Augmented Reality Library

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***Abstract* – We have developed a mobile application, named as, Augmented Reality Library (AR Library) for library of Jinnah University for Women, Karachi, Pakistan. This mobile application gives you an opportunity to see computer generated books in the AR Library as in your real-environment. It involves the integration of 3D digital content of the physical books, magazines and shelves. With AR Library, user can first look up for the book using this mobile application from their cell phone. Identify the book or magazine and be able to see digital content by augmenting same as in the physical environment.**

Keywords - Augmented Reality, AR Library, 3D Model, QR Code, AR Marker.

I. INTRODUCTION

Augmented Reality [1] has gain many people's sight by its marking functionalities as **Pokémon Go**. Although it seems like a new technology but it was first used by Ivan Sutherland in 1968 [2]. The term Augmented Reality was originated in 1990 by a researcher Tom Caudell who merge virtual graphics on to the physical world to illustrate digital display. Augmented Reality is considered to be a technology that allows virtual objects to exist in real environment. It gives virtual information by immersing it onto the physical world. The AR technology [2] has many applications from Head Mounted Display to Hand-held devices, from indoor to outdoor, education to military and so on.

Augmented Reality applications [2] initially was used in military, industrial, and commercial but it has taken over many other fields and it has estimated that it will become the largest platform in the world. Its rapidly increasing application in drones industry has proven it on the ground by overlaying the data over the real-world, it would take AR to the skies. Its work in applications like Google Sky Map, Snap Chat, Augment, AR GPS Compass Map 3D, and Daqri are remarkable. When it comes to education it provides an engaging and interactive information experience. With the advent of digital age, libraries and physical books are seeming to fade away but library is a unique and valuable resource. The realness of holding a book has lost as almost everyone prefer reading a digital book. The application we are introducing is Augmented Reality Library (AR Library). It gives students and teachers a new way of learning. Further, in this paper, we will discuss different modules of this system, its working and tools and technologies.

II. RELATED WORK

Basically, Augmented Reality mobile applications are free or low-cost. A research project ShelvAR showed the successful work of organizing the books onto the shelves.

Researchers at Miami University created **ShelvAR** [3] on 2011 an augmented reality App that makes all those books easier to organize. ShelvAR consists of an Android App and a set of coded tags, representing call numbers that are placed on books' spines. When librarian scans the code on the spine of the book it shows graphical overlay to help with shelf-based library work. The ShelvAR app is an ingenious use of augmented reality to help facilitate the sorting and arranging of books.

Another industry-leading augmented reality application **Aurasma** [4] introduced in May, 2011 that lets teachers or students create and share your own augmented reality generated content. It uses tagged images, objects and also physical location to real world with digital content e.g. displaying video, audio and 3D animations. The latest updated version is 6.0.1 now known as **HP Reveal** [4].

Augmented Reality Library Instruction System (ARLIS) [5] is basically for enhancing library instruction in elementary schools. Successfully, student learning performance is improved significantly by using the ARLIS. Moreover, it demonstrates library skills and concepts to students in 3D view. ARLIS overcomes shortcomings of personal teaching skills of librarians that may adversely affect student learning performance by conveying the same learning content to all students.

III. AUGMENTED REALITY LIBRARY

Augmented Reality Library involves registering books, magazines, library card, assigning QR codes and AR Marker to them and displaying data like its content, availability and other important library instructions. Figure 1 shows the block diagram of the proposed AR Library.

There are five modules in AR Library Mobile App as **Book module**, **Magazine module**, **User Card module**, **Shelve module** and **Staff module**.

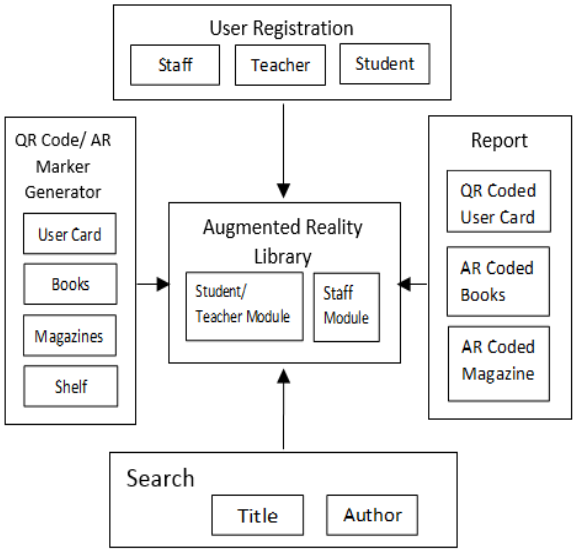


Fig 1. Block Diagram of AR Library

In AR Library Mobile App, there will be three different type of users i.e. Staff, Teaching faculty and Student. User Registration module involves registration of library staff, teaching faculty, and students. Therefore, users will be categorized as registered and unregistered user.

The product AR Library gives you an enhanced version of traditional Library for the users like librarian, Teaching Staff and students of Jinnah University for Women. AR Library gives you benefits like searching for a book or magazine and viewing the overview of books, magazines in a 3D View by scanning the AR Marker on them in your real environment and saving that information for later review in an offline mode. The librarian will manage and update AR Marker status of shelves, user card, books and magazines so that the user can always see the updated information. In library of JUW where we are working, consist of almost 45,000 books, about 70 types of magazines and journals and approximately 280 shelves comprising 24 departments. Initially, we are working on 3 shelves and 100 books and magazines and 1 user card.

