A framework for Exploring Iraqi tourism sites by Augmented Reality application

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ABSTRACT

Augmented reality is an interdisciplinary field that uses information technology and computer vision in various areas, including medicine, education, architecture, industry, tourism, etc., to enrich a real-world perspective in real-time with additional digital information. This paper aims to provide an overview of this technology, its types and tools, To promote its usage in Iraq's tourism industry. Iraq contains tourist areas, civilizations and ancient heritage places that date back thousands of years but suffer neglect due to the lack of tourism activity. This paper also presents a framework for developing a mobile augmented reality application that serves Iraqi tourism sites called IraqAR. The application works based on Markers, and it was developed by the unity game engine and Vuforia SDK. It has three key characteristics and runs on the Android platform. After the application recognizes a specific image marker or QR code, the user may explore 3D model of a sites that is related to it, listen to explanatory audio that gives a description of the chosen tourism attraction and read information about it. As a support advertising medium, the image marker or QR code printed in the form of a book. One of the applications of the Human and Computer Interaction discipline is this new method of engagement to promote tourism objects. The user will be able to learn about Iraq's tourist attractions in a new and unique way, and the site will be able to attract more motivated tourists as a consequence of this application.

Keywords: Augmented reality, Tourism, cultural heritage, historical monuments, overview.

1. Introduction

Iraq has a diverse range of tourism attractions, including historical civilizations, holy sites for people of all faiths, and the natural beauty of Iraq's mountains and rivers, which span from north to south[1]. Attractive locations, historical monuments, and social activities that have become a longstanding local community tradition in a specific area are considered tourism objects. For locals and foreigners, the natural condition, the attractiveness of architecture, and the unique characteristic of social life in every tourism object form the tourist attraction. Tourist attractions are also closely related to tourism products[2]. Many tourists visit various tourist sites to learn about local customs, opinions, history, food, culture, and sporting activities[3]. The growth of

tourism objects is gradually becoming more significant in the world economy[4].

Tourism organizations are focusing on e-tourism marketing in light of the influence of information and communications technology (ICT), which is becoming more visible, proactively, engaged, and clear, allowing people to interact with visitors more effectively[5].

For more than 25 years, tourism has been inextricably linked to technological advancements. The Internet and information and communication technologies (ICTs) are now crucial on all operational, structural, strategic, and marketing levels to promote worldwide interaction among suppliers, intermediaries, and consumers worldwide.

The domains of information, communication, and technology (ICT) have been rapidly expanding. Tourism development is aided by advances in information communication and technology. Many smartphone applications, such as Hopper and Google Maps, are now used for tourism.AR is one of the fastest-growing information and communication technologies. Augmented Reality (AR) is a technology that allows users to interact with their surroundings in real-time. This technology allows users to interact with virtual items in the real world in real-time [6].

New types of mobile applications have been made possible by the advancement of mobile devices and their computing capability. One example is augmented reality (AR), which mixes and aligns virtual things with real-world environments, allowing users to experience augmented surroundings by adding computer-generated components to the actual world. In recent years, augmented reality has attracted a lot of attention and has been successfully implemented in a variety of fields, including medicine, entertainment, industry, education, and tourism[7].

In this paper, 1) some concepts and basics related to augmented reality technology and the devices used in it will be presented, 2)some studies related to augmented reality in tourism will be discussed, and 3) A proposal to design a Mobile Augmented Reality (MAR) framework that serves tourism objects in Iraq will explain.

2. Theoretical Background

It's crucial to emphasize the most recent and relevant initiatives in mobile augmented reality, as well as the technology accessible for AR mobile applications. However, it is critical to have prior knowledge of the definition and capabilities of AR.

2.1 Augmented Reality Definition

As defined by Ronald T. Azuma, augmented reality is the merging of the actual content with the virtual content Fig.1, allowing people to engage with the digital world in real-time. Interactivity between real and virtual items is feasible thanks to device-specific input devices, and effective tracking is required for a successful integration[8].

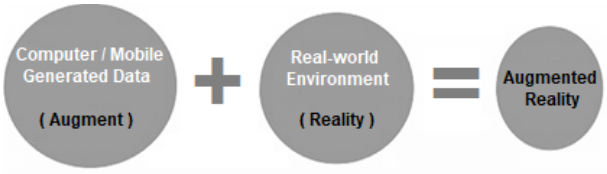

Fig. 1. Augmented reality Concept

Because augmented reality is connected between the actual world and virtual reality, it's impossible to discuss the concept of augmented reality without mentioning virtual reality. The term Virtuality Continuum was introduced by Paul Milgram and Fumio Kishino[9] in 1994. It is a term used to describe an idea that displays a continuous scale ranging from entirely virtual to the physical world, as shown in Fig. 2. As a result, whereas the user is completely immersed in a virtualized environment in virtual reality, the user can be aware of the virtual and real worlds in augmented reality, thus according to their understanding. [9]

