

## Location-based Augmented Reality Application for Tourism

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### ABSTRACT

Owing to the advent of modern functionalities, mobile devices have become more common and useful in existence today. In addition to the simple current features, mobile apps have been used in different ways to help the consumer locate positions throughout their everyday life activities among others. Through greater development of smart phone and cellular technology, location-based applications and augmented reality based applications play a significant role in everyday life. Augmented reality is a technology that combines a smart phone's virtual environment with the real world of nearby locations as seen by the user. AR overlaps the physical world with computer-generated augmented reality graphics. Geo-based Augmented Reality is a combination of position-based technology and GPS used to map a device's positioning and to overlay the screen details regarding the point of interest. AR can also be combined with geospatial data technologies, along with positioning sensors such as optical compasses, gyroscopes, and accelerometers, to get a fully interactive and thrilling experience. Due to these features, AR and Position Dependent Service have become more common nowadays and are being built in various solutions in mobile devices. Geo-based AR mobile app is a good companion for looking for a particular spot. The application may view details on nearby landmarks along with directions to that location using the combination of AR and location-based systems and include appropriate position details. This paper aims to explain the android-based functionality of the Augmented Reality and Location-Based System, which is deployed to provide the smart phone customer with the opportunity to scan for tourist destinations, interactive advertisements, easy location, map views and routes of these places.

### KEYWORDS

Augmented Reality, Geo-based augmented reality, Location-based system, Interactive tourism

## INTRODUCTION

Technological advances and man's growing dependence on mobile phone technology have turned out to be a push factor in the use of Augmented and Virtual Reality applications in almost all domains. While Augmented Reality (AR) has long existed as a tool and has also been used in many industries, its full potential in the travel industry remains to be fully determined.

AR can augment or virtualize one's view of the surroundings using AR supported digital devices such as a laptop, computer or a hand-held cell phone. To be simplified, AR is a virtualization technique that superimposes computer-generated data, such as text, video, graphics, GPS data, and other multimedia formats, on top of the real-world view, as captured from the camera of a computer, a mobile phone or other devices. [26]. Increased computer-generated real-world view data is mainly intended to improve the individual or domain's perception of the subject matter in the physical setting. Augmented reality, which comes under the umbrella of mixed reality, implicitly provides a complex and immersive distribution of knowledge through the co-existence of a physical and simulated world inside a piece of digital content. [4].

Adding layers of location-based information that take the domain's real physical environment as its background, instead of replacing it with a virtual artificial environment, has made mobile AR more interactive compared to other location-based services (LBS). At places powered by AR-based applications, stories and exhibits help tourists explore independently thus lowering the dependence on the human tour guide. Augmented experiences extended to travellers with innovative mobile apps, facilitate their travel quest and building trust. Seeing that AR's popularity is expected to rise exponentially due to technological advances and studies into usability, adoption, and usefulness, it is important to identify what are the basic requirements for users to embrace AR.

Geo-location based AR, also called as marker-less AR, refers to elements of augmented reality that are grounded at a real-time location. Digital data is virtually preserved in the actual physical environment, allowing users to access it using AR-compatible devices such as smart phones. Well known example of location-based AR is Pokémon Go. Similarly, a location-based application also allows the user to navigate to desired destinations with the help of directions displayed on the top of the physical roads visible on the hand-held mobile device.

Although GPS can perform similar functionality, it cannot provide an interactive experience to the user like providing information about the monuments and places of interest nearby while guiding the route to a particular location. That provides the traveller with a good experience. Facing landmarks or monuments, these interactive AR guides can help navigate a dynamic intersection easily on the hand-held device like the smart phone.

These have become a means of attraction for modern tourists and a way of maintaining the rivalry of business workers. These applications can help businesses provide interactive advertisements and help woo their customers by providing better user experience and improving their sales and thereby earnings.

### **LITERATURE SURVEY**

The results of the study of current works of literature indicate that the advancement of mobile technology has made a considerable difference to the tourism industry, especially in four sectors-transport, lodging, catering and tourist attractions. In several cases, the growing reliance of citizens on cell phones and the difficulty of the production of tourism experience have generated a need for a more immersive encounter with tourist destinations through the usage with technical applications. [35].

Visitors are individuals who typically have "no to no environmental knowledge," according to McKercher and du Cros. [31]. Throughout this case, the AR technology will tie together the quickly changing modern world by leveraging interactivity, flexibility and sensitivity to put together the IT industry and the tourism field. Leue [28] identified that four potential external variables influence AR user acceptance including enjoyment, personal innovativeness, perceived benefits, costs, and information quality. Information is provided through the use of different interactive technologies within an AR framework. Such formats range from sound and image to video clips, 3D models and hyperlinks that may lead the user outside of the application. [26]. Past will be replicated and maintained for many years by way of Image Processing techniques such as Augmented Reality and nowadays of mixed reality integrated with the different handheld devices[33]. According to Dai-In Hana [15], AR has been tried in various ways for tourism purposes, but a clear application template has not been provided. Besides, the end-user point of view has been largely neglected in the development process of AR in tourism. Kounavis [26] suggests that the absence of interoperability of AR systems across mobile platforms often

accounts for the lower demand and use of these technologies. Therefore, to clarify, smartphones with camera apps, high-performance CPUs, large-capacity storage and wireless network connectivity must be the mobile phone that is extremely appropriate for use as a portable AR handheld device to ensure compatibility and adequately capable of maximizing AR features [26]. Amirian et al. (2016) [13] developed a landmark-based pedestrian navigation system using machine learning in addition to AR. Zhou et al. (2016) [47] developed a recommendation system for sightseeing spots, and Rehman et al. (2017) [38] proposed an indoor navigation system.

