to define Mixed Reality (MR) environments as environments in which "real world and virtual world objects are presented together within a single display, that is, anywhere between the extreme of the Reality - Virtuality continuum"[2].

This study focuses on AR through smartphones. The world is measured through the smartphone's sensors and virtual content is displayed on the device's screen.[7]

Mobile AR applications or solutions are designed based on a specific platform and lack cross-platform support. To reach more users, an AR application needs to go through repeated development cycles to accommodate different platforms, which undoubtedly increases the cost of development and deployment [3]. Although there are already some preliminary attempts toward Web-based AR (Web AR), the limited networking and computing capability greatly hinder its practical application [3]. Since 2017, the Web AR provisioning solution has gradually attracted developers' attention again due to the ever-increasing development of user devices and mobile networks and has emerged as a promising direction for Mobile AR [3].

The invention of the World Wide Web marked the beginning of a new era, with a Web-based service provisioning paradigm. The native cross-platform and lightweight features of the Web simplify service access for users, thereby facilitating the large-scale promotion of Web-based applications. Besides Web browsers, many mobile Apps(e.g.,Facebook and Snapchat) nowadays are also designed in a hybrid (Native + Web) way, which has both the advantages of good interaction experience and cross-platform support. All of these infrastructures provide a common platform for the pervasive promotion of Web AR. Here, we define Web AR as a type of Web AR implementation approach [3].

Museums are keen on presenting their collections in a more appealing and exciting manner to attract visitors. Some recent surveys in Europe show that about 35% of museums have already started (June 2003) developments with some form of 3D presentation of objects. In many cases, these are only projects at some initial stage, but the number is rapidly growing and it is evident that the museums start to recognize the potential offered by these technologies. Two main difficulties that museums encounter while trying to widely adopt the Virtual and Augmented Reality technologies in their standard way of operation are efficient creation of 3D models of artifacts and building virtual exhibitions based on these models. Significant research investment has been recently made in the area of 3D model creation. The technology becomes better, quicker and more affordable. [9]

Although the technology of the Web offers a promising approach for the cross-platform, lightweight, and pervasive service provisioning of Mobile AR, there are still several challenges to applying Web AR in real cases. Computational efficiency, energy efficiency, and networking are three important challenges. AR is a computation- and data-intensive application. The limited computing and rendering capabilities on the Web make it more challenging to achieve a high-performance and energy-efficient WebAR [3]. The good news is that several technological advances have started to enter the landscape of Mobile AR. First, the upcoming 5G networks bring new opportunities for Mobile AR, especially Web AR. They provide higher bandwidth and lower network delay, which improves the data transmission on mobile networks. Second, the introduction of new characteristics, such as multi access edge computing, device-to-device (D2D) communication, and network slicing, provides an adaptive and scalable communication mechanism

that further provides efficient infrastructures for the deployment and promotion of Web AR [3]. The soon to be available 5G networks and the rapid performance improvement of mobile devices, therefore, have laid a solid foundation for the practical deployment and application of Web AR on a large scale.

Our project illustrates how web based augmented reality can create a platform that let's the user use it's phone camera to entertain and educate itself by watching artifacts or monuments of the museum virtually and gaining information about it in a more interactive fashion and three dimensional form giving detailed insight of the same.

1.1 AR and the Museums

According to the 2015 Trendwatch Report, digitally mediated personalization and personalized learning are two global prominent trends in museums in recent years. A majority of museums with over 50,000 on-site visitors are using new mobile-only technology. Through mobile apps, museums can provide supplemental information about an exhibit or the museum itself; or as a personalized mobile guide through the museum collection or gallery spaces.

