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RESEARCH ARTICLE

Brief Study of Augmented Reality Mobile Applications

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Abstract— Rapid Development of Mobile devices have extended the Augmented Reality custom from personal computers to Mobile devices. The highly cooperative and interactive nature of Augmented Reality has given rise to various AR applications listing from games, navigation and so on. Range of existing AR applications has therefore leads to the urge to know the underlying concepts, implementation, comparison and fruitful result these apps offer to the users. The objective of this survey paper is to compare and discuss certain chosen apps which are quite familiar amongst the AR applications admirer on the basis of fundamental parameters.

Keywords— Augmented Reality, Handheld Augmented Reality, Handheld Devices, Operating Platforms, AR Apps, SDKs

I. INTRODUCTION

The AR based application development for mobile device started around 10 years back. After the growth in mobile application development since the iPhone AppStore opened in July, 2008, Device makers have created application outlets for other mobile platforms including Nokia Ovi, Windows Phone, Android and more. Industry analyst evaluate that there are wide number of applications through various application stores available, many of which are cross-platform [1].

Evolution of geo-tagging is one of the primary reason which leads to the entrance of Augmented Reality in mobile field. AR can redesign the way of these geo-tags as information can be displayed into real world view more effectively. With the development of advanced and affordable head mounted display (HMD) such as Google Glass, AR can be made more accessible to the general public [2].

II. GENERAL CONCEPT

A. What is Augmented Reality?

Augmented Reality (AR) is an advanced and fresh technology that involves the coating of computer graphics on real world. It is augmentation or supplementation of elements by computer generated sensory such as video, GPS data or graphics over the real environment. With the help of this technology, information about the real world becomes interactive and manipulable to/by user [3].

Augmented Reality in mobile applications lets user interact in real time by overlaying digital information onto the real world which explores utilizing camera equipped mobile devices as platforms for sensor-based,

video see through mobile augmented reality. This project also probes new and exciting applications supported by this technology, and UI solutions and models motivated by the restrictions of mobile devices [4].

B. Why chosen Handheld Displays for Geo-Based app development?

Handheld Augmented Reality is the implementation of AR concept between user and real world in the handheld devices such as mobile phones, tablets.

Augmented Reality is categorised into 3 display technologies which are Head Mounted Display (HMD), handheld display and spatial display [5] amongst which Handheld display technology has better advantage over other. The reason is:

- Handheld devices are portable and extremely worldwide.
- Handheld technology ample processing power and local network makes it an optimal platform for opulent and unequivocal Augmented Reality applications.
- Touch screen input mechanism is familiar and therefore users finds it an easy way to interact, effortless and socially suitable.
- Handheld technology can be used in both indoor and outdoor environment.

Handheld Augmented Reality offers exciting insight for Navigation. It uses the computational/graphic power with components like compass, tilt, GPS, integrated camera and such handheld devices.

III.DISCUSSION

We have introduced the AR concept and display technology it has been implemented and accepted on widely. Now we will discuss certain revolutionary Augmented Reality applications in handheld environment and compare them on certain parameters. These parameters are chosen because of the fundamental concept associated with the technology or we can say the hierarchical structure of insight readers may want to know during the comparison taking place. We will be discussing and comparing 3 applications which are 'Here City Lens', 'Layar' and 'Wikitude'.

A. Components Used

- 1) *Here City Lens*: It is the AR app for Windows phone 8. Previously, it was named Nokia city lens. It allow user to find and get information about a location by simply pointing the camera of the phone at a location [6]. It is a GPS based Augmented Reality app whose working with simplicity makes it a highly user-friendly application which also allows the app to run without internet connection using pre-loaded maps. Components used in this app are Built-in Camera, Compass, GPS and Maps [7].
- 2) *Layar*: It is one of the first mobile augmented reality app created by third party in 2009 with an open development platform to invite many developers to create AR content [8] and today it not only contains digital information related to geolocation as well as images but also features animated augments, sharing, gaming elements etc. This app is available on two largest mobile devices market holder platforms- iOS and Android. Components used in this app are built-in Camera, GPS, Magnetic compass, tilt sensors, accelerometer and internet connectivity [9].
- 3) *Wikitude*: It was the first Location-based Augmented Reality application which was made public. It got released in 2008 as a freeware. Not only just GPS-based but it also used image recognition which makes it Marker-based Augmented reality application as well [10]. This app was available on almost every major platforms- Windows, Android, iOS, Bada, Blackberry. Components used in this app are built-in camera, GPS, Compass, accelerometer and internet connectivity [11].

B. SDKs

- 1) *Windows phone 8 SDK*: Windows Phone 8 SDK is used for developing all kinds of apps that run on Windows Phone. The AR apps also utilize the same Windows Phone 8 SDK. Windows Phone 8 comes as an extension of .NET framework on Visual Studio IDE. A dedicated version of Visual Studio IDE which is only used for Windows Phone app development called "Visual Studio Express for Windows Phone" is available to download for free. App developers have three environments to code Windows Phone apps a) C#/Visual Basic.NET (.NET), b) C++ and c) HTML5/JavaScript. The AR apps on Windows Phone generally also require an additional assembly. In our case, we used SLAR Toolkit which is a Windows Phone and Silverlight Toolkit and is available as an open source code library [12].

