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Historical Insights using Augmented Reality

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Abstract:- India, a nation steeped in history and tradition, is losing its heritage sites fast. This part of the world has an intriguing and fascinatingly rich and varied heritage that is thousands of years old. Monuments and paintings, are robust tokens of the many characteristics and antiquities that form the joint consciousness and become an absolute part of us. Some forms of menace to heritage monuments can be absence of awareness about the culture, misguidance by people, tampered boards, etc. The project is focused on the importance of using modern technologies in preserving and exploring Cultural Heritage. Specifically, Augmented Reality (AR) can possibly improve the client experience identified with social legacy. Augmented reality is "an enhanced version of reality created by the use of technology to overlay digital information on an image of something being viewed through a device (as a smartphone camera)." The undertaking gives a framework that joins location-based sight and sound retrieval with an enlarged reality on the customer's mobile devices. The system will enable users to query collections of historic multimedia content for perspectives of their current surroundings and overlay them onto their current view using a mobile device. This way, the proposed system offers a virtual window into the past.

Keywords:- *Augmented Reality; 3D Rendering; History; Android; Computer Graphics.*

I. INTRODUCTION

Augmented reality (AR) is a shared association of a true domain where, the articles that live in reality are improved by computer created inventive data, at times over different tactile modalities, including picturing, sound, and tangible. AR can be differentiated as a framework that satisfies three essential highlights: a mix of genuine and virtual universes, continuous cooperation, and exact 3D enrollment of virtual and genuine articles. The overlaid tangible data can be useful (for example added substance to the indigenous habitat), or damaging (for example covering of the natural environment). This experience is impeccably joined with the physical world to such an extent that it is seen as a vivid part of the sincere condition. The proposed system aims to bring objects or elements from the history of a monument, onto the display of the mobile phones. To give an experience to users that gives them information about the monument, how it is linked with the heritage of the country, in an augmented tour form.

To develop a mobile tour guide system using augmented reality to guide the tourists with respect to their visit and provide them the visual experience of the history of a particular monument. Enhance the overall tourism experience. Gain meaningful information about the historical sights. Promote tourism in that particular city.

II. RELATED WORK

A. Literature Survey

There is a lot of research done in the field of augmented reality. Especially because it a relatively new and an expanding field, and hence different new methods and techniques have been experimented to achieve set goals. Some of the previously presented methodologies that we have studied are summarized below.

An electronic guide application has been presented for android smartphones and tablets to help users to reach the places of their interest by Athanasios Kountouris and Evangelos Sakkopoulos. Their proposed system with the help of internet technologies help users to reach user preferred locations instead of using a personal guide, a tour guide book or any online website. Their system includes designing software for showing cultural sites, inserting or deleting cultural sites of user interest, study of navigation system using smartphone. The drawbacks of the system proposed are as follows, no proper use of reality navigation to store new POIs at the server-side in order to be able to share them.[1]

Another application that has been implemented is, GoFind for tourists and historians which gives a virtual view in city's past via augmented reality-based user interface. Historic photo collections are important for cityscapes development but are buried in archives. With the proposed system the historic multimedia collection is brought to mobile devices. The system provides the overlay of past and present view. In the system the back-end handles retrieval queries and front-end handles user's interaction. The system has following drawbacks, only a picture will overlay the real-life scene, to show how the place looked in the historic times, but it won't give much information or show any 3D models relative to the site.[2]

Majorly two applications have been implemented for representation of cultural heritage using virtual and augmented reality in Tunisian cultural heritage in the marker based augmented reality field applications. One part of proposed system uses a picture on magazines as markers

to superimpose the 3D model of that place. Along with superimposition the system also provides interactive augmented reality for guided tours. The system uses real-time 3D imaging.[3]

Another idea that has been implemented is in interest of, promoting the Taiwan dark tourism through the augmented VR experience. The information about Taiwan's dark tourism destinations was used to build up an augmented virtual reality project for guided tour. GoPro Hero 4 six-camera set, Kolor Autopano Giga and Panotour Pro software, and the web platform Holobuilder were applied in this experiment. Few places were selected to carry out and implement the idea and a tour itinerary was designed for the same. The system has following drawback, external hardware as well as advanced software is required for the development. The drawback of the system is as follows, since this is a VR experience the use of hardware lens is mandatory and AR does not use lens, only a mobile device is required.[6]

There also been a keen interest of the users in a game-based augmented reality applications. One such guidance system for Yuanmingyuan and a time travel game called MAGIC-EYES using Augmented Reality technology. The proposed system by X. Wei, D. Weng, Y. Liu and Y. Wang, can help the tourists immerse themselves in the mystical legend. MAGIC-EYES makes use of plaques, stone tablet, patterns of buildings and geographical location information to identify the user's location, which is then combined with AR-based interactive game to complete the guided tour. The traditional guidance system uses the traditional audio, cartoon and GPS to guide a tourist to reach the designated place and display the historical legend. The system has a drawback of being a game in which you are able to see the computer-generated environment on the mobile phone, and not the real environment. Hence, not being able experience the real-world based augmented reality experience.[9]

