AR-based Indoor navigation for Parking Assistance

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Abstract

In today's world, where time is money, people spend much time finding the right parking spot at a big parking lot. Also, people tend to forget where they have parked their vehicles. Hence it is important to design an application that makes it easier for motorists to find a parking spot and make it a stress-free experience. Users will not be able to utilize GPS service inside or at the underground parking lot as It's influenced by huge buildings and structures. To overcome this shortcoming, we use augmented reality (AR). Unlike virtual reality(VR), AR does not alter the whole real world with the virtual one. AR is projected on top of the real world to add more local information to it in the form of graphics, audio, and videos.

1. INTRODUCTION

1.1. Overview:

Though presented as some cutting edge innovation similar to the "Iron Man" style of interactivity AR has been around for years. In 2016 the AR-based game "Pokemon GO" got the attention of the world. AS it allowed users to capture Pokemon characters bouncing around in their surroundings. It raised many questions about technology as many felt that it was distracting users. Since then, AR has been integrated with many technologies like self-driving cars, heads up displays of fighter pilots, and many more. In today's world, where time is money, people spend a lot of time finding the right parking spot at a big parking lot. Over half of humankind, about 4.000 million people, live in cities. In 2030 this Fig. will rise to 60%. A 35% travel during rush hours is looking for parking spots that are hard to find, which leads to a wastage of 96 hours yearly. A survey of 2000 adults displayed that 44% of motorists say finding a right park-spot is hell lot exhausting. The system introduced in this project takes advantage of the predefined model for parking space, which will then be allocated and navigate the user to their spot. Thus we aim to develop an Indoor navigation system that will use the concept of AR and Dijkstra algorithm for the shortest path to navigate the user to their desired parking spot. To do so, we're going to develop the model for that parking lot in AR, and users will have to scan the QR code to access that model.

1.2. Literature:

GPS signal is obstructed in indoor areas because of surrounding structures. During this study, rather than using satellite signals for positioning, an Indoor Navigation system was developed, which utilizes an accelerometer, camera, and compass component on the phone. AR is applied for the routing process, which removes the dependence on the map. It uses a built-in camera of the phone; hence no map is used.[1]

This paper describes the creation of a map in AR using Unity3D Vuforia packages for any small buildings with the local information that a typical map fails to provide. Results indicate that developed application provides information on target image also capable of providing a route between source and destination through the camera in AR.[2]

The Dewata AR application makes use of cutting edge AR technology to convey information of a temple in the form of 3-dimensional objects, videos, and audio. User has to scan the tourism brochure using an Android device; then it can display information about those tourism objects. Hence DevtaAR can be used to promote tourism sites more effectively and bring more tourists to Bali.[3]

ARCampusGo application makes use of AR technology to provide local information and the importance of the destination place. This application can provide a path to nearby memorials then the user can view the details about it by scanning the structure.[4]

To solve the problem of the shortest path and the best path Dijkstra Algorithm is used. They are calculated by

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understating an important factor, which is traffic conditions on the shortest path. The sole purpose of this study is to lower the implementation cost. An important outcome is that Driver can also provide alternative paths for the same route.[7]

The purpose of this study was to compare the potential of ARCore and ARkit that would assist in selecting the right framework to ramp up the prototyping and development of future AR/VR applications. The characteristics selected for this comparison where: CPU performance, Memory requirement, floor mapping on diff surface types, etc.[8]

A database capable of storing information to the database and bring required data from it at exponential speed is known as a real-time database. Firebase is a lot more than just a real-time database. MongoDB may serve as a non-relational database capable of storing information in a disorganized manner to connect information from different sections to one another.[10]

2. PROPOSED SYSTEM

The proposed system is an AR-based application through which the user can navigate to the allotted spot using our AR directions. Initially, when the user enters the parking lot, he will either scan the QR Code or just open the application and press the allot button to get a parking space allotted to him once he is authenticated. Then the air guide will accompany him to the parking space allotted.