As QR codes, mobile phone guided audio tours, and smartphone apps have become widely used mobile features in museums all over the world, some museums are starting to explore ways to weave in more interactive and customized features that can enhance visitor experience. Already on a path of convergence with mobile technology, AR has become a portable tool for discovery-based learning that can enhance the information available to patrons when visiting gallery spaces, interacting with real-world objects, or even exploring outdoor installations. AR tools offer visitors the possibility to deploy their own smartphones as pocket-sized screens through which surrounding spaces become a stage for endless extra layers of information. In addition, compared with the widely used QR codes scanning mobile feature, which usually is a manual tracking system, the AR feature on museum apps work with automated image recognition to realize the scanning of real world objects. [8]

2. Literature Survey

Museums typically display information in an indoor environment. This study will use AR technology for such environments. Indoor AR applications benefit from a more predictable movement of users than outdoor AR applications. Adding sensors, optical markers, location cameras and/or other localization technologies to important areas can prepare an environment for AR applications . Indoor AR generally uses visual tracking with markers or visual features of the environment . A problem with visual features is the need for invariance. With changing light conditions, this is problematic . Using visual markers is a stable visual tracking method for AR but it distracts from the user experience. To not overly distract users while displaying virtual content, it is desirable to hide or keep the markers as invisible as possible for the users.

A Mobile Augmented Reality in Museums: Towards Enhancing Visitor's Learning Experience[1]

The paper states use of M.A.R.T.S (Mobile Augmented Reality Touring System) in a museum to create a user interface for AR.This article presents the design and implementation of a handheld Augmented Reality (AR) system called

Mobile Augmented Reality Touring System (M.A.R.T.S). The results of experiments conducted during museum visits using this system are also described. These experiments aim at studying how such a tool can transform the visitor's learning experience by comparing it to two widely used museum systems. First, we present the museum's learning experience and a related model which emerged from the state of the art. This model consists of two types of activity experienced by the observer of a work of art: sensitive and analytical. Then, we detail M.A.R.T.S architecture and implementation. Our empirical study highlights the fact that AR can direct visitors' attention by emphasizing and superimposing. Its magnifying and sensitive effects are well perceived and appreciated.[4] by

visitors. The obtained results reveal that M.A.R.T.S contributes to a worthwhile learning experience.

Enhancing the functionality of augmented reality using deep learning, semantic web and knowledge graphs[2]

This paper gives us knowledge about 'Augmented Reality' History and definitions, Integration of AR in semantic web, knowledge graphs and machine learning/ deep learning, how AR can be used with other contemporary technologies to reinforce effectiveness and efficiency of its application

More specifically, AR provides real-time access to the rapidly flowing data mainly at the right time and in the corresponding space. The aim of this study was to showcase how AR functions and services can be enhanced when integrating other technologies such as deep learning, semantic web and knowledge graphs and to present the potentials that their combination can provide in developing contemporary, user-friendly and user-centered intelligent applications.[5]

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Web AR: A Promising future for mobile augmented reality-state of the art, challenges and insights[3].

We learn about typical AR processes, browser support for enabling web technologies, TBS AR system architecture, Different web AR implementations. The paper presents a survey of Web AR in three focused subject areas. First, it reviewed the principle of Mobile AR and three typical implementation approaches. Second, it discusses the challenges and enabling technologies for when AR meets the Web and describes different Web AR implementation approaches. Finally, it summarizes the ongoing challenges and future research directions of Web AR. Recently, the Web-based AR implementation method has also received focused attention from the W3C group, and the Web XR Editor's draft was released in March 2018.[3]

Through the literature study we can infer that AR is a scaling concept and we have huge scope in developments in AR or using AR with other contemporary technologies in order to make use of AR in learning, training , entertainments etc. fields .Through mobile apps, museums can provide supplemental information about museums or as a personalized mobile guide through the museum collection or gallery spaces. AR can be used as a powerful tool for engagement as it is an endless layer of information.

3. Proposed System

By increasing the interactivity of the users with the museum objects we let users have a better understanding and knowledge of that particular object. It is hard for users to go out given various factors(Say COVID pandemic) or students to visit museums for that crucial end date project; this augmented reality app provides a better close view of museum objects as well as can provide explanation to various artefacts in the museum. In this proposed system, we start with a link; the link can be propagated in the form of a normal link, QR code or nfc. The link leads to a html page with 3D model of a museum/ viewing gallery which can be viewed with a 3D viewer already loaded on the html page. The museum is divided into four categories namely 'Space Expo' 'Egyptian Expo','Dinosaur Expo' and 'Weapons' which are annotated. Clicking on any annotation lets viewers to go through various subcategory links. When a viewer clicks on any particular link the predefined models to that link are loaded; this link leads us to the augmented reality scene where the models get loaded and users can experience the augmented reality overlaid into their own physical reality. It is to be noted that the web app asks for the camera

permissions which is a requirement to view and load AR models into the scene.