Augmented Reality has the potential to merge visual media and information and to improve the actual environment. This ability to combine interactive media around the real environment gives way to AR learning opportunities that provide optimal conditions for immediate, contextual and situation-based learning scenarios. Prior work has suggested that the integration of different sensors offers new ways to communicate with the environment around us. [34]. Location-Based Service (LBS) is an information service that accessible with mobile devices through the mobile network and using the ability to make utilization of the location of the mobile device [44]. On the other side, new monitoring technologies provide several ways to classify artifacts in the physical world. They vary from the well-known Global Positioning System (GPS) to the GSM, GPRS and UMTS systems, which allow the identification and location of cell phones within the sphere of influence. [25]

The majority of previous work on the application of AR to tourism has shown that AR's intuitive interaction has significantly improved user interactivity, marketing, and overall experience.

## **METHODOLOGY**

The analysis conducted in this paper was based on the study and review of the current literature relevant to this research area. The data was gathered from article newspapers, articles, books, sessions, conferences, and events. Mobile technology, mobile augmented reality, tourism technology, geographic information system, indoor maps are the main areas that have been studied and reviewed. Even researched were the latest technologies utilizing augmented realities. The conclusions drawn from the existing literature have been contrasted with the present software research.

### **Location-based service**

Location-Based System (LBS) can be defined as an application or program based on a particular location. To be elaborated, LBS is an intelligence service that is available through the mobile network for mobile devices and that allows the use of the cell device place [44].

LBS consists of two categories, which are triggered and user-requested [10]. In a user-requested scenario, the user is getting the position once and utilizes it on subsequent requests for information that depends on a specific location. This kind of service generally involves both individual location (finding where you are) and service location (where is the nearest). For example, the kind of service of LBS is navigation (map) and direction (routing information). On the contrary, triggered LBS depends on the prearranged condition, when accomplished it will get the specific position of a device. An example is when the user passes the limit of a mobile network. One more example is in emergency services, it will activate a call to the emergency center and request location automatically from the mobile network. [41]

### **Existing AR applications and Software Development Kits**

Wikitude was released on Android in 2008, later on, iPhone and Symbian platforms. It has been voted best AR browser of 2010 by readers of Augmented Planet. This extracts details from Wikipedia and Qype and overlays the geo-located data onto the screen. It comes with a lot of worlds that can be overlaid onto the real world which can be seen through the mobile device's camera. POIs can be created by the users themselves and location-based digital content that can be accessed through the Wikitude software framework. [21]

ARKit is Apple's augmented reality development platform for iOS mobile devices. ARKit helps developers to build high-definition iPad and iPhone AR experiences. Device captured environments can be supplied with virtual 3D text, objects, and characters. AR scenes created by a single user are permanent and can later be used by people visiting the website. Motion coprocessors like the iPhone 7 Plus M10 can effectively track data from the gyroscope, accelerometer, and magnetometer. For having a better experience, Pokémon Go uses ARKit. [18]

ARCore was initially released in 2018 and is a Google-designed software development kit for the development of Augmented Reality applications. ARCore uses three main technologies that allow the phone to understand its place in the world and detect the size and location of any type of surfaces, including the integration of virtual content with the true environment, motion detection, environmental awareness, and light estimates. ARCore

SDK is available for Android, Unity for Android, Unity for iOS, Android NDK, iOS and Unreal.

The Vuforia platform uses state-of-the-art, robust and powerful computerized image recognition and provides several capabilities for the mobile device. A Vuforia SDK-based AR-App is a camera which captures image frames and sends content to a tracker; a camera-based image converter in an OpenGL ES rendering format; a tracker that can load and trigger several data sets simultaneously and contain real-world objects tracked and detected by computer vision algorithms. It also offers quicker local target detection with the ability to simultaneously track five targets. The SDK supports both native developments for iOS and Android, while also enabling the development of AR applications in Unity that are easily portable to both platforms. [19]

## CONCLUSION AND LIMITATIONS

The advent of mobile technology in the last few decades has fundamentally changed the way travellers connect and communicate with their world. Increasing human dependency on mobile phones and the complexities of evolving tourism interaction has created a need for a more engaging tourist destination experience through the use of digital apps. Mobile Augmented Reality tech is considered capable of narrowing the distance between the need for a deeper understanding and satisfying the tourist's ideal experiences. Integrating digital data with the real-world environment through the mobile device app makes travellers' contact with their interactions more direct. Enhanced reality is aimed at affirming the four aspects of travel and tourism—transport, lodging, leisure, and tourist attraction. Therefore, there is huge potential to use smartphone AR as a tool for successful analysis of tourism and enhancement of tourism experience.

Despite the broad range of AR technologies in the travel industry, there are many reasons and factors to impede the use of technology in this area. There is no interoperability of the latest AR systems on different platforms. Though there are several frameworks for designing AR software, the use of platform-wide applications is still not feasible. It also needs a decent Wi-Fi or internet connection to use the device all the time. Most areas have neither full Internet coverage nor reliable mobile roaming rates. Many of the other reasons why software is less used in the city are the useless content and the lack of functionality of the devices.

## SCOPE AND RELEVANCE

AR as a technology has a broad range of different domains. The applications developed to provide the user with a virtual view of the rooms, easy flight bookings and also customized real-time information, particularly in the travel and tourism industry.

The AR platform uses immersive storytelling for museums and other such locations. AR enables one to be taken through a guided, multi-sensory experience through past, present and future loops of time. Not only for these sites but also an office building, schools, and universities, various apps may be used to enhance not only the usability but also the overall experience of the user.

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