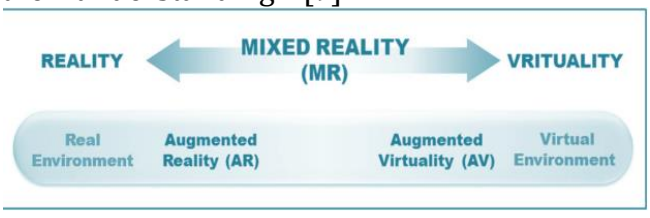

Fig. 2 Reality-Virtuality Continuum

As a result, augmented reality is a set of technological tools that combine actual and virtual information in real-time, allowing for

accurate three-dimensional registration. Sutherland invented the first optical see-through, the Head-Mounted Display (HMD), in 1968, allowing the perception of reality blended with computer-generated features. Other types of displays, such as hand-held displays and spatial displays, may be utilized to view AR in addition to head-attached displays[10, 11].

2.2 AR technology types

The fundamental division of augmented reality is tracking or orientation in real space, and according to this orientation, the virtual element is placed in the specified place. AR performs tracking by two types:

1- Marker-based AR

This type of augmented reality depends on a pre-defined point or mark in space, thanks to which applications using AR technology will install the required virtual elements, such as a 3D model. This space marker is usually an AR marker Fig. 3, a barcode Fig.4 and a QR code Fig.5. For example, the Real-life Marker is more sophisticated, as shown in Fig 6. For instance, this technology can recognize human traits from which to create the desired marker and then create the desired response. Thanks to this, many popular applications have been designed for smartphones with this technology [12].

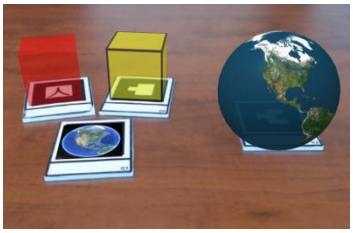

Fig. 3 . AR Marker

Fig. 4.QR Code

Fig. 5.Barcode

Fig. 6.Snapchat application

2- Markerless Based AR

As the name suggests, this is a technology that is no longer used for orientation in the

brand space but often uses, for example, Global Positioning System(GPS) coordinates, gyroscope or compass. Detects real-world environments, allowing the user to place any virtual objects anywhere in space. As with the previous Technology, Marker-less AR is available to end-users, and it is possible to install an application with this technology, such as Wikitude, as shown in Fig.7 or Layer. Applications include events and information, pop-up ads, and navigation support[12, 13]

Fig.7.Wikitude application

2.3 Display systems

In order for the user to interact and receive augmented reality, there must be display systems to integrate virtuality with realism. Techniques for displaying that information can be used as a monitor, hand-held screens, glasses, or even lenses. Recently, some methods of work that were characterized by low cost, which are digital glasses, have been developed[14].

It is necessary to address the different methods of display, as there are three types that can be employed: Hand-held, Head-held, and spatial[15], as shown in Fig. 8 below:

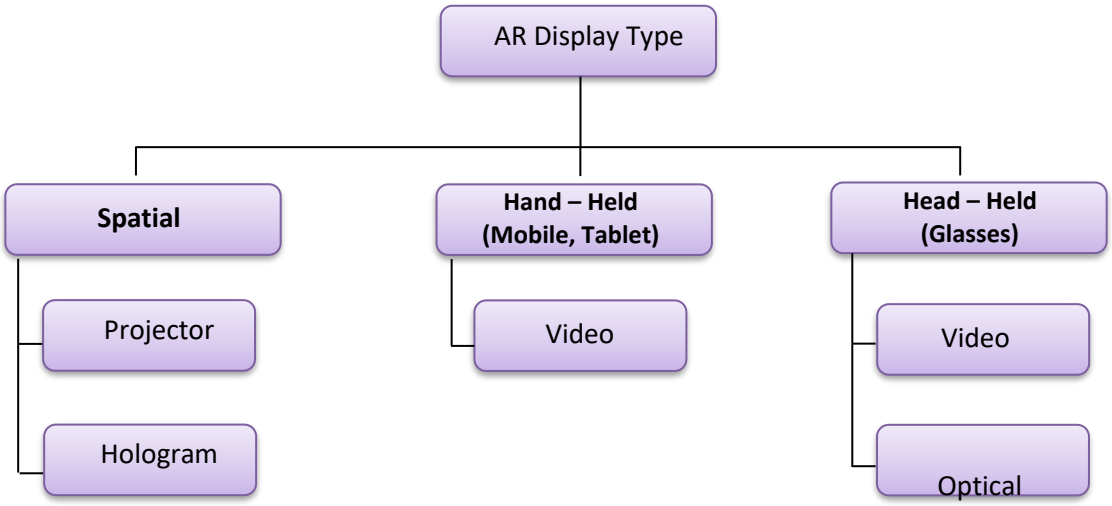

Fig. 8. Display systems classification [15]