Augmented reality enhanced the learning view and entertainment factors of the museum. With augmented reality the experience becomes interactive and fun learning at the same time. The app is web based application hence no hassles of downloads or memory usage. Most augmented reality apps use a marker but with 6DoF tracking we try to resolve that issue and the AR image is rendered into the physical space within the comfort of the user. The user can browse through various categories without a problem and view models as per his requirement thus enriching the user's experience of learning while increasing interactivity with the objects.

4. Implementation

Augmented reality apps need to be downloaded and take up a large chunk of memory in your devices. The system we have proposed is a webapp/web page that can be viewed without any hassle of downloading the content or waiting for updates. The user is directly led to a webpage that lets the user view the museum as though viewing a webpage on a website.

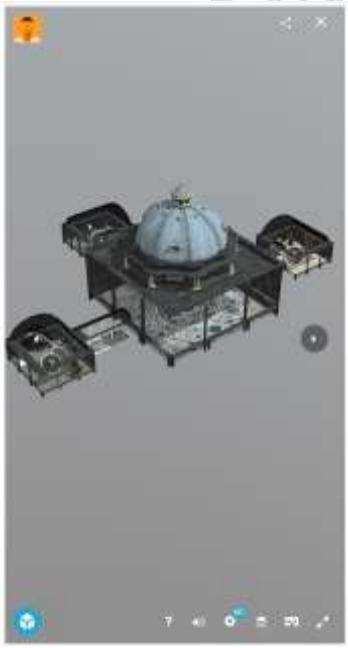

fig 1: Museum 3D Overview

Museum categories & subcategories UI:

