AR Library Navigator: A Library Navigation System Using Augmented Reality

Jawaria Hafeez[1*], Muneeb Ahmed Khan[2], Maham Azam[3], Sallar Khan[4], Asma Shafi[5]

[1*]Sir Syed University Of Enginerring And Technology Jahafeez@Ssuet.Edu.Pk
[2]Sir Syed University Of Enginerring And Technology Amuneeb80@Gmail.Com
[3]Sir Syed University Of Enginerring And Technology Syedamaham300@Gmail.Com
[4]Technological University Dublin, Ireland, B00168602@Mytudublin.Ie
[5]Sir Syed University Of Enginerring And Technology Asmashafi2019@Gmail.Com

ARTICLE INFO	ABSTRACT
	The evolving needs of users in the digital age have prompted libraries to make changes in recent years. As information repositories, they have embraced technology to improve the overall library experience and boost resource accessibility. Augmented reality (AR) is one potential method for transforming the way users engage with libraries. The "Augmented Reality Library Navigator" is a state-of-the-art tool that offers a novel and immersive method of library navigation by utilizing augmented reality technology. Here is a summary of the system from this abstract. The purpose of the Augmented Reality Library Navigator is to let library patrons interact more with both digital and physical collections by making information more accessible and streamlining the search process. The seamless integration of this system with mobile devices allows users to access a multitude of functions. Users can find books, journals, study spaces, and other resources with the help of the augmented reality (AR) system, which superimposes digital data on the real physical environment of the library. This real-time solution is location specific. Aside from multimedia about the library's holdings, interactive features include book recommendations, event notifications, and more. The main features and benefits of the Augmented Reality Library Navigator are discussed in this abstract, along with how it might enhance everyone's experience using the library, regardless of how familiar they are with its design or available resources. Along with creating a more distinctive and engaging experience for users, the system offers library staff a new way to filter and customize content. Furthermore, covered in this abstract are the challenges and aspects to consider when utilizing augmented reality in libraries, such as user privacy, the technological infrastructure, and the fact that "AR systems overlay digital information on the accessibility of physical libraries." It illustrates how further developments could enhance how people use libraries by talking about prospective future developments and research topics in the field of augmented reality in libraries. An exciting new way to improve user experience, engagement, and access in libraries is the Augmented Reality Library Navigator, which marks a major advancement in library services.

Keywords: Augmented Reality, Library Navigation System, Android Application, Blender, Unity 3D |

1. Introduction:

The augmented reality library navigator employs cutting-edge augmented reality technology to enhance the library experience for users. Users will find a more efficient and interesting way to access and engage with library resources because of this integration of the traditional library functions with the potential of augmented reality. Here's a more detailed breakdown of the concept:

One innovative solution that seeks to transform how people interact with libraries is the Augmented Reality Library Navigator. Libraries, with their extensive holdings of books, journals, and multimedia materials, have long been considered knowledge repositories. But the digital era has changed how we obtain information, and libraries are adjusting by utilizing technology to stay current. The primary goal of the AR Library Navigator is

to facilitate efficient user navigation within the library. By utilizing indoor location technologies or augmented reality markers, users can use their smartphones to get real-time recommendations for finding the books or resources they're looking for. As a result, heavy paper maps are no longer necessary, simplifying the user experience.AR has the power to breathe life into interactive library catalogs. By scanning book covers or catalog entries with smart devices, users can obtain additional information about books, including reviews, availability, and summaries. By encouraging users to look beyond their initial search, this interactive feature enhances the finding of new resources. AR-enabled guided library tours could be beneficial for new patrons or guests. They can listen to a virtual tour guide who describes the many sections, resources, and features of the library. The Augmented Reality Library Navigator can give library patrons an immersive and engaging experience by utilizing Blender and Unity to create 3D models and animations with QR code-based navigation. It uses technology to improve library experiences overall and provides answers to common problems like navigation, information access, language diversity, and event promotion. A library navigator with augmented reality can effectively address a range of common problems and challenges that libraries and their patrons face. Here are some ways that this state-of-the-art technology can assist with these problems: Libraries can be large, complex places where users may find it challenging to locate specific volumes, sections, or resources. AR Library Navigators help users navigate the library efficiently by providing step-by-step instructions in real-time. This improves the user experience overall and reduces frustration, which is crucial for beginners. Large collections are common in libraries, and finding the right material can be challenging. By offering interactive catalogs that let users scan books or catalog entries to obtain additional information like summaries, reviews, and related resources, augmented reality (AR) can facilitate this process. Users can choose their loans with greater knowledge thanks to this. Library staff could spend more time providing users with individualized support and expertise by using AR to automate navigation and information retrieval tasks, thus improving overall service quality. Ultimately, a comprehensive solution to numerous challenges faced by libraries can be found in an Augmented Reality Library Navigator. It makes things better for users, highlights the services offered by libraries, makes things more accessible, and engages people in novel ways. By adopting augmented reality (AR) technology, libraries can continue to be vital community hubs while transforming to meet the needs and expectations of their users. By providing a few helpful options, an augmented reality library navigator enhances the overall library experience for both patrons and libraries. The main remedies that this technology offers are as follows: By helping patrons find their way around the library, AR Library Navigators reduce frustration and save time. Patrons may quickly access specific books, sections, or resources by following the step-by-step instructions provided on their devices. Details about library resources are now more easily accessible to users. Users can make more informed decisions by using augmented reality (AR) to scan book covers or catalog entries and obtain additional information such as availability, reviews, and summaries. The AR Library Navigators facilitate the use of the library by individuals with disabilities. Text-to-speech technology makes libraries accessible to those with visual impairments, and sign language interpretation helps clients who are hard of hearing or deaf. Tech-savvy users, especially younger ones, are drawn to libraries by AR technology because it makes the institution more engaging and relevant in the digital age.AR Library Navigators gather and examine relevant information about user behavior, interests, and preferences. Libraries could use this information to adjust programs, collections, and services to better suit the needs of their patrons. Library staff members can better manage their time by automating tasks related to navigation and information retrieval. They can concentrate on offering clients individualized support, knowledge, and other valuable services. To put it briefly, an Augmented Reality Library Navigator provides workable ways to improve the library experience by making it more relevant, approachable, engaging, and user-friendly. It makes use of technology to help libraries overcome common problems and adapt to the shifting needs of their users in the digital era. Cultural heritage communication is increasingly taking advantage of innovations in digital technologies, and LBAR applications can be utilized for creating informative cultural tours. Using LBAR applications, users are prompted to visit cultural heritage monuments and places where significant historical events have occurred. When the users get close to these locations, digital content appears on the screens of their mobile devices, informing them about various aspects of these locations, such as historical facts, architectural and artistic trends related to human constructions, etc. Applications designed for augmenting the environments with cultural heritage content are numerous. Overlaying the physical world with historical information is present in many initiatives. Today AR is being utilized in many industry sectors. For example, tourism is an industry sector exploiting AR technologies' potential for marketing and educational purposes. Education is a sector that also benefits from AR, and by exploring the literature, one can find a wide variety of applications that have been applied at all levels of education. [1]We believe that VR and AR offer unique and innovative opportunities for older adults. Older adults, their relatives, and their professional caregivers can take advantage of these tools to improve their daily lives. However, the use of technology can be challenging, especially when older adults lack access to new tools or digital skills. Developers, practitioners, and researchers in the field must acknowledge digital inequalities and provide older adults with training tools, support services, and digital solutions that consider their heterogeneous backgrounds and needs. [2] To stimulate training for the older adults who need to improve their balance we have developed balance training aids using AR and HoloLens. The older adults get help to perform exercises correctly with both verbal and visual feedback. Exercise automatically increases as the person performs better and hopefully with the help of training aid one can increase motivation and adherence to training for a better result. The concept of feasibility in this study refers to how feasible the training is with the help of the new