1- Head-Mounted

It is represented by glasses or even lenses, and a lot of companies specialize in their production (Sony, Google, Vuzix, Microsoft, Etc,..), and each type has unique features in the display or application settings, as it is not possible to Addressing all of them, but it can be said that companies are constantly updating the methods and possibilities of presentation[16]. Head-mounted display systems mean attached to

the head using goggles or a helmet. The most commonly used tool is glasses. In this respect, we must distinguish between VR and AR glasses, where the difference may not be noticeable. For example, glasses from PlayStation for PS4 provide users with just virtual reality; glasses are opaque, without interaction with the outside world. In contrast, glasses for AR are transparent and provide the user with contact with the environment [12, 17].

2- Hand-Held

The wide spread of advanced mobile devices has led to an increased interest in mobile phone-based applications, as these devices are now equipped with high-resolution digital cameras, screens, graphic capabilities, and broad connectivity. The advanced technological accessibility to the geographical location through the Global Positioning System (GPS) resulted in enhanced spatial awareness and greater perceptibility by adding virtual spatial, graphic contents [18].

3- Spatial:-

This type depends on on-site broadcasting systems such as (Projector) or (Hologram) It performs the process of optical formation of a three-dimensional image by using a light source, which may be a laser device in the case of a hologram, consisting of a ghostly object within a specific area, but one of its disadvantages in the event of an obstacle in front of the broadcast device, the image will disappear, so it needs site control[19]. The three types differ in terms of ease of use, cost and efficiency, but mostly the purpose of the use (education, industry, medicine, architecture, planning or any other aspect) is what determines the appropriate type to achieve this purpose.

2.5 How Augmented Reality Works

Three subsystems can be found in an AR system: 1) Recognize, 2) Track and 3) Combine [20]. To begin, recognition is the process of recognizing any image, object, body, or location from an obtained image in order to overlay digital data.

The tracking process correlates to the image, object body, or space's real-time localization in space. These two processes (recognition and tracking) can be completed using a variety of methods. AR marker-based systems rely on real-world data. As reference points (markers) for virtual information to be superimposed, symbols are used. In such scenarios, the picture is processed with respect to the target object, and the location, as well as the orientation and movement of the visualization display, are approximated.

Marker-less AR systems, on the other hand, use a variety of sensors to detect their place in the physical environment, including a mix of electrical devices (e.g. accelerometer, compass, and location data – GPS), camera, composite vision, and others [21-23], hybrid approaches incorporate two or more data sources. The virtual information (e.g. video, 3D, or 2D) is placed over the real stuff in the last phase, mixing.

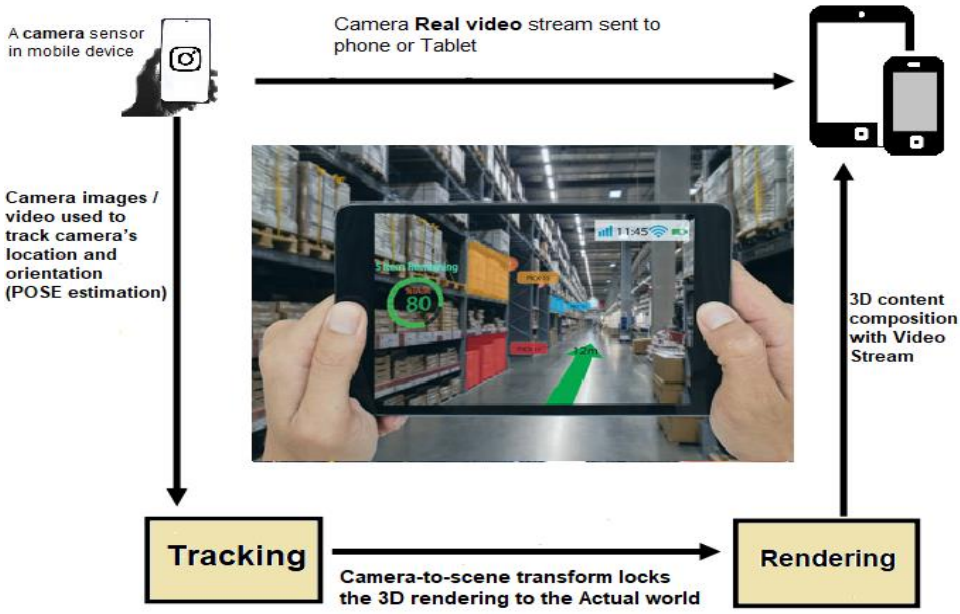

Fig. 9. AR does Augment natural scenes with digital content[24]

The rendering engine elements, as well as the positional tracking module, are both included in this procedure. The rendering engine's capabilities are a vital part of a realistic integration. In general, the virtual components, particularly the 3D model, should be examined and fully understood for the virtual object to look smoothly integrated with the actual surroundings [23, 25].