1: Space Showcase

fig2 : Space Expo Subcategories

- ❖ SpaceExpo subcategories

a. Astronaut

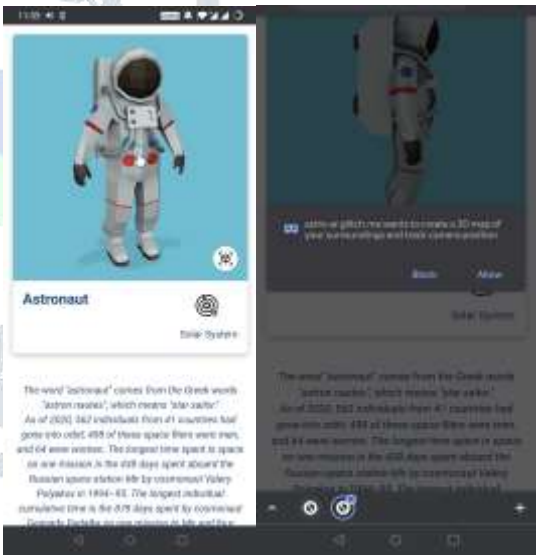

fig2a.1: Astronaut fig2a.2:permission prompt

fig2a.3 : Astronaut in AR

b. Solar System

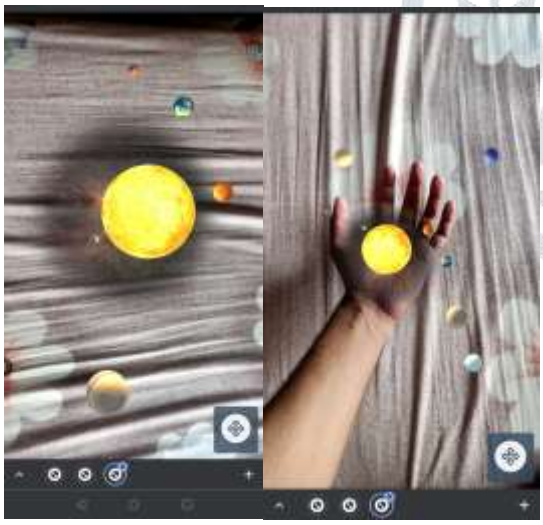

fig2b.1: Solar system fig2b.2:On hand

c. ISRO Rockets

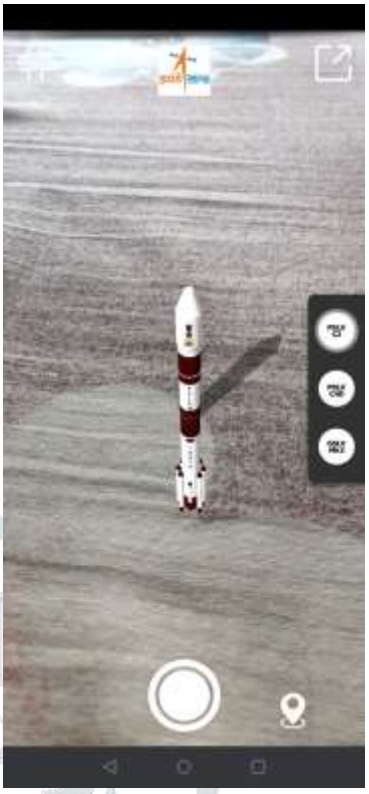

fig2c.1: PSLV C2 rocket

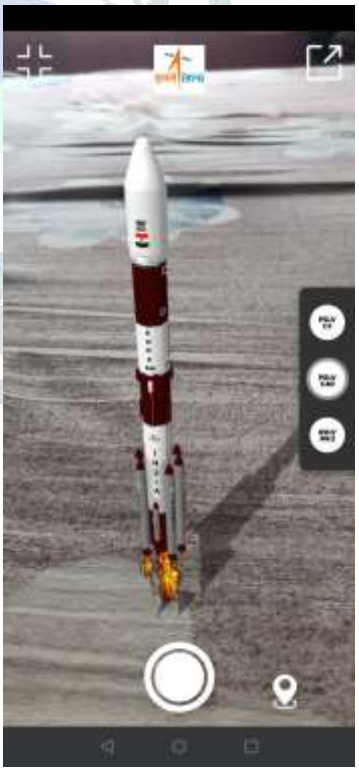

fig1c.2: PSLV C40 rocket

fig2c.3: GSLV Mk3 rocket

2: Egyptian Artifact Showcase

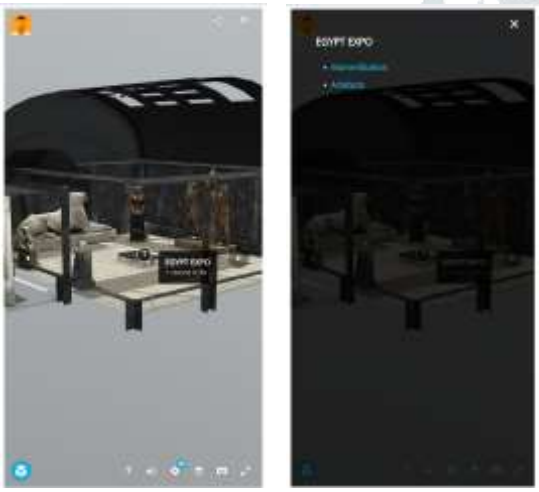

fig3: Egyptian Expo & subcategories

❖ Egyptian Expo subcategories

a. Mummification

fig3a.1: Mummy coffin closed

fig3a.2: Mummy animated coffin open on button click

b. Artifacts

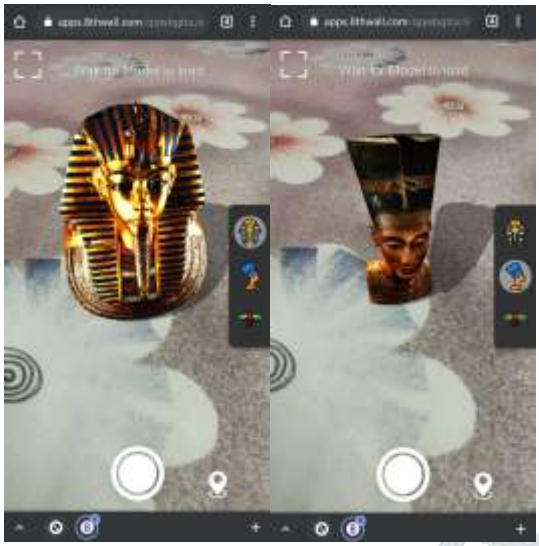

fig3a.3: Bust views Tutankhamun & Nefertiti

fig3a.4: Hieroglyph

3. Dinosaurs Showcase

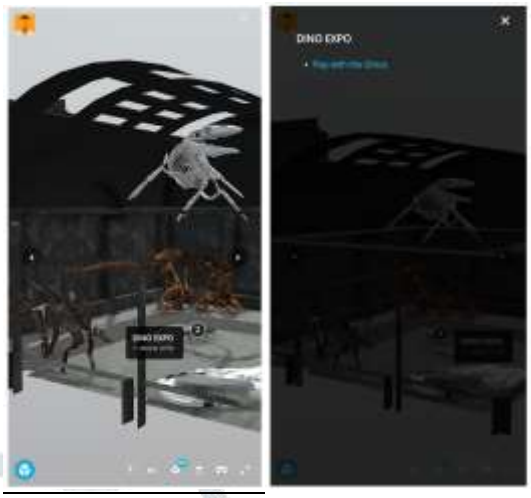

fig4: Dino Expo & subcategory.

❖ Dino Expo subcategory

a. Play with the Dinos

fig4a.1: Tyrannosaurus rex

fig4a.2: Brachiosaurus

fig4a.3:Velociraptor

4. Maratha Weapon Showcase

fig5: Maratha Weapon Expo & subcategory.

- ❖ Maratha Weapons Expo subcategory

a. Weapons of Maratha

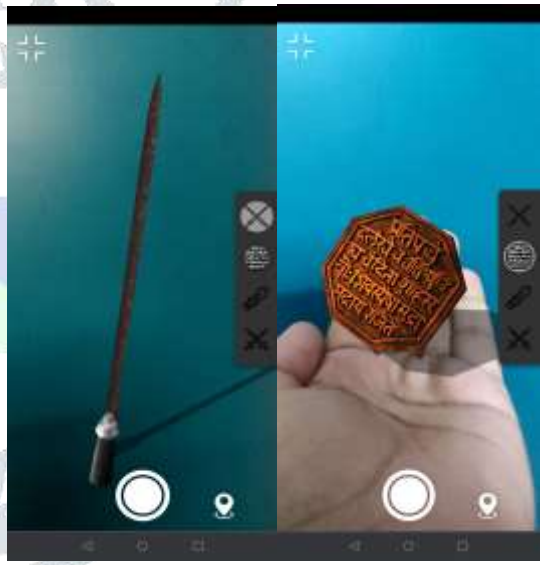