technology and training approach. The study showed that training with the new technology is, to some extent, feasible for the older adults, but needs further development. Also, the technology seemed to stimulate increased motivation, which is a prerequisite for adherence to training. However, the new technology and training require further development and testing in a larger context. [3] In this modern era of mobile applications, Augmented Reality (AR) is becoming one of the emerging areas of implementation for researchers around the globe. While live gesture detection and 3D model creation still need more attention from researchers. In this paper, we present an interactive AR character that directly interacts with real objects. The interactive AR character automatically determines how to behave and to control real objects. This current research presents three studies that test the social psychological effects of Augmented Reality. In this research, we are using Apple's IDE for native iOS development on swift, Xcode for UI design and architectural functionalities of our application. We used the ARKIT library to import all the necessary functions and classes to manipulate and use according to our needs. Finally, we successfully deployed an IOS application which can detect live gestures of our hand movements and then create 3D models with the help of our hand gestures. [4] Technologies such as AR and VR have been highlighted as a solution used to resolve problems of older adults who face various challenges in their latter part of life. The main goal of these emerging technologies is to facilitate care for them, to monitor and support their health. Social and emotional wellbeing have also recently been recognized as an important factor for enhancing their quality of life. However, there is a lack of AR and VR technologies for supporting their social and emotional wellbeing. New technologies that have been designed without understanding the characteristics of older adults impede their experiences with these technologies or even cause harm to vulnerable users. However, this study proposes significant insights, existing gaps, and future research directions for studies of AR and VR through a critical assessment of the selected papers. We identified challenges and barriers that older adults experience in using AR and VR applications. [5] For the Better accomplishment of the Augmented Reality application, we make some strategy to work smartly. The work is divided into four stages: Designing, Development, Modeling, and Integration. The team started the work parallel for Designing and Development, for this purpose we used Adobe XD and Android studio. Besides this, we created 3D models. You must find a place to import models and for that you must move your cell phone and then marker will catch the place to display models. Then through AR Core camera, labeled models will display on screen after just a click on a model and then click on marker as shown in Figure 7. You can rotate and zoom in or zoom out of the model according to your requirement. Also, you can choose any other model from the list as well. The first model will be removed from screen automatically and next selected model will display on screen. [6] The new AR features added in the traditional maps combine existing Street View and Maps data with a live feed from your phones camera to overlay walking directions on top of the real world and help you figure out which way you need to go. In addition to directions, the new AR mode can help identify nearby places, too. This new feature helps the user to get a better view and an interactive screen which will allow the user to find ways without any worries and problems. The application can even further be expanded to create a treasure hunt app using the same location-based nature and can be integrated with the original application and a local repository can be added to store visited places. The new social and recommendations features such as getting a nearby cafe and its ratings or a shell petrol pump nearby would give user an experience with less hindrances in their way and enjoy their journey cheerfully. [7] The recent boost of popularity in using AR is tied to the developments that took place in mobile technology. When smartphones and tablets went mainstream in 2010, AR also became more publicly available. AR applications for libraries. There exist a few studies that offer detailed, practical information in integrating AR into library services that will help other librarians in deciding whether to adopt the technology in their own libraries or not. the advantages and challenges of integrating AR into the library orientation programs of academic/research libraries. With the variety of emerging technologies that are currently available in the market, it is very important for librarians to make careful analysis and research before deciding which of these will be helpful in reaching the goals of their respective institutions. AR offers a strategic medium through which librarians can attach additional digital information to real-world objects and simply let patrons interact with them. In relation to librarianship, AR is not simply a technology, but a channel librarian can use to disseminate information and guide patrons in their studies or research. If properly implemented, AR can be a powerful tool to provide better access to information for library patrons. [8] Augmented reality architecture comprised of six elements including user, interaction, device, virtual content, real content, and tracking. This is also the approach to articulate the AR requirements and narrow down the definition. The review of 15 AR publications for older people demonstrates the domain analysis in terms of transportation, training, age in place and entertainment. We also observe that since 2012, the number of articles related to AR application design for older people rapidly increased. It gives insight into the current situation for the ageing population within the AR community and points to my future determination of specific AR area. [9] Augmented Reality is considered as an emerging content display technique that can improve and enhance learning content presentation as well as interaction between learners and learning contents associated with location-based real-life learning objects (RLO). To apply AR technique for the learning, the major technical challenge is to identify real-life objects (the realities). To tackle the technical issue, this paper presents a Location-Based Object Identification Algorithm that we proposed and have implemented in a mobile learning application. The algorithm aims to identify the real-life learning objects by matching the tagged location information of the RLOs with the current location and orientation of the mobile device. Furthermore, the algorithm also provides the guidance capability to navigate learner to the right RLO among the nearby RLOs for learning. A real-life learning object is a real-life object used as a location-based