In the zone of location-based augmented reality one specific application familiarized, comprised of a transportable visit be able to work with framework consisting augmented data. The application will assist the visitor with finding the precise location additionally the data about the necessary spots and it will likewise give the augmented view so the connection between the vacationer and the spot will be simple. The GPS service is similarly handy for the vacationer to discover the spots without any problem. The visitor will encounter the physical nearness of the location on their cell phones which the user needs to visit. This framework gave a thought for another framework.[8]

Hence, the detailed study in the area of location-based augmented reality applications, and learning from the similar previous work is completed. We were able to get a basis for our tourism augmented reality application.

B. Augmented Reality

Augmented reality (AR) is an intellectual encounter of a genuine situation where the objects that live in reality are enhanced by computer produced perceptual data, once in a while over different tangible modalities, including visual, sound-related, and haptic. AR can be characterized as a framework that satisfies three essential highlights: a mix of genuine and virtual universes, continuous cooperation, and exact 3D enlistment of virtual and genuine articles. The overlaid tangible data can be helpful (for example added substance to the common habitat), or ruinous (for example veiling of the indigenous habitat). This experience is flawlessly intertwined with the physical world to such an extent that it is seen as a vivid part of the genuine condition.

A portion of the uses of AR can be, AR can help in envisioning building ventures. Computer-generated pictures of a structure can be superimposed onto a genuine neighborhood perspective on a property before the physical structure is developed there. AR can likewise be utilized inside a planner's workspace, rendering vivified 3D representations of their 2D drawings. Engineering touring can be improved with AR applications, permitting clients seeing a structure's outside to essentially observe through its dividers, seeing its inside items and format.

With nonstop upgrades to GPS precision, organizations can utilize augmented reality to picture georeferenced models of building destinations, underground structures, links, and funnels utilizing cell phones. Augmented reality is applied to introduce new tasks, to fathom nearby development challenges, and to improve special materials.

AR applied in the visual expressions permits items or spots to trigger aesthetic multidimensional encounters and translations of reality. Augmented reality can help in the movement of visual craftsmanship in exhibition halls by permitting gallery guests to see fine art in displays in a multidimensional route through their telephone screens.

C. SLAM

Simultaneous Localization and Mapping (SLAM) is turning into an inexorably significant subject inside the computer vision network, and is accepting specific enthusiasm from the enlarged and augmented reality ventures. 'SLAM' is certifiably not a specific calculation or a bit of programming, but instead it alludes to the issue of attempting to simultaneously localize (for example discover the position/direction of) some sensor as for its environmental factors, while simultaneously mapping the structure of that condition. This should be possible in various manners, contingent upon the circumstance.

The precondition of recuperating both the camera's position and the guide, when nor are known in the first place, recognizes the SLAM issue from diverse endeavors. For instance, marker-based tracking isn't SLAM, in light of the fact that the marker image (comparable to the guide) is known beforehand. 3D recreation with a fixed camera rig isn't SLAM either, in light of the fact that while the guide (here the model of the item) is being recuperated, the places of the cameras are as of now known. The test in SLAM is to recuperate both camera posture and guide structure while at first knowing not one or the other.

SLAM idea is principally utilized, when the organization condition is ambiguous. In any case, if there should be an occurrence of enlarged reality the space is known in the genuine world, and it must be characterized in the virtual world. Since to show enlarged reality the client's relative situation in nature ought to be known. Subsequently, SLAM isn't the most valuable strategy for the proposed application.

D. AREA (Augmented Reality Engine Application) coordinate system and track notion

It fundamentally comprises of a versatile enlarged reality portion that empowers area based portable expanded reality applications. It comprises of the ECEF facilitate framework. ECEF (abbreviation for earth-centered, earth-fixed), otherwise called ECR (an initialism for earth-centered rotational), is a geographic and Cartesian arrange framework and is now and then known as a "traditional earthbound" framework. It speaks to positions as X, Y, and Z facilitates. The point (0, 0, 0) is characterized as the focal point of mass of Earth, thus the term geocentric directions. The good ways from a given focal point to the focal point of Earth is known as the geocentric span or geocentric separation.

Its axes are lined up with the international reference pole (IRP) and global reference meridian (IRM) that are fixed regarding Earth's surface, subsequently the descriptor earth-fixed. This term can create turmoil, since Earth doesn't pivot about the z-axis (not at all like an inertial framework, for example, ECI), and is along these lines on the other hand called ECR.