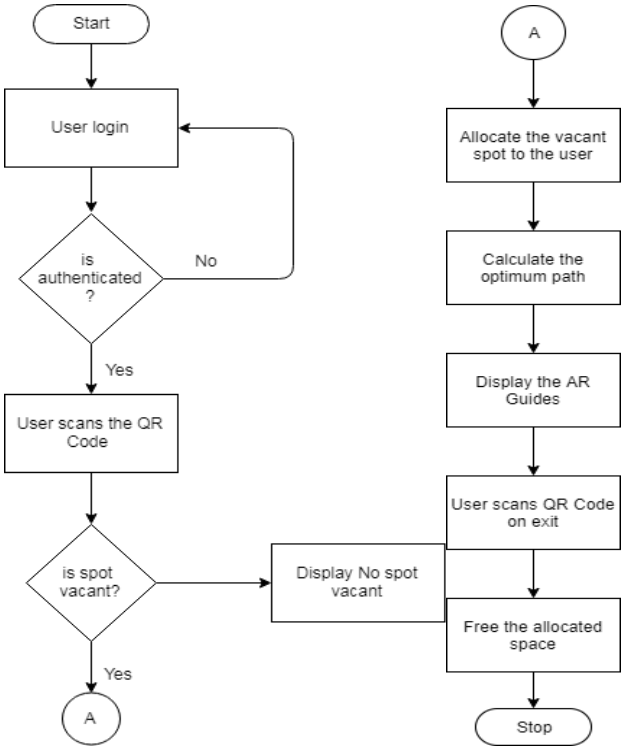

Fig. 1: Control flow diagram

Simultaneously the request will be sent to the system to find a vacant spot nearest to the user. Once the spot has been allotted, the optimal path from the user to the node will be calculated using the user's device. After that, the path to the spot will be displayed on the users' device, which will help him navigate to the spot. After the user reaches the spot, the spot will be marked INUSE and will be freed for further use once the user scans the QR code on exit or either by using RFID to identify the user.

The map used to find optimal paths is created by dropping nodes in the virtual world and then mapping it with the real world. Once the admin opens the application, the plane detection process starts. Once it is completed, the admin can drop/create nodes wherever he pleases to, once the process of dropping nodes is completed the admin will press the save button to save the map on the cloud. Then the mapping process begins where the nodes will be mapped with the real world, and their adjacency matrix will be fed to the system. Now we will have the map and its matrix stored on the cloud, which will be used for calculating the optimal path for the user to traverse the parking lot and will also be useful in traversing ar guide in a virtual world.

3. COMPARATIVE ANALYSIS:

In this section, the analysis of the proposed system concerning the existing system has been done. The results compare the existing system and proposed system. It can be seen that AR-based Indoor Navigation can drastically decrease the amount of time spent in the parking lot searching for your vehicle. As GPS signals weaken in indoor places, a predefined AR model can be very effective in a multistory parking lot.

3.1. Modules used are as follows:

Plane Detection Module: This module searches for a plane using ray casting. Ray casting is the use of line intersection tests to locate the first object intersected by a ray in the scene. Once the plane is detected, it is rendered using shaders that can be used by the admin to drop nodes and thus create maps.

AR Display Module: This module is responsible for displaying all the essential AR models in the application according to the scene. This module also loads the map from the storage and displays it accordingly and is also responsible for rendering the model that guides the user to the allocated parking lot.

Admin Module: This module is responsible for dropping nodes on the detected plane and saving them to the storage. It also maps the nodes with each other by creating an adjacency matrix, which is then used for further calculations. This module can also be used for editing making changes in the previous map.