2.6 Mobile Augmented Reality

Despite the fact that there are alternative ways to provide an augmented reality experience (such as head-mounted or spatial displays), it is crucial to note that mobile technology (as found on smartphones) is generating significant achievements in outdoor augmented reality applications. Because they combine high-speed wireless data interchange (Wi-Fi, 3G, and 4G) and incorporate high-end image sensors and low-cost GPS receivers, mobile devices with rising computing power appear to have a converging influence on diverse forms of current technology [26]. The usage of both inside-out and outside-in tracking devices has enabled the tracking and registration of the user's speed and position, as well as the direction in which the device is pointing. With the increasing processing power of smartphones, both show technology and real-time representation of things appear to be powerful tools for conveying a clear image. For all of the reasons stated previously, one may argue that smartphones are the most device for augmented reality apps. However, mobile computing devices 25 (smartphones) offer a distinct benefit over static computing devices (desktop PCs) in that they can move with the viewer. For a person to communicate with their physical surroundings in any given situation, an AR application must be designed; it would be reasonable to do so through a device that can be moved about with the user at any given time.

Several crucial features were offered by [27]in order to determine the dependability and utility of mobile augmented reality. It's critical to keep these aspects in mind when building AR experiences if you want to get a good result. The first is the user's location, which is used to analyze the user's environment and provide them with related virtual content. The second factor is the speed with which virtual elements are linked to physical objects. The system's robustness and ability to work in shifting conditions are the third factors to consider. Last but not least is the scene's scalability in terms of overlapping actual and virtual items. This scalability is essential both in terms of physical scale and virtual information scale.

2.6.1 Augmented reality platforms

Unreal Development Kit, Unity, Godot, Engine, Cocos2D, Mono Game, Marmalade, and others are some of the most popular cross-platform engines on the market. We'll go over the most often used platforms in any design phase of (the MAR) application

- **Unity 3D**

Unity is an engine that is often used to create video games. It is a popular engine because it can target games to various platforms, allowing developers to create applications that can operate on mobile devices, web browsers, PCs, and consoles[28]. Unity's most recent version is 2022.1.3, which can be downloaded for free from the company's website.

- **unreal**

Unreal Engine is a gaming engine created by Epic Games. Unreal Engine 5 is the most popular game engine for making movies and AAA projects[29].

2.6.2 mobile Augmented reality SDKs

Many critical components of an AR application are facilitated by the Augmented Reality SDK: AR detection, AR tracking, and AR content rendering. Users can look through a comprehensive selection of SDKs. However, due to their requirements, only the Top five of them were chosen to be described here: All of the following SDKs are available for Android or IOS. They enable tracking processes using 2D photos and 3D models, Use GPS sensors and IMU sensors, have packages available for Unity 3D, and they are also free to use with a commercial SDK option.

- **Wikitude**: This SDK features image identification and tracking, as well as a 3D model generation with video overlaying and location-based, augmented reality. Its free plan, on the other hand, has several constraints for developers[30].
- **Vuforia**: Vuforia is an augmented reality software development kit for mobile devices. It is capable of detecting images and objects that are used as feeds to generate actual landscapes. Vuforia offers Application Programming Interface (API) in C++, Java, Objective-C, and.Net languages. This software also includes an object scanner component [31]that allows users to scan a wide range of physical models for later usage as object targets in Unity.
- **Kudan**: This SDK may support tracking and location requirements with markers or without markers. Images recognition and location requirements were used in several of the tests. Kudan tracking appeared to be able to tolerate more motions than Vuforia, and recognition appeared to perform better at a distance[32].
- **ARkit**: - (ARkit) was launched by Apple in June 2017. This IOS-specific kit enables the construction of augmented reality apps for iPhones and iPads running IOS 11 or later. All IOS developers with an Apple Developer Account can get their hands on the Apple ARkit SDK[33].
- **ARcore**: - Google's response to Apple's ARkit is ARcore. It's an augmented reality application development platform that was released in early 2018. For AR, the SDK uses Google Play Services. Google's response to Apple's ARkit is ARcore. It's an augmented reality application development platform that was released in early 2018. For AR, the SDK uses Google Play Services. ARcore is Google's follow-up to Tango, the company's first augmented reality computing platform (or Tango Project). The platform was supported for four years until March 1, 2018, when Google stopped supporting the ARcore platform[33].