The z-axis stretches out through evident north, which doesn't match with the momentary Earth rotational hub. The slight "wobbling" of the rotational pivot is known as polar movement. The x-axis converges the circle of the earth at 0° scope (the equator) and 0° longitude (prime meridian in Greenwich). This implies ECEF turns with the earth, and in this manner directions of a point fixed on the outside of the earth don't change. Change from a WGS84 datum to ECEF can be utilized as a transitional advance in changing over speeds toward the northeast down organize framework.

Due to advancements in hardware and software technologies over time, and availability of better hardware components on selected mobile devices. Components such as gyroscope, accelerometer, magnetometer, GPS, and a camera module of the mobile device can be used in place of using an algorithm serving for the same purpose.

III. PROPOSED METHOD

This document is the summarization of an application based on augmented reality on the android platform. The proposed system is an android application. The application has been developed using the Unity and Android Studio platforms. The said application consists of following features such as, displaying of 3D models on the mobile screen, audio for an explanation as a part of the tour, information in text form for reading purpose, and relative images as well.

The application is built using android, as to give a proper augmented reality experience to the end-user there are certain pre-requisites which include software as well as hardware requirements.

In the case of virtual reality experiences, the end-user requires a special lens or virtual glasses, that the end-user has to mount on their head to be able to experience the virtual objects around them. Whereas, in an augmented reality, the end-user requires a device with a camera as a primary requirement and a display screen onto which the virtual objects will be portrayed. Hence, mobile phone is a pre-requisite to use the various components such as gyroscope, magnetometer, accelerometer, GPS, display screen, and camera. The combined use of these sensors, performing individually or in combinations makes it possible to deliver the augmented reality experience.

The system architecture entails the following main modules:

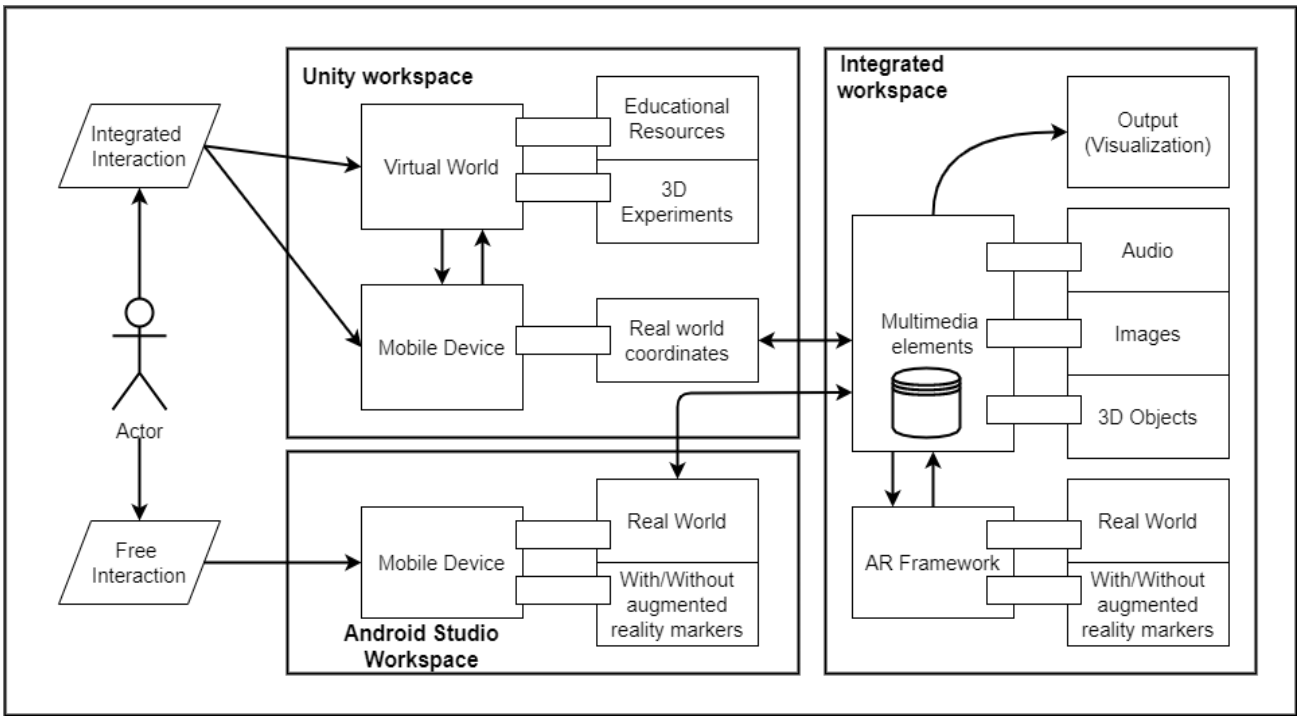

Fig 1: - Proposed System Architecture

A. Unity workspace

The Unity workspace consists of the manipulation of 3D objects (they may also be referred to as 3D models or in Unity terms as assets), plane detection, and the rendering of the 3D objects. The Unity platform is used along with the ARCore SDK, to be able to use the camera, to be able to visualize the 3D models, and to be able to anchor the 3D models at a given location. The Unity workspace also includes adding the audio part of the augmented reality tour.