fig5a.1: Dandpatta fig5a.2: Rajmudra

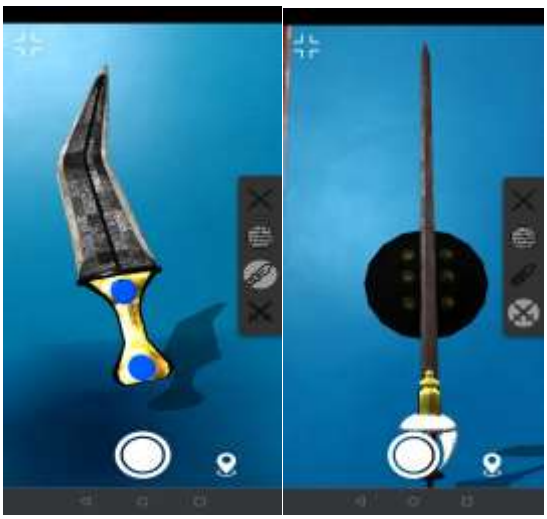

fig5a.3: Jambia fig5a.4: Sword

5. Conclusion

Through this app we try to bring the museum in the comfort of a user's home. The app lets the users tour the museum without the need to actually visit it. The app needs no prior downloading and works in any browser supporting webGl technology (Google Chrome, Ios Safari, Firefox etc.). The app provides better interactivity with the objects in the museum thus increasing learning capability and enhancing understanding. The different interactions like animations, videos etc provide users with new engaging experiences. Augmented reality can be said as the future of technology. Technology giants like Google, Apple, Amazon have started investing their businesses in this technology, devising research and developments accordingly(ARcore ARkit). The app is a use case for augmented reality usage and shows how augmented reality can be used in various ways to weigh in better learning through interactions. It also provides the users with entertainment through new experiences to make them acquainted with AR technology and its applications

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