2.7 Augmented reality in tourism

Tourism encompasses a wide range of actions, services, and industries, including modes of transportation, lodging and enjoyment, sports centres, restaurants, stores, historical and cultural sites, and so on. E-tourism is the process of digitizing the entire tourist sector and architecture. The elimination of

seasonality, more effective communication with clients, and an increase in visitors and revenues, in general, are some of the benefits of e-tourism [34]. Tourism is growing in popularity as a result of globalization[35] and the simplicity with which people may move from one location to the other.

One of the most essential approach to e-tourism is Augmented reality utilization. Augmented reality is utilized to increase the visitor's overall experience of cultural heritage, historical, or attractive place. Furthermore, with the interactive, realistic, and complicated AR system, users' comprehension of particular events, facts, vital information, and locations can be enhanced, motivated, and stimulated. Cranmer, Jung, Dieck, and Miller concluded that Augmented Reality (AR) is a new technology that is desperately required in the field of tourism since it may be used to help travellers find major attractions in their immediate vicinity. Tourist potentials that are interesting and distinctive attract a lot of study into the creation of tourism products. However, as compared to other themes, the number of research exploring the use of AR technology is relatively minimal. The tourist industry has a key role in ensuring the long-term sustainability of tourism attractions that are strongly linked to their natural state, strongly reinforced, and community activity[36].

Numerous projects of mobile AR to obtain tourism objects, such as Dieck and Jung, introduced an acceptance model for Augmented Reality (AR) mobile - an area of research in this area that has gotten little attention. According to the developed framework, the acceptability of AR mobile among young female travellers in the United Kingdom (UK) has a chance, which is determined by seven distinct dimensions, including information and system quality, a fee per utilization, suggestions, and innovative employees, danger, and facilitating conditions[37].

In their work, Waruwu, Bayupati, and Putra developed smartphone applications incorporating Augmented Reality (AR) for tourism in Bali. They proposed that E-tourism in Bali could be improved and that information technology can assist passengers in having new travel experiences. They designed the Dewata AR application to present 3-dimensional objects, video, and audio information about the Tanah Lot Temple using AR technology[38]. The application scans tourism object brochures with Android smartphones or tablets, displaying three-dimensional objects, movies, and audio information about the tourism objects. An AR application comprising various touristic virtual elements such as locations, photographs, and films was developed by a research group from Bournemouth University in the United Kingdom [39]. In Mugla, Turkey, an AR application prototype for geo-tourism was built[40]. This application provides users with information on the geological formation, as well as routes and road maps leading to that place. As well as more applications, MobiAR is a location-based Android program that allows individuals to obtain data and interactive elements about a city on their phones[41]. When the user points the smartphone camera in a specific direction and to a particular position, the program will display the nearest travelling sites with information about their distance and direction from the user. This application eliminates the need for the visitor to do a time-consuming search on the Internet, as an example, and allows them to experience touring as a leisure activity. There are other AR tourism uses in the literature Review papers on virtual heritage systems[42] and smartphone AR applications for tourism [39]are available to interested readers. Many AR-based tourism smartphone apps are also available in the Travel and Tourism category on Google Play and the App Store. With the continued growth of AR technology, it is projected that the quantity and complexity of applications will increase in the future.

Based on the literature analysis, a mobile augmented reality (MAR) framework was proposed to attempt and enable tourists in Iraq to obtain information about tourism objects much more quickly, efficiently, and attractively by enriching users' experiences while also providing knowledge in the most pleasurable way possible through the use of augmented reality technology. In order to save, retrieve,

and recognize the objects, we used the unity platform and Vuforia SDK, which runs the Android app, to enable the AR capabilities and database of images recorded and uploaded to the Vuforia cloud that is after that used for later steps serving MAR.

3. Research Method

Augmented reality is a type of media that attracts people and provides them with new experiences. According to a prior study, the use of Augmented Reality in tourism offers travellers with an exciting experience while visiting a tourism site. Because of the engagement and unique experience that the tourist had, a smartphone application that uses Augmented Reality for tourism might be regarded as one of the techniques to promote tourism [43]. The current study took the following steps, as shown in Fig.10.