learning object in the location-based mobile learning setting. A location-based adaptive mobile learning application, called Multi-Object Identification Augmented Reality (MOIAR) has been developed to apply AR techniques into mobile learning applications. It is empowered by the Location-Based Object Identification Algorithm to identify the real- life learning objects in the mobile learning setting. The implementation of the mobile learning application has proven the usability and the practicality of the Location-Based Object Identification Algorithm, to improve the learning content adaptability, the MOIAR also utilizes the 5R adaptive mechanism, which not only provides adaptive learning contents but also assists real-life learning object identification (Chang & Tan & Fang, 2010). The 5R adaptation concept for location based mobile learning is stated as: at the right time, in the right location, through the right device, providing the right contents to the right learner. [10] Augmented reality (AR) is a new technology that has emerged with potential for application in education. While a lot of research has been conducted on AR, few studies have been conducted in the education field. The number of studies on AR is growing due to the effectiveness of this technology in recent years. AR has been used in different fields in education. AR provides an efficient way to represent a model that needs visualization (Singhal et al., 2012). AR also supports the seamless interaction between the real and virtual environments and allows a tangible interface metaphor to be used for object manipulation. AR technology is still new in education, thus there are still some limitations. However, the review of the research indicates that most of the limitations are related to technical issues. Such limitations can be overcome over time as research on the integration of AR in education is replicated and improved. When the potential of AR technologies is more fully explored, the beneficial functions of AR can begin to be used widely in all fields of education and the efficiency of the teaching and learning process will be improved. [11] The development of a mobile augmented reality engine constitutes a non-trivial task. In particular, the following challenges emerge: To enrich the image captured by the smart mobile device's camera with virtual information about POIs in the surrounding, basic concepts enabling location-based calculations need to be developed. An efficient and reliable technique for calculating the distance between two positions is required (e.g., based on data of the GPS sensor in the context of outdoor location-based scenarios). Various sensors of the smart mobile device must be queried correctly to determine the attitude and position of the smart mobile device. The angle of view of the smart mobile device's camera lens must be calculated to display the virtual objects on the respective position of the camera view. Furthermore, a location-based mobile augmented reality engine should be provided for all established mobile operating systems. However, to realize the same robustness and ease-of-use for heterogenous mobile operating systems, is a non-trivial task. [12] Augmented Reality (AR) technology and smartphones to implement a mobile campus touring system. Throughout the development and evaluation of the AR mobile touring system, students' reactions to the use of the system were gathered. Most of the users highly valued the use of visualized augmented information in the AR campus touring system. They also appreciated gaining situated awareness and using the AR mobile campus touring system to acquaint themselves with the new environment. Different from other touring systems, this AR campus navigation application offers immediate information to satisfy students' timely needs. The use of the AR mobile tool provided students with context-aware location-based learning experiences. However, some research limitations and developmental issues should be well considered. Future studies of gender differences and self-efficacy issues might be investigated in relation to learning outcomes. We expect that this AR mobile touring system can allow freshmen to readily experience interactive learning. It is also hoped that, in the future, the use of AR can be applied in more learning settings on campus as an innovative alternative for bringing experiential and ubiquitous learning to students. The development of a mobile augmented reality engine constitutes a non-trivial task. In particular, the following challenges emerge: To enrich the image captured by the smart mobile device's camera with virtual information about POIs in the surrounding, basic concepts enabling location-based calculations need to be developed. An efficient and reliable technique for calculating the distance between two positions is required (e.g., based on data of the GPS sensor in the context of outdoor location-based scenarios). Various sensors of the smart mobile device must be queried correctly to determine the attitude and position of the smart mobile device. The angle of view of the smart mobile device's camera lens must be calculated to display the virtual objects on the respective position of the camera view. Furthermore, a location-based mobile augmented reality engine should be provided for all established mobile operating systems. However, to realize the same robustness and ease-of-use for heterogenous mobile operating systems, is a non-trivial task. [13] AR applications superimpose 3D and/or 2D graphics on top of the real-world view. This suggests that the available information can be continuously updated through the design of new objects. In turn, these objects and 2D graphics are inserted and handled by the AR applications with the help of geo-location data, or more recently AR tags, which can be easily read by mobile devices and computers. However, the specific technological requirements for AR mobile applications depend largely on each individual case. All AR mobile platforms require the use of web servers for the hosting of data, databases, and AR tags for points of interest (POIs) in the case of tag recognition. In addition, such applications require that users are equipped with smartphone devices. Moreover, in cases of location-based mobile AR applications, which require the identification of the user's location and direction, the devices need to be set with a gyroscope and a GPS system. In all cases, mobile devices will need to have fast CPU, large RAM capacity, a camera and Wi-Fi or 3G enabled Internet connection which will allow data transmission. It should be noted however that nowadays the latest generation smartphones (if not all) are able to handle mobile AR applications. [14] In terms of tourism-specific functionality, most applications offer interface elements for keyword search and browse through available information. All applications provide map-based services, even though they vary in form and implementation.