A. Augmented Reality Library

In ARL mobile application, there will be three different type of users i.e. Staff, Teaching faculty and Student. User can scan the respective AR Marker through AR Camera by pointing toward AR Marker within given range. Upon opening mobile application, a menu screen will appear (see figure 2). On scanning the AR Marker on book, AR 3D view of book or magazine will be displayed in your real environment and you can therefore interact with it (see figure 3). Each dial of 3D cube contains different information like on first dial there will be picture of respective book or magazine and other dials contain information regarding user policies, table of content and etc. If the user is library staff, it will display the login page, user will avail features to update book or shelf details and updating user's status. Whereas, other user will scan the respective AR Marker through AR Camera by pointing toward AR Marker within given range. User can also make search by author name and title.

Fig 2. Menu Screen of AR Library

Fig 3. View of Book Module

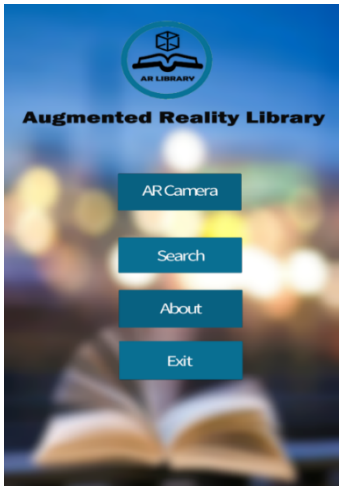
AR

B. *User Registration*

This module involves registration of Library staff, Teaching faculty, and Students by giving QR Code to their respective User Cards. Therefore users will be categorized as Registered and unregistered uses. Registered user will be given more features like saving AR view for an offline mode and viewing extra information etc.

C. *QR Code/ AR Marker Generator*

QR Code (Quick Response Code) is a two dimensional barcode (see Figure 4a). It can be read by any imaging device. QR Code is basically used for tracking, identification, document management. QR Code is assigned to User Card whereas, Books, Magazine, Shelves have assigned AR Makers. The QR Code and AR Marker will be generated by library staff through AR Library web application (see Figure 5). The assigned QR code to user card will display its user information in a 3D view. AR Marker is somehow same as QR Code but it displays the virtual information (see Figure 4b). These



Markers and QR Codes are then registered in the cloud database.

Fig 4a. QR Code Marker

Fig 4b. AR

Fig 5. Web Application of AR Library

D. *Report*

On Scanning AR Maker given to the book and magazine, it will compare it in our database, if it matches, it will render the information in the real world.

E. *Searching*

Searching gives you an option to search the exact placement of books and magazines by author name and title of books and magazine.

IV. TOOLS & TECHNOLOGIES

The technology is proving itself as a very useful tool in our everyday lives. Augmented Reality technologies are classified into **Marker-based AR, Marker less AR,** and **Location based AR [5].** Augmented Reality provides different SDKs for different purposes like recognition of objects, deploying 3D Models and provide streaming

in the mean real time. Of course, there are other aspects that you need to consider including supported platforms, whether they offer a Unity plugin, as well as additional features and pricing. The more advanced the augmented reality tools used in Mobile Apps [6] are, the more powerful they can detect 3D markers and real-life objects [7]. Our AR mobile apps are based on image recognition, In an AR environment, a 3D object can be rotate, move, scale and control.

We are using Vuforia cloud database for registering AR Marker and QR Code in the cloud so that we can easily use these marker by importing this database to unity and create respective 3D model for every individual AR Marker and QR Code.

The Unity 3D [7] is used to create both three-dimensional and two-dimensional games as well as simulations for computers, consoles, and mobile devices. We are using Unity for modeling 3D view information.

Microsoft Visual Studio is one of the famous developing platform which allows you to easily develop and deploy web applications, mobile applications, web services and websites. We are using Microsoft visual studio for developing desktop application where librarian can generate AR Maker and QR Code along with the information as per the requirements. Desktop application also contains the database of all the information of QR coded user card, AR coded books, magazines and shelves and its report.

Different programming languages are used in the development like Microsoft C#, Java, HTML, JQuery and Bootstrap.

V. CONCLUSION

"AR Library" is basically about displaying the virtual data as equal to the real world. This system will give user an easier and different way to look into book contents and other related details like author and so on. AR Library application will simply scan the AR Marker on the book and generate 3D view of information about that book and augment it in the real world. Books, magazines and Shelves will be assigned AR Marker whereas, user card will be assigned QR Code which will be registered in database. AR Library gives you benefits like searching for a book or magazine and viewing the overview of books, magazines in a 3D View by scanning the AR Marker on them in your real environment and saving that information for later review in an offline mode. Many possible future directions can be predict through further research.

VI. FUTURE DIRECTION

In this era of technology where digital interaction is becoming an important part. We should think broadly about mobile augmented reality applications as for library too. Many possible future directions can be predict through further research. ARL is limited for book search and viewing information. Its work can extend to searching the content of the book, looking for a reference on the web, getting an instant translation, an option to take notes and highlights, collecting book passages and an option to turn printed text in to editable notes [8]. Some of the feature are still available but not for libraries but for other special dedicated applications.

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