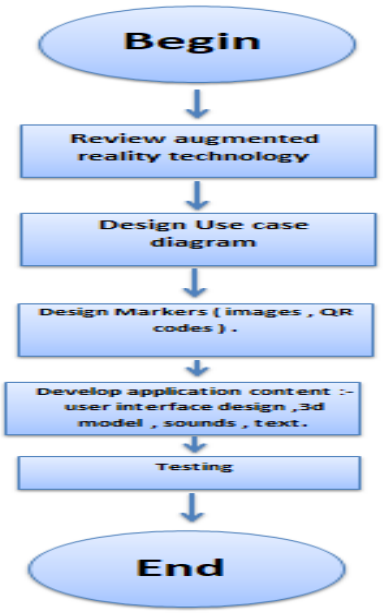

Fig. 10 Flowchart of the research method

1 - Review of the concept of augmented reality and the most important types, hardware and software equipments needed for its work.
2 - Review of some studies related to the use of augmented reality in tourism.
3 - Design a use case diagram and activity diagram for the proposed application.
4 - Design markers (images, QR codes) for each tourism sites.
5 - Develop application contents (3D model, Embedding Sounds and text)
6 – Testing application.

3.1 Use Case diagram of IraqAR

The application was first designed using the Unified Modeling Language (UML). In software engineering, UML is used to depict, specify, build, document, and maintain software systems. This research makes use of a case diagram. The Use Case Diagram depicts the application from the user's point of view[44]. The use case diagram in Fig.11 shows the functionality of IraqAR. There are some use cases include:

The user can view a list of tourism sites through the application. Users can view complete information about
a tourism destination as well as listen to audio descriptions. Finally, the user can utilize the camera for scanning a QR code or image marker so as to rendering 3d model related to a specific tourism site.

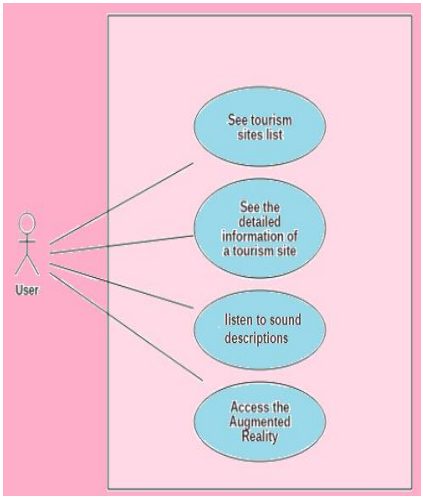

Fig. 11 Use Case diagram

3.2 designing and uploading markers

As we mentioned earlier, the image or QR code will be pre-defined for the user in order to use it to explore the tourist place. The marker includes either multi-view images of the specified location or a unique QR code for it. It is customized and then uploaded to the Vuforia for later use.Fig.12 shows the use of multi-faceted images and a unique QR code to assign them to the archaeological site of the Ziggurat

Fig. 12.Ziggurat site, Nasiriya, Iraq

QR codes are generated By QR Code Generator[45], which is a website that facilitates the process of creating a unique QR code for any image, text or file, taking into account the number of characters, their arrangement and sequence pattern. So that a unique QR code is formed, Vuforia SDK uses a 0–5 rating scale to determine how well an image or QR code may be detected by the camera. Having a higher augmentable grade indicates a better ability to recognize. Images and QR codes related to tourist sites must be printed and ready for the process of recognition by submitting them in the form of a small book containing a name, a picture and a QR code for each tourist place. This book is

considered an assistant medium for the work of the proposed application.

3.3 Modeling Tourism Object

The three-dimensional structure is significant because it is the symbol through which the visitor gets to know about the tourist attraction that drew his attention. It's also critical that the three-dimensional model's formation be accurate so that the tourist seriously thinks it's closer to reality. As a result, the presence of this 3d object in the real world has improved the user's vision as required. There are numerous programs that aid in the 3d model creation process. We use Sketchup2020, which is a free program that allows for making 3D objects.

The Unity platform includes these models whit extension (FBX). Unity, After recognition method complete working successfully by Vuforia, rendering these objects, along with other digital information, to enhance the tourist's perception of reality. (Figure 13) shows how to make a model for the Ziggurat, an archaeological tourist site.

