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AR INDOOR NAVIGATION

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***Abstract*—Ar Indoor Navigation: AR or we can say Augmented Reality Indoor Navigation uses AR technology that is present in our smart-phones to provide directions in large indoor space.The smart-phone captures the real environment using device's camera.It usually works by taking live feed by user's camera and plotting the shortest route from source to destination.Indoor Navigation is quite complex as we have limited lighting or have dynamic nature of indoor environment.**

We have used Unity Engine to develop the environment so that we can easily modify and manage the navigation path.It has been seen that Augmented Reality applications provide better experience than traditional maps as it becomes complicated to navigate.3 environment are required for AR Navigation that includes Android Studio,Xcode and Unity Engine.Vuforia Engine uses computer vision to recognize and track objects and images in real-time. ARToolKit is used as it captures objects from images or video sources and then optically tracks and marks them using OpenGL.Different Points of interest are created so that objects can be deployed for identifying a particular room/hallway.

Keywords - **Augmented reality (AR),Indoor navigation,Visual positioning system (VPS),Simultaneous localization and mapping (SLAM),Beacons,QRcode,Visual Markers,Indoor mapping,Wayfinding,Navigation Assistance,Context-aware navigation**

I. INTRODUCTION

With the rapid advancement in technology,AR has become one of the most attractive technology .AR adds layers of digital knowledge to real world.In other worlds it combines the best of both worlds and presents a enhanced experience to the user. Despite being in so advance there still lies the problem of indoor navigation.Traditional navigation systems rely on landmarks or a map that could be quite confusing some times.The main issue is that GPS cannot provide information above a particular altitude.This problem can be solved by the introduction of smart-phones as they have many inbuilt sensors such as cameras,gyroscopes and accelerometer that help us to solve the problem of orientation and altitude.Once the information is captured then they are processed such a way that shortest route is calculated between source and destination.Currently A* Algorithm is deployed to calculate the shortest path.Indoor navigation can also provide the different points of interest or we can say the different points of attraction as well as the time that would be required to reach the destination.Using AR,3D objects are directly projected in real-time,leading to various changes in the environment.With the help of computer vision a new phase of navigation can be introduced which could be fun as well as where all the expectations are met.

II. LITERATURE REVIEW

In the paper [1], the author introduces an innovative indoor navigation system utilizing augmented reality technology. The proliferation of technology in the 21st century has substantially enhanced the capabilities of mobile devices, with Android emerging as the dominant operating system for application development. While significant strides have been made in outdoor navigation, achieving effective results for indoor environments remains a challenging task, particularly in complex settings like offices, hospitals, and shopping malls. To address this challenge, we propose a mobile workflow that harnesses the power of true inspiration.

Their research outcomes are built upon the foundation of the ARCore SDK, which seamlessly integrates domain-specific learning with machine learning. This approach empowers our system to recognize and interpret real-world objects, delivering dynamic and adaptable solutions for indoor navigation. Our proposed system encompasses two primary phases: mapping and testing.

During the mapping phase, users have the option to create their own maps by capturing environmental features through their mobile camera, and these features are stored in a JSON database. Users also have the choice to seek assistance for navigation. In the testing phase, users are prompted to input their desired destination, and our route planning algorithm determines the optimal path from the user's current location. Waypoints and directional markers are presented on the mobile screen to guide users to their destinations.

The distinctive feature of their system lies in its robustness. It continually updates the content database by analyzing real-time video footage captured by the device to accommodate new indoor features or products. Additionally, for text-based information without specific functions, we employ QR codes as navigational aids to enhance functionality. Following the completion of this work, our future plans include expanding compatibility to other operating systems to reach a wider user base. We also intend to explore patterns for distinguishing similar objects within indoor environments and seamlessly integrating outdoor orientation for navigation between indoor and outdoor spaces.

Their results demonstrate the system's ability to identify, describe, and visualize features through the superimposition of augmented reality objects. Overall, our research yields promising outcomes for addressing indoor navigation challenges across a variety of settings, from educational institutions to commercial facilities, and more.

The research paper [2], the author presents an indoor navigation system that utilizes augmented reality (AR) technology to tackle the challenges associated with navigating indoor spaces, where conventional GPS signals often fall short. This system incorporates the use of QR codes for selecting destinations, Google ARCore for real-time user location tracking, and the A* algorithm for optimizing pathfinding.

QR codes are strategically positioned within the indoor environment, allowing users to effortlessly choose their intended destination by scanning a QR code. Google ARCore plays a pivotal role in the system by continuously tracking the user's location in real-time, serving as an indoor equivalent to GPS.