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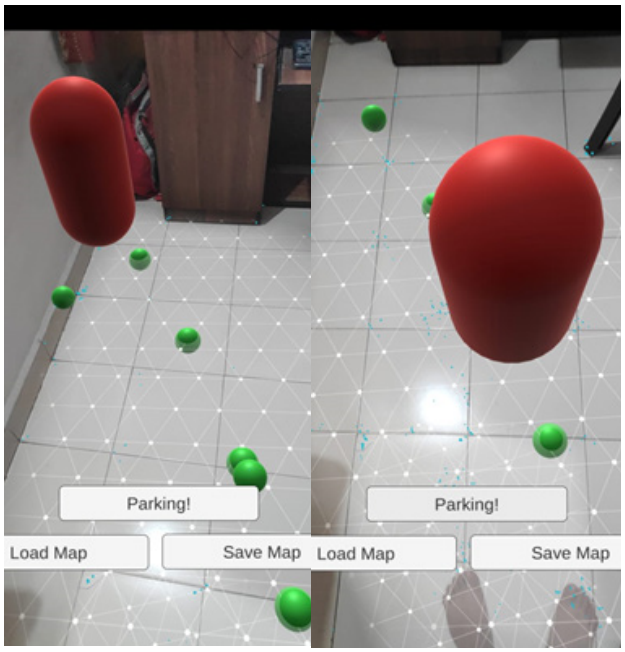

Fig. 2: Screenshot of Initial testing

Calculation module: This module is responsible for calculating the shortest path from the user's location to the allocated parking lot. It also maps the parking lots with its respective nodes, stores, and retrieves the status of the nodes.

4. CONCLUSION

A 35% travel during rush hours is looking for parking spots that are hard to find, which leads to a wastage of 96 hours on a yearly basis. Thus the Indoor navigation system, which can guide the user to their desired parking spot in the quickest way possible, will save thesse valuable hours and make the experience stress-free. It will also allow optimum use of the parking space available in the parking zone.

5. REFERENCES:

[1] Kumawat, A and Kumawat, A. (March 2018). Augmented Reality: Map with information using Unity-3D. International Journal of Scientific Research in Scienceand Technology.

[2] Waruwu, A. and Bayupati, P. (January 2015) Augmented Reality Mobile Application of Balinese Hindu Temples: DewataAR Published Online January 2015 in MECS.

[3] Pawade, D. et al (May 2018). Augmented Reality Based Campus Guide Application Using Feature Points Object Detection Published Online May 2018 in MECS.

[4] Rehman, U & Cao, S. (2016). Augmented-Reality-Based Indoor Navigation: A Comparative Analysis of Handheld Devices Versus Google Glass. IEEE Transactions on Human-Machine Systems. PP. 1-12. 10.1109/THMS.2016.2620106.

[5] Idris, Mohd & Y.Y, Leng & E.M, Tamil & N.M, Noor & Razak, Zaidi. (2009). Car Park System: A Review of Smart Parking System and its Technology. Information Technology Journal. 8. 10.3923/itj.2009.101.113.

[6] Woda, M. (January 2020). Capabilities of ARCore and ARKit Platformsfor AR/VR Applications. 10.1007/978-3-030-19501-4_36.

[7] Guiding People in Complex Indoor Environments Using Augmented Reality IEEE 2018 Augmented-Reality-Based Indoor Navigation: A Comparative Analysis of Handheld Devices Versus Google Glass.

[8] Cankaya, Ibrahim & Koyun, Arif & Yigit, Tuncay & Yüksel, Asım. (2015). Mobile Indoor Navigation System in iOS Platform Using Augmented Reality. 10.1109/ICAICT.2015.7338563.

[9] Dhotre, D. (2016). Research on Object-Based Augmented Reality Using Unity3d in Education System Vol-2 Issue-3 2016 IJARIIE-ISSN(O)-2395-4396.

[10] Singh, R. et al (June 2017). Real-Time Databases for Applications (IRJET) Volume: 04 Issue: 06 [9] Research on Object-Based AR Using Unity3d in Education System Vol-2 Issue-3 2016 IJARIIE-ISSN(O)-2395-4396.

[11] Makariye, Neha. (2017). Towards shortest path computation using Dijkstra algorithm. 1-3. 10.1109/ICIOTA.2017.8073641.

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