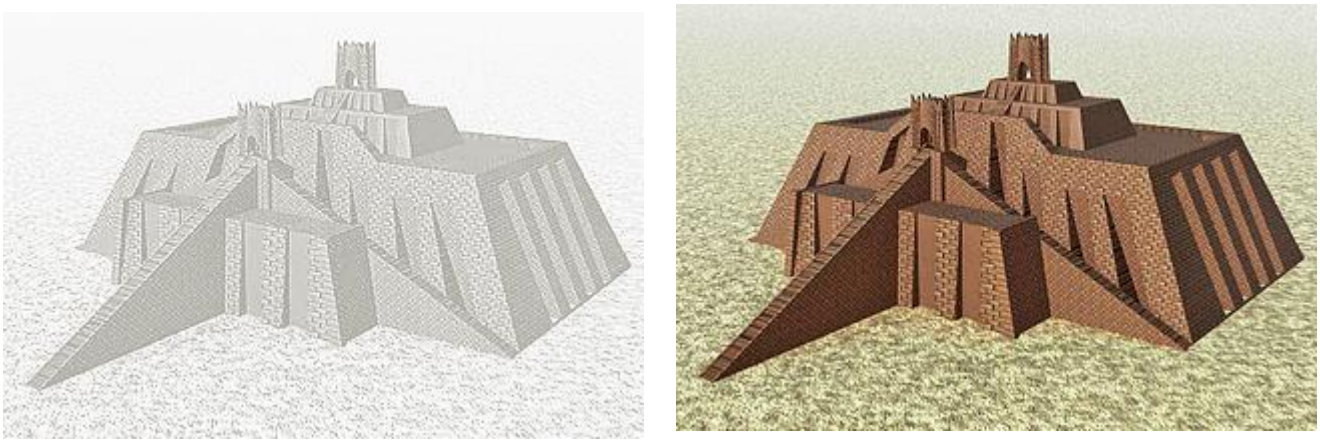

Fig. 13. Ziggurat 3d model By Sketch up

3.4 User Interface design:

This step is concerned with creating the user interface for the mobile application. The user interface is designed in accordance with the Google Material Design standards. The design criteria aid in ensuring that the application is user-friendly and attractive. In Fig. 14. The first screen (a) is a welcome screen that contains two main buttons.

Through the first button, the user is directed to the

the second screen (b), which con tains an embedding space for images and a text box for the title of that image. (c) the most important part of the user interface. After pressing the second button in the main menu, the camera will open inside this page. Then after the recognition function is done by Vuforia. The user is transferred to the last page (d), which includes a 3D model display area within the view of the camera, a text box for the name of that place, a field for audio information and its operation, and

The last field is a title and a text box that includes an explanation of that place that was displayed.

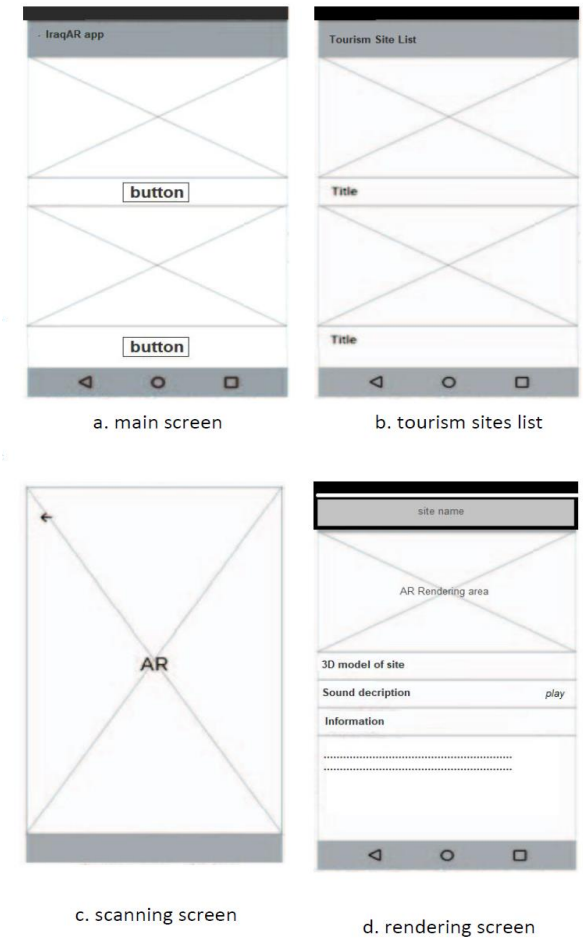

Fig. 14. User Interface design

4. Result and discussion

The proposed system architecture and the application are all discussed in this part. Fig. 15 show the user can see a list of tourist sites in Iraq and its image through a simple interface.

Fig. 15. User access list of tourism sites in Iraq

This research uses the marker-based Augmented Reality approach. Because it provides superior precision, the smartphone app uses the marker-based method of Augmented Reality. As shown in Fig. 16, the augmented reality Function starts to run by instructing Vuforia recognition for an image or QR code related to one of the tourism sites. The user guides the camera to an image target or QR code associated with any tourism object. QR codes are pre-defined for the user for all tourism sites in Iraq. With the help of the

Vuforia SDK, Augmented Reality uses the camera of a mobile device to scan a target image or QR code. The mobile device then renders and displays a 3D model as well as information and sound descriptions about the target image or QR code that has been recognized. Scanning specific photos or QR Codes is thought to give visitors an interactive experience by presenting AR items from marker images.