However, it was observed that besides map-based services and communication, further tourism-related functionalities such as m-Commerce, feedback, routing, and tour generation, are rarely supported. Context-based push of information is supported only by two applications (Yelp and mobbed), which enable the user to set criteria for context- based notifications. Feedback is one feature that can be incorporated in AR view, enabling the user to rate and comment immediately upon his/her visible surroundings. Additionally, routing and tour generation would be suitable in AR view, since AR facilitates navigation. AR-specific functionality was explored (Table 1). Exploration of the immediate visible surroundings of the user is probably the most obvious advantage that AR mobile applications could provide to tourists. In terms of this functionality, the AR-view in the examined applications enables the tourist to either display different virtual layers of spatially relevant information or display one specific virtual layer of spatially relevant information. The former approach enables the user to explore available content for an unfamiliar environment without having specific background knowledge of the most relevant/interesting content. Further, almost all the reviewed applications provide an interactive display with "clickable" annotations that expand to deliver more information about the selected POI (Wikitude, Layar), open map view (Local scope, London AR guide) or lead to a different screen with more detailed information.[15] In terms of commercial development, many unchartered domains exist that are yet to be commercially exploited. In commercial products, the first-mover's advantage is important to a product's success. Firstly, AR is not incorporated into any of the mainstream genres yet. Imagine for example StarCraft being played by physically placing game cards on a map. Secondly, it seems like there are no serious AR games on the market currently. Most of the serious games created by the research community are technological demos at best, and it is up to the commercial developers to make these demos into professional solutions such that society can benefit from them. Moreover, the advent of marker-based technology has made AR so much more accessible to consumers than it was previously, therefore this era would be a good time to make commercial AR games.[16]

2. Research Methodology:

To better accomplish the objectives of the Augmented Reality application, we create some clever working strategies. The project is divided into four stages: designing, developing, modeling, and integrating. Using Unity 3D and Visual Studio, the team began working on both design and development at the same time. For the animated model, we also created 3D models using Blender, an open-source platform. To give our application a polished look, we lastly include the models into Visual Studio. Below attached Figure describe development steps of our Augmented Reality Application,

System Development Life Cycle
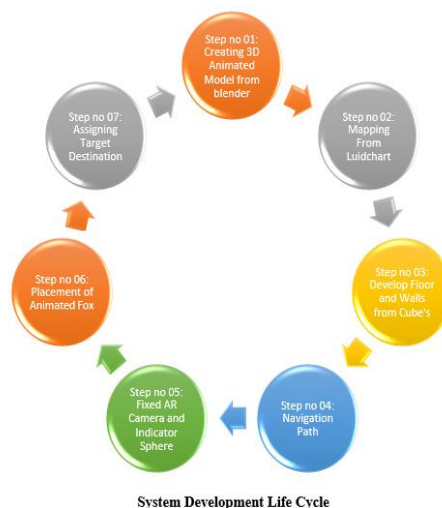
• Creating 3D Animated Model from blender:
By building a 3D animated model in Blender and integrating it into an AR library navigator, the user experience can be enhanced and a more engaging way to browse the collection provided. As seen in "Fig. 1", we can create an animated character for navigation.1. First, use Blender to create our 3D object by modeling and designing it. You can make and use a fox character or object to be a part of our AR Library Navigator. Blender provides a wide range of modeling and animation tools. Make use of textures and materials to give our model a pleasing visual appeal. Use Blender's texturing tools to add more color, texture, and detail to our model. To animate our 3D object, make use of Blender's animation features.