The A* algorithm is employed to ascertain the most concise and effective route from the user's present position to their designated endpoint, taking into account both actual distance and heuristic estimations. The incorporation of NavMesh is briefly alluded to, delineating the sections within the building where user mobility is feasible, supplying essential information for route plotting.

However, the paper lacks a dedicated results and evaluation section, which could have demonstrated the system's performance, accuracy, and user experience. It would be advantageous to incorporate visual aids, such as diagrams or figures, to visually represent the system's architecture and functionality. The paper briefly alludes to future work and expansion plans, which could be expanded upon to provide a more comprehensive outlook.

In conclusion, the paper introduces a promising solution for indoor navigation using augmented reality, effectively addressing the limitations of traditional GPS within indoor settings. Nevertheless, it would benefit from the inclusion of results and visual aids and a more comprehensive discussion of future research and development prospects.

According to the paper [3], the author introduces a novel solution in the form of an Augmented Reality (AR) navigation application tailored for intricate facility settings, such as university campuses and amusement parks. The challenge lies in the fact that typical map applications often lack comprehensive information needed for navigation within these specific environments, particularly affecting individuals who may not possess strong map-reading skills.

The AR navigation system offers real-time guidance using overlays, enhancing the user's capability to reach their destination seamlessly. One key advantage is its ability to present information in a manner that aligns with the user's point of view, significantly improving navigation accessibility, especially for those who may find conventional maps challenging.

An essential component of this system revolves around the implementation of Kalman filtering, a methodology that merges data sourced from inertial sensors and the Global Navigation Satellite System (GNSS), like GPS, with the aim of refining the precision of user location estimation. This meticulous approach guarantees the precise placement of AR objects within the user's immediate environment.

Furthermore, the paper sheds light on the constraints associated with prevailing navigation applications and their inability to efficiently guide users through non-public areas. It accentuates the necessity for specialized navigation applications tailored to the unique requirements of specific facilities, and the current research project strives to bridge this existing gap.

While the paper lays the foundation for the AR navigation system concept, providing more detailed information, sharing practical examples, and presenting research outcomes would further enhance its comprehensibility and relevance for readers interested in this field.

In paper [4], The author's study delves into the benefits of AR applications in enhancing operational performance and reducing workloads. Their research involved implementing AR technology in headgear, providing users with visual and auditory instructions, with a particular focus on task support within nuclear power plants. The study encompassed the design, development, and evaluation of AR-based prototype applications tailored for indoor navigation and essential task assistance in the context of nuclear power plants.

The findings of the research indicate that the use of AR technology effectively lessened the workload for workers, concurrently improving their situational awareness and enhancing overall efficiency while reducing the likelihood of errors. This research presents compelling evidence supporting the potential of AR to enhance human performance and alleviate workloads. However, it underscores the importance of considering human factors and the necessity of designing AR systems that optimize efficiency while minimizing potential drawbacks.

In paper [5],the author talks about how the mobile phones have revolutionize the basic tasks.Auhor also discuss the strength and weakness of each technology,and also compares them to each other.In this sensors were used as point of interests and according to signal strength the time of arrival and angle of arrival was determined.With the help of difference of time of arrival the position was determined.

Different technologies such as infrared,ultrasound,and optical/visual was implemented.Hybrid technologies were used so that they could combine the different technologies in a promising area for future development.

In paper [6],the author talks about how they developed a prototype application based on AR,GIS,GPS.It was developed so that customers in departmental stores could find products quickly and easily.The application also collects the user data so that it could understand customer behaviour which can be implemented to make better decisions on behalf of the user.

They ran a small test on a small group of users and found it quite successful.Future research should focus on developing a more robust and scalable application, evaluating the application with a larger group of users, developing new features for the application, and using the data collected by the application to develop new insights into customer behavior and interests.

III. CONCLUSION

AR Indoor Navigation systems are a promising technology with the potential to revolutionize indoor navigation. By carefully considering the hardware, software, development tools, and system architecture requirements, developers can create AR Indoor Navigation systems that are accurate, reliable, and user-friendly.

AR Indoor Navigation systems can provide a number of benefits, including Improved accuracy,enhanced user experience,diverse applications

The future of AR Indoor Navigation systems is very bright. As the technology continues to develop, we can expect to see AR Indoor Navigation systems become more accurate, reliable, and affordable. We can also expect to see AR Indoor Navigation systems deployed in a wider range of indoor environments.

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