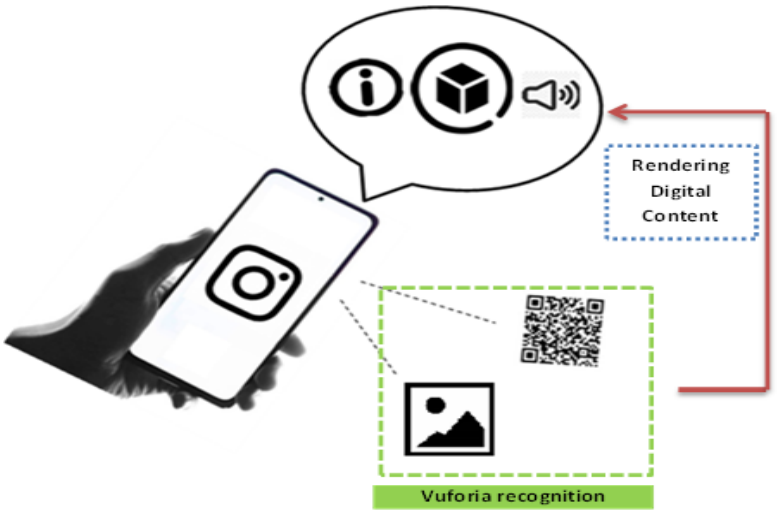

Fig. 16. The application's system architecture

Fig. 17. below is the prototype of the application based on the user interface design in Fig. 14. The main screen in the user interface will appear in front of the user after opening the application. The main screen (a) contains two main buttons (tourist sites button and open the camera button). The first button is concerned with directing the user to a list of tourist sites in Iraq, as in The screen (b) that contains pictures and a name for each tourist or archaeological area. The second main button is called Open Camera. It is interested in opening the Marker recognition area in the separated screen (c). At last, when the image target or QR code is detected successfully by the Vuforia recognition method, all digital content will be presented on screen as shown in screen (d).

a. main menu

b. sites list screen

b. recognition screen b. rendering screen

Fig. 17. Prototype of the application

We use the Unity Game Engine and Vuforia SDK. This game engine can be integrated with Vuforia SDK. The AR technology is provided by the Vuforia SDK, While Unity is used to create the application's virtual environment. The camera in Unity's virtual environment will be replaced by AR Camera to implement AR technology. This AR Camera will recognize the marker and display the three-dimensional object in actual time. By placing the marker, the user can interact with the 3D object. Vuforia SDK was used in IraqAR application recognition. This SDK includes the AR Camera, which is used to implement AR technologies.

The main screen consists of two main buttons. The first button for the Showing tourism sites list. Users can scroll down to view more. The second button opens the camera and then starts the recognition and tracking features, allowing us to find an image or QR code. Detection provides for the detection and tracking of images or QR codes. They must be physically clear and stable in order to function effectively. The surface should have characteristics that are based on contrast. To enable recognition, use the Vuforia website to create a developer account and access the Vuforia portal. Then creating a new database that includes all of the photographs and QR codes connected to tourism destinations in Iraq, the images and symbols are saved in the Vuforia database. The image and QR codes kept in the database are later utilized to be linked with a three-dimensional model, which is then presented to the user in a specialized augmented reality region on the second screen, In addition to the text and audio information that has been provided after the QR code or image detection.

5. Testing

The prototype was conducted on the work of the application in the laboratory and specific categories of tourist sites. The work of the application was tested on three tourism sites only.

Initially, the application installation was tested. Then the functionality of the application was tested. The suggested AR-based app is a Demo Version that has been tested in laboratory settings. There are currently no outcomes from its implementation in a real-world scenario in terms of reduced operational expenses or user feedback. Our future study will include a detailed description of the results.

6. Conclusion and Future work

In this paper, augmented reality technology in general, its main types and the devices it works on were reviewed. Mobile Augmented Reality has been introduced as a growing technology destination. Mobile AR-based services can work anywhere, showing digital data connected to the user's real-world surroundings whenever they want. As a result, mobile AR can be applied to a wide range of scenarios and situations.

In this research, we present a framework for leveraging Augmented Reality technology to visualize Iraq tourism sites. The AR-based app was created to assist users in learning more about tourism attractions by boosting their experience. It helps people comprehend the significance of Iraq tourism attractions, which include cultural and historical sites. In the future, we want to improve the user experience by adding geo-location and user navigation to the Android application.

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