Fig. 1: Creation of 3D model

• **Mapping from Luidchart**

Floor plan and room layout templates might be available on Luidchart. Look through the template collection to see if there is one that would work for us. If not, we can begin with a blank sheet of paper. Using the shapes, lines, and other drawing tools in the Lucid chart, as illustrated in "Fig. 2", create the walls, rooms, and other components you need for your floor plan. Give shapes labels, patterns, and colors to help you identify the various parts of your floor plan. You can just resize and arrange the objects on canvas to create the right floor plan layout. Using the distribution and alignment tools, we ensure that the objects are properly spaced and aligned. To annotate the rooms, we utilize text boxes measurements as well as any other important floor design elements. After creating your floor plan, make sure to save our Luidchart document by selecting Publish and Export.
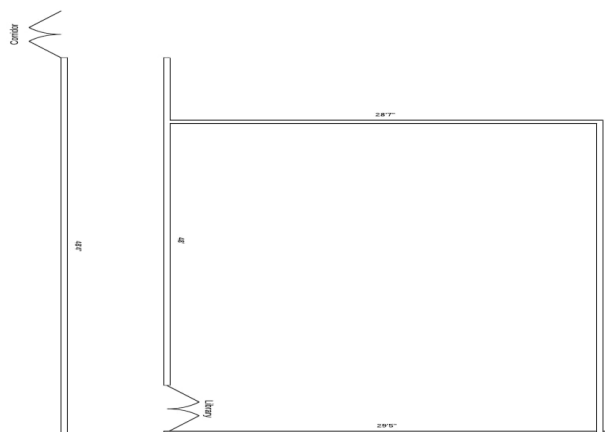
Fig. 2: Formation of library map

• **Develop Floor and Walls from Cube's**

Using Unity, you can create a floor and walls out of cubes by dragging and dropping cube objects into the 3D scene. The cube primitive objects that Unity comes with can be used to construct a floor and walls out of cubes. Right-click in the Hierarchy window and select "3D Object" > "Cube" to build a new cube. For clarity, rename it to "Floor". Go to the Hierarchy, right-click on the "Floor" cube, and select "Duplicate." As seen in "Fig. 3", rename the duplicated cube to "Wall" (or "Wall 1").3. We can keep making copies of the "Wall" cube and arranging them in different locations to make more walls. Run the scene to check our space. With the addition of a first-person character controller and additional player control scripts, the room is now navigable. We can build on this base by including more features and details in your 3D scene, like windows, doors, furniture, and interactive elements, based on the needs of your project.
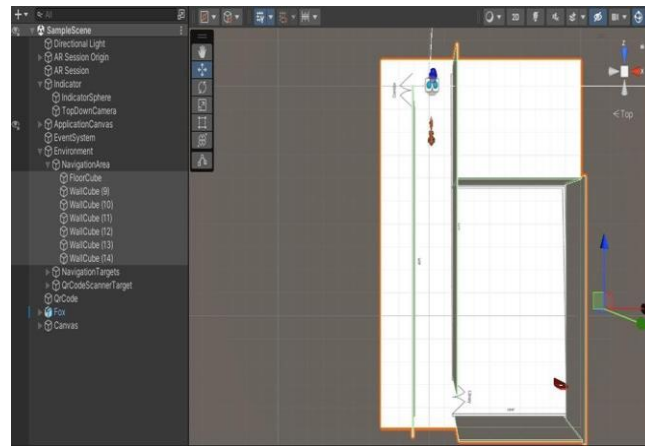
Fig. 3: Setting up floor & walls

• **Navigation Path**

In Unity projects, defining navigation areas and establishing a navigation system are usually necessary before assigning a navigation path to span a whole region. For characters to navigate the scene with intelligence and to create paths, Unity's Navigation system is extremely helpful. In the Navigation pane, click the "Bake" button, as seen in "Fig 4". This will create a mesh called a NavMesh, which will define the walkable parts of your scene. The Navigation window allows us to set up multiple levels for our navigation system. Make sure our scenario has all the navigational objects we need. This entails describing any obstacles as well as the walker-friendly surfaces. When required, attach NavMesh parts to our objects. To block the path, for example, or to act as a platform, we can add a NavMesh modification component to an obstacle or platform. NavMesh Agents must be set up before we can create character objects that can move around the scene. These agents specify the parameters of the characters, such as radius, acceleration, and speed. Visualizing and diagnosing your navigation system with Unity's integrated debugging tools, like Gizmos and the NavMesh visualizer. Using NavMesh and NavMesh Agents, we can define walkable areas, obstacles, and navigation layers, and then design characters or objects that can navigate through the scene intelligently.
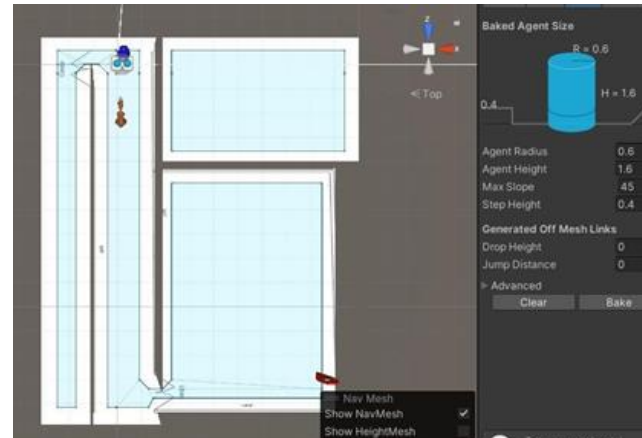