- 2) *Layar SDK*: With the help of Layar SDK, Developers can build AR content and obviously AR based apps for multiple platforms. Layar SDK provides 30 day free trial period before proceeding purchase [13]. For AR apps in iOS, iPhone layar SDK can be integrated into an iPhone app associated with certain hardware requirements of SDK. It requires the Programming language as objective-C with back-end XML. For AR apps in android, Android layar SDK can be integrated into an android app associated with certain hardware requirements of SDK. It requires programming language Java with back-end XML. Layers however can be created by using many programming languages like PHP, java, MySQL etc. as long as response is in JSON format [14]. Layar SDK has two types of SDKs- VISION SDK or LAYAR VISION SDK for image/marker based AR apps and GEO SDK or GEO LAYAR for location based AR apps [15].
- 3) *Wikitude SDK*: With the help of Wikitude SDK, Developers can build cross-platform AR based apps for which it uses web technologies like HTML, JavaScript, CSS. Wikitude SDK offers a free trial with many features but one cannot publish app by using this and therefore developers to acquire SDK key should register with Wikitude GmbH formerly known as Mobility GmbH to acquire SDK key mail to the given address [16]. Integration of different environment apps into Wikitude SDK associated with certain hardware and software requirements have different libraries consists of different programming languages with similar base features [17].

C. Working

- 1) *Here City Lens*: The working of Here City Lens is based on Location-based Augmented Reality technology. User's position can be detected using GIS- Geographic Information system (location-based service) of mobile device incorporated with mobile network by which user can get information about the nearby locations like places, restaurants etc. from maps. As we go deeper into the mechanism, Here City Lens works on a simple algorithm. It initiates from the built-in camera whose purpose is well known by the users and with the help of calibrating GUI puts the information in the AR Toolkit Marker Recognition System which is a computer tracking library [18] for creation of AR applications to overlay virtual imagery on real world. Its purpose is to detect a defined pattern for real world objects called markers, calculates the position and orientation of marks and transform the virtual objects to align them with markers [19]. All this information is then feed to AR engine which is in the core of application which then goes into augmented objects repository to fetch relevant data and creates information from it. Feeds with relevant information are superimposed by AR engine on the display screens of device in the form of video stream and augmented objects [20].
- 2) *Layar*: Layar application development has been done on an open development platform comprising of various sections developed separately which makes it a wide domain to discover. For relevant discussion within the scope of this paper, we had chosen to explain the working of Geo layers and 2d and 3d objects in Vision layer. Geo layer is a layer which returns augments or simply POI (Point of Interests) with the help of GPS which detect user's current location and physical geo-locations. User when launch layar then the layar client calls for getPOI request from layar server which validates the getPOI response returned from POI service provider and gets back to layar client from where AR augments is displayed to user. Request and response of getPOI are packed with certain parameters like 'alt' and 'transform.translate.z' to collect user's current altitude as well as POIs altitude relative to user's latitude [21]. 2d and 3d objects in vision layer is about rendering of 'target objects' in camera view which is done through getPOI response when layar client recognizes the target object. Vision enabled target 2d and 3d objects are rendered by positioning the origin of objects in a coordinated system around the origin of target objects by changing translate transform values. Scaling and rotating transformation are done for all local origins of 2d and 3d augments [22].
- 3) *Wikitude*: The working of Wikitude is closer to the simplicity of Here City Lens and far simpler from the Layar. This location-based Augmented Reality application when recognises the Point of Interests (POI) calculates the positions of virtual objects on the displays of mobile screen using user's position through GPS or Wi-Fi. It also calculates the direction in which the user is facing by using Compass and accelerometer [23]. The information associated to the POI is overlay on the screen through computer generated content. For image-recognition which is marker-based

augmented reality, similar markers detection, calculation and transformation mechanism follows as in Here City Lens.

IV. CONCLUSION

Evolution of geo-tagging is one of the primary reason which leads to the entrance of Augmented Reality mobile field. AR can redescribe the way of these geo-tags as information can be displayed into real world view more effectively. With the development of advanced and affordable head mounted display (HMD) such as Google Glass, AR can be made more accessible to the general public [24]. As per the discussion and comparison we did, we found that these revolutionary application with advanced technology has been accepted and admired worldwide. It shows the potential of such applications which has rewrite the norms of existing technology to shape it to the next level. AR concepts are redefining the existing parameters we have in handheld devices in a clever and interesting way and the purpose we have observed so far is not just to elevate this 'future technology' but to express the ease and level of interactivity between systems and users. Cross platforms development with SDKs integrated with already available resources encouraging the developers to explore self-ability and to showcase the strength of AR which can justify it's prospective. The scope of this technology cannot be kept limited as it's just the beginning of new era which invites different communities to involve in and evolve this technology.

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