B. Android Studio workspace

- The user interface part of the proposed system is present in the android studio workspace. The application can only be retrieved by a registered user after being able to login in the application. Hence, the name, phone number, and other user details need to be stored in the database. Once the user has logged in, into the application, they should be able to see information about all the places available in the system. Initially the proposed system consists of three places situated in three different cities in the state of Maharashtra, India. The user should be able to see the monuments of the city they are currently present at.
- Information about the places in text form for reading as well as relative images are available. This module is a small sub-part of the application, in addition to the 3D models and audio.
- The user interface is required to be user friendly, and hence proper instructions are given at every step, so that the user does not have any issues while navigating through the application.
- Augmented experiences require a few permissions from the user's mobile device. It is important that the user feels safe while using the application. In order to enhance security of the developed application an OTP (One Time Password) verification is used in the android studio workspace, to confirm that the user is logging in and not an imposter.

C. Integrated workspace

- The integrated workspace consists of the combination of android studio and unity. The module developed in Unity can be built under the android platform, but to provide the additional features, it is exported into android studio.
- Hence, resulting in an integrated application, with the rendering and visualizing part from Unity, and user interface and security part from android.
- The location service that is required to know the current position of the user is also included in the android module while integrating the Unity module.
- When the application is started, the user will be able to see an option of Augmented tour. The camera will start and user can select and navigate to certain positions in monument's location and 3D model will be rendered in real time based on the location.
- The options to get an audio tour are given in three different languages namely, Hindi, English, and Marathi. The user will be able to listen to the audio as per their convenience.

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IV. RESULT

The resulting application consists of the following modules. The first page gives an option to create a new account for the user who is visiting the application for the first time, and a login option for the user who has already created an account.

The user on creating the account has to enter their mobile number for OTP (One Time Password) verification. And on entering the number generated, gets to login. The user then gets to explore the three cities available in the application.

One of the monuments available in the system is, Phalke Samarak in Nashik.

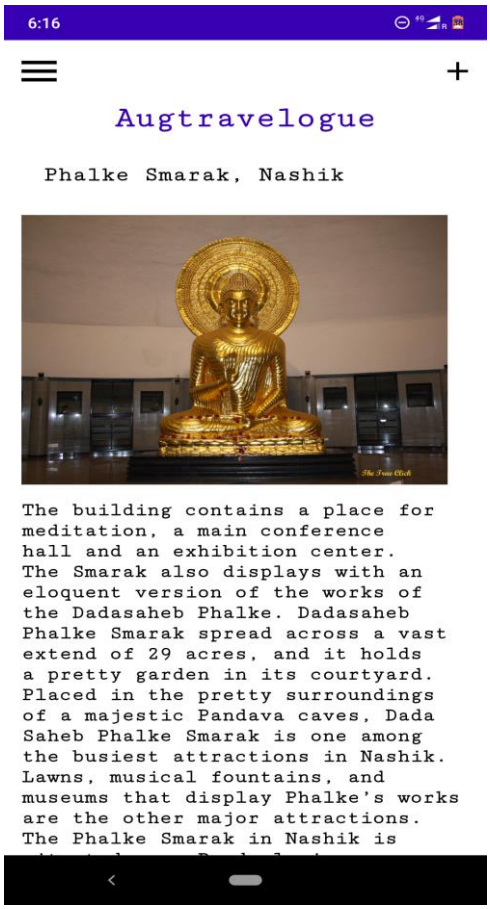

Fig 2a

Fig 2b

Fig 2a depicts the image of the page showing information based on Phalke Samarak. Fig 2b depicts the image of one of the pages that open during the augmented tour, on this page the 3D model of Buddha is displayed, which can be observed alongside audio information, which is available in three languages, namely Hindi, English, and Marathi.

V. CONCLUSION

In this paper, an augmented reality system is being proposed with the purpose of being able to portray the mobile device as a portal to the user through which they are able to see 3D objects related to the historic significance of that monument. An augmented experience along with an audio playback in three different languages, to spread the usage of the application for all the masses. India is a country with rich heritage and culture. Currently the application is restricted to fewer number of cities, however in future the application can be enhanced to cover various cities with significant monuments in India.

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