Fig. 4: Defining navigation areas

• **Fixed AR Camera and Indicator Sphere**

To set up an Augmented Reality (AR) experience in Unity, place an AR camera and an indicator sphere at the beginning of the corridor. Assuming you have the required AR framework and have already configured your AR environment, this might be done. Place an augmented reality camera in your scene if you haven't already. This camera may be included automatically or may need to be manually configured, depending on the AR framework we're using. We can add an AR Camera to AR Foundation by choosing "Game Object" > "XR" > "AR Camera." Place the augmented reality camera where you want the corridor to begin. Our experience with AR will start here. Achieve the same position for the AR Camera and the indicator sphere. To make the sphere more visible to users, we might want to change its size and look. The AR Camera settings may need to be configured, depending on our AR framework. For instance, the AR Camera component in the Inspector of AR Foundation allows us to adjust the tracking mode, device camera, and other settings. Make sure the AR camera and indicator sphere are positioned correctly at the beginning of the corridor, as shown in "Fig. 5", by testing our scene in the Unity editor or on an AR device. The concept of placing the indicator object and AR Camera at the intended starting point is still the same.
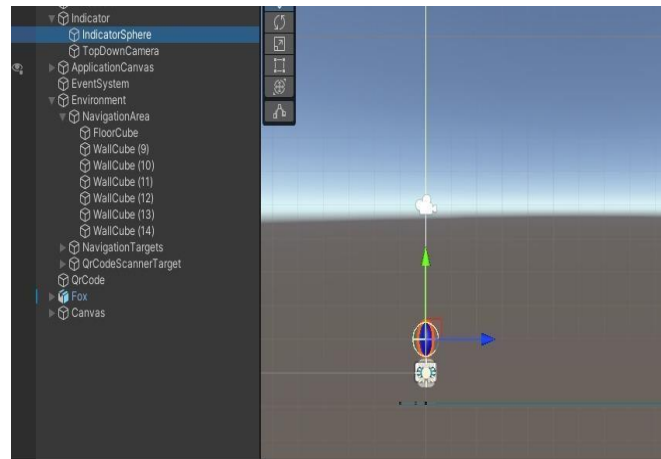
Fig. 5: Defining navigation areas

• **Placement of Animated Fox**

To place an animated fox or any other 3D character in Unity, you must import the 3D model, set up animations, and place the character in our scene. Obtain or make a fox 3D model. The model needs to be in an OBJ or FBX file type or another compatible format. Copy the fox model into the "Assets" folder in your Unity project to import it. If our fox model has animations, set up the animation controllers and the animations. This is done using Unity's Animator window. By making an Animator Controller and dragging our animation clips into it, we can indicate the transitions between animations. To create an empty GameObject, right-click in the Hierarchy panel and select "Create Empty". This GameObject will serve as the home for our fox model. To make the model of the fox a child of the empty GameObject in the Hierarchy panel, drag and drop it onto the object as shown in "Fig. 6". We can now manipulate and move the fox as a result. Use the Inspector window's Transform component and the empty GameObject in the Hierarchy panel to adjust the fox's position and scale. Play the scene and watch how the fox moves and behaves. To suit the intended scenario, make the necessary adjustments to the position, scale, and animations. Save your Unity scene once satisfied with the animated fox's positioning and behavior.
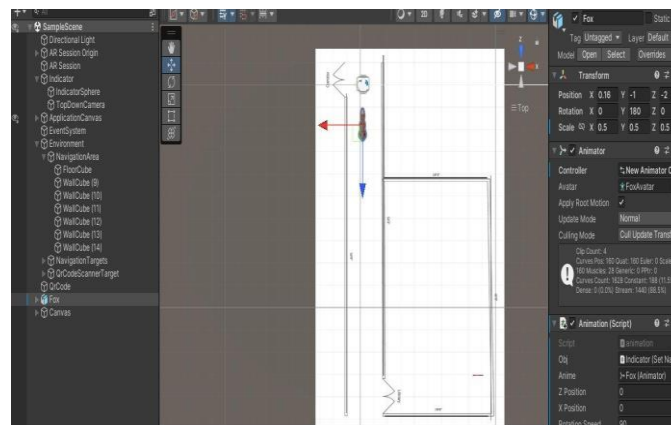

Fig. 6: Placing the fox

• **Assigning Target Destination**

In Unity, assigning targets to destinations entails naming places or objects as destinations that characters or other game elements must reach. This feature is frequently utilized in navigation scenarios. Choose our direction for the Unity scene. These could be any objects we choose to use as targets, such as empty GameObject and markers, which would control how the character moves and allow us to write a screenplay or use one that already exists. References to the locations should be stored in the script using variables. In the Unity Inspector, assign the destination objects (the blank GameObject or markers) to the destination variables of the script. To do this, drag and drop the destination objects into the corresponding slots of the script components. In the screenplay, explain the character's movements to the assigned locations. One of the useful utilities is Transform. Translation is a rigid body. We might use a pathfinding algorithm or Add Force, depending on how complex our application or game is. Once the character reaches a location, move on to the next one on the list. This can be done by having the character move in a new direction and updating the script to reflect the current location. Continue in this manner until the character has visited each of the predetermined locations. Loops can be used to iterate through the destination list. As illustrated in "Fig. 7", we can add additional behavior to the character once they arrive at a destination, such as animations, interactions, or logic unique to the game. Watch the character's movements as it goes from one location to another by playing the scene. Troubleshoot

any issues that surface during the transfer. Unity users now have a broad framework for assigning goals to destinations thanks to this procedure. The specifics of implementation will depend on the needs of our application or game and the movement logic we decide to use. If you need more advanced pathfinding, we can utilize Unity's NavMesh system.
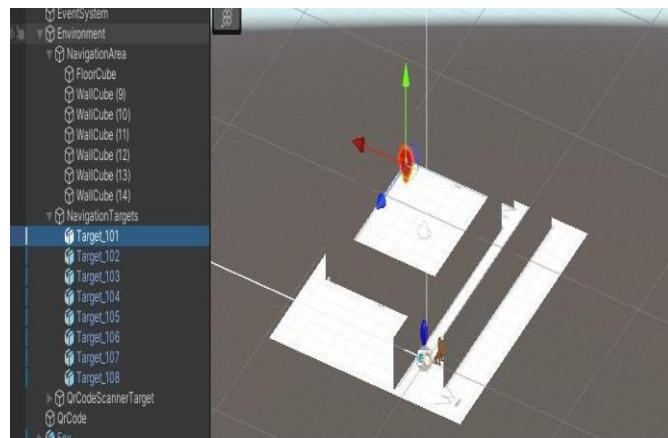

Fig. 7: Setting up target destination

3. Result And Discussion:

- **Login & Registration Interface**

The Login page where students or teachers can login to their Id's or can register as shown in "Fig. 1".
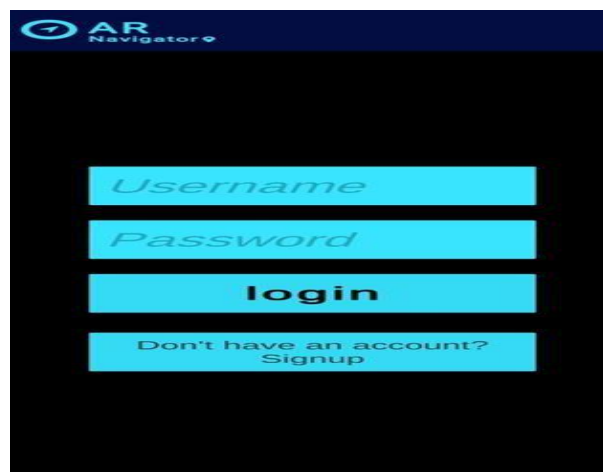

Fig. 1: Login Screen

User can create newone account and the login information is saved in backend file as shown in "Fig. 2".

Fig. 2: Registration screen

- **Scanned QR Code to Select Target**

After Login Students or Teacher Scanned specific QR Code which contain fixed value of specificSelected Target as shown in "Fig. 3"

Fig. 3: Scanning QR code

Then select desire book from drop down box as shown in "Fig. 4".

Fig. 4: Choosing book from drop-down box

- **3D Animated Fox Navigate User**

After selecting the book 3D animated Fox will appear in front of user and will guide them towards selected location as shown in "Fig. 5" and "Fig. 6"
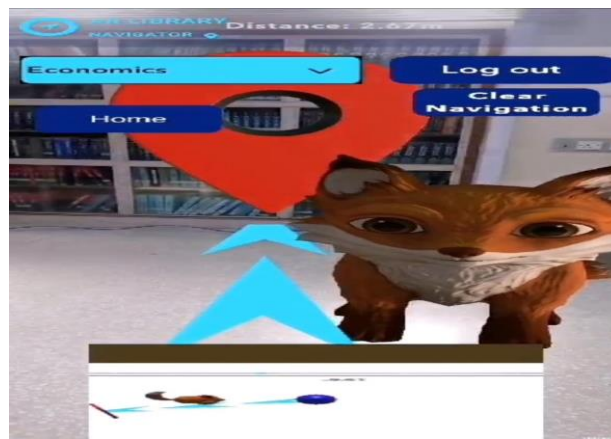

Fig. 5: Start navigating towards book

Fig. 6: Arrived at destination

• **Popup Message Will Appear**

On Reaching To the target Popup message will appear and give user two option, first one is "exit"option to bring user on Scan QR code screen and other option is "home" which bring user on that screen from where he/she can select another book as shown in "Fig. 7".
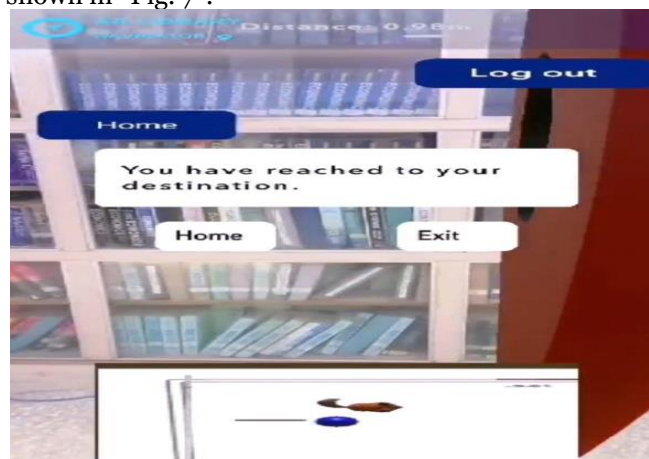

Fig. 6: Showing popup message on arrival.

4. Future Work:

Given how augmented reality (AR) is changing how people interact with information and physical spaces, the field of augmented reality libraries has a lot of room for growth and innovation. ultimately enhance and increase the potential of augmented reality libraries. Large buildings, shopping centers, hospitals, and educational institutions are just a few of the many different domains in which our library navigator may be used. This AR library navigator's primary advantage is its ability to provide precise, real-time navigation throughout the library. Consumers find resources, study areas, and bookshelves more quickly and with less difficulty. Libraries could use the AR navigator to enhance learning opportunities. Interactive 3D models, historical reconstructions, or multimedia content can be incorporated to give researchers and students immersive and educational information. Libraries can establish a progressive reputation and attract tech-savvy patrons by utilizing innovative technologies such as the AR navigator.

5. Conclusion:

One revolutionary development that is revolutionizing the library experience is the Augmented Reality Library Navigator. This innovative technology offers several benefits that enhance user interaction, resource access, and library navigation by seamlessly fusing the physical and digital domains. By using augmented reality, libraries can make sure that their services remain relevant and accessible to a wide range of users, even in the face of an increasingly digital environment. By simplifying navigation, providing personalized recommendations, and promoting interactive learning opportunities, the AR navigator enhances both the educational and recreational aspects of using the library. Moreover, it offers a forum to fulfill the needs of a diverse spectrum of users, including those with disabilities, while promoting inclusivity and community involvement. Future development on this technology is probably going to concentrate on increased customization, integrating it with newer technologies, privacy concerns, and improving accessibility. In addition to altering how people interact with libraries, this dynamic fusion of the digital and physical realms is future-proofing these establishments, making

them relevant and dynamic in the digital era. More than just a navigational aid, the Augmented Reality Library Navigator opens the door to a new level of library engagement and services.

6. ACKNOWLEDGEMENT:

Author Contributions
The following are the contributions made by each author to this study: Senior. Lecturer Javeria Hafeez helped with the thought, methodology, modifying, and evaluation. The formal assessment and invalidation were contributed by Muneeb Ahmed Khan. Validation and research were done by Maham Azam. Asma Shafi helped with the written form, presentation, corrections, confirmation, and gathering of data in addition to providing resources and formatting the initial edition.

7. References

[1]   A. Kleftodimos, A. Evagelou, A. Triantafyllidou, M. Grigoriou, and G. Lappas, "Location-Based Augmented Reality for Cultural Heritage Communication and Education: The Doltso District Application," *Sensors*, vol. 23, no. 10, May 2023, doi: 10.3390/s23104963.
[2]   A. Seifert and A. Schlomann, "The Use of Virtual and Augmented Reality by Older Adults: Potentials and Challenges," *Front Virtual Real*, vol. 2, Apr. 2021, doi: 10.3389/frvir.2021.639718.
[3]   S. Blomqvist, S. Seipel, and M. Engström, "Using augmented reality technology for balance training in the older adults: a feasibility pilot study," *BMC Geriatr*, vol. 21, no. 1, Dec. 2021, doi: 10.1186/s12877-021-02061-9.
[4]   S. Khan, S. Abbas Ali, M. Nadeem, and R. Chawla, "Augmented reality based gesture detection & object creation system using XCode & ARKit," *3C Tecnología_Glosas de innovación aplicadas a la pyme*, pp. 79–91, Nov. 2020, doi: 10.17993/3ctecno.2020.specialissue6.79-91.
[5]   L. N. Lee, M. J. Kim, and W. J. Hwang, "Potential of augmented reality and virtual reality technologies to promotewellbeing in older adults," *Applied Sciences (Switzerland)*, vol. 9, no. 17. MDPI AG, Sep. 01, 2019. doi: 10.3390/app9173556.
[6]   J. Sallar, T. Fatima, S. Khan, A. Sheikh, R. Ali, and W. Alam, "Augmented Reality Based Automotive Engineering and Object Detection System," *Indian J Sci Technol*, vol. 12, no. 28, pp. 1–9, Jul. 2019, doi: 10.17485/ijst/2019/v12i28/147002.
[7]   A. Anerao, S. Pramanik, H. Bobade, and S. N. Firame, "Location Based Augmented Reality Navigation Application," *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, pp. 241–245, May 2019, doi: 10.32628/cseit195340.
[8]   J. F. Santos and S. M. Esposo-Betan, "Advantages and Challenges of Using Augmented Reality for Advantages and Challenges of Using Augmented Reality for Library Orientations in an Academic/Research Library Setting Library Orientations in an Academic/Research Library Setting." [Online]. Available: https://docs.lib.purdue.edu/iatul/2017/challenges/7
[9]   S. Liang, "Research Proposal on Reviewing Augmented Reality Applications for Supporting Ageing Population," *Procedia Manuf*, vol. 3, pp. 219–226, 2015, doi: 10.1016/j.promfg.2015.07.132.
[10]   Q. Tan and W. Chang, "Location-Based Augmented Reality for Mobile Learning: Algorithm, System, and Implementation." [Online]. Available: www.ejel.org
[11]   N. F. Saidin, N. D. A. Halim, and N. Yahaya, "A review of research on augmented reality in education: Advantages and applications," *International Education Studies*, no. 13, pp. 1–8, 2015, doi: 10.5539/ies.v8n13p1.
[12]   P. Geiger, M. Schickler, R. Pryss, J. Schobel, and M. Reichert, "Location-based Mobile Augmented Reality Applications Challenges, Examples, Lessons Learned." [Online]. Available: http://www.area-project.info
[13]   T. L. Chou and L. J. Chanlin, "Location-based learning through Augmented Reality," *Journal of Educational Computing Research*, vol. 51, no. 3, pp. 355–368, Oct. 2014, doi: 10.2190/EC.51.3.e.
[14]   C. D. Kounavis, A. E. Kasimati, and E. D. Zamani, "Enhancing the tourism experience through mobile augmented reality: Challenges and prospects," *International Journal of Engineering Business Management*, vol. 4, no. 1, pp. 1–6, 2012, doi: 10.5772/51644.
[15]   Z. Yovcheva, D. Buhalis, and C. Gatzidis, "Overview of Smartphone Augmented Reality Applications for Tourism," 2012. [Online]. Available: http://ertr.tamu.edu
[16]   C. T. Tan and D. Soh, "Augmented Reality Games: A Review," 2011. [Online]. Available: https://www.researchgate.net/publication/260480270