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AUGMENTED REALITY BASED INDOOR NAVIGATION

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ABSTRACT

For indoor navigation systems, GPS satellite signals are incorrectly trackable. The goal of the project is to develop and create an augmented reality-based indoor navigation system. The main goal is to navigate around various areas within major buildings, such as airports, hospitals, retail malls, and other places where GPS satellite signals may be carefully tracked for navigation purposes. People may use the Augmented Reality-Based navigation system to assist them position themselves and navigate across enormous structures. Simultaneous Localization and Mapping (SLAM) is the Technique employed. AR-Core localization, QR-code repositioning, Unity navmesh navigation and AR path showing are the four parts of the project. The admin is in charge of uploading the map and placing the markers in Unity. The user scans the QR code with the smartphone app, and the app displays the path to take using augmented reality items after selecting the desired destination (arrows). Using the A Star pathfinding algorithm, the app navigates the user to the shortest path.

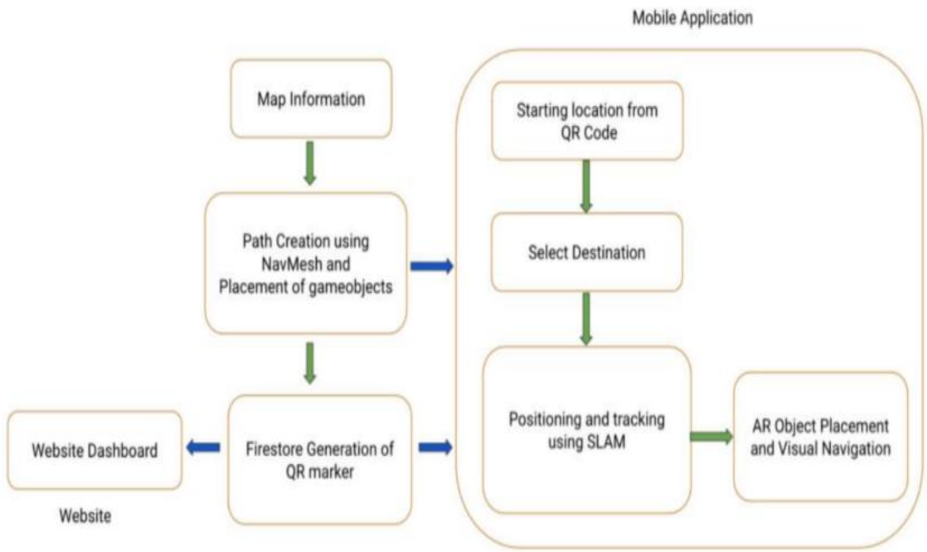
Keywords: Navigation, ARCORE, UNITY NavMesh, Android, Augmented Reality.

I. INTRODUCTION

The need for indoor navigation systems has increased in recent years, with the advent of underground shopping malls and large-scale commercial facilities. Radio wave strength and Bluetooth, magnetic repositioning, location based on visual markers, radio frequency identification (RFID) tags, and dead reckoning are some of the existing technologies for indoor positioning and navigation. These techniques, on the other hand, have high installation costs and accuracy issues. Although the current Global Positioning System (GPS) is usually useful for outside navigation, due to the satellite's poor radio wave acceptance, it is inefficient for interior navigation. As a result, for interior navigation, a positioning system other than GPS is required.

II. PROPOSED SYSTEM

Figure 1 depicts the general architectural schematic of the proposed system. Because of the NavMesh components and their benefits, Unity was chosen as the development environment for the project. The suggested interior navigation system is organised into four primary modules: AR Core-based localization, QRcode repositioning, unity navmesh navigation, and AR path displaying. QR codes are dispersed throughout the facility at various locations. The user may scan the QR code at a certain place and pick which location to visit. The route to the destination is displayed as a line-render within the minimap, which is located at the bottom.



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After selecting a destination, augmented reality elements (arrows) appear on the camera frame, allowing the user to navigate to the location. On the minimap, users may also choose between different viewpoints. The administrator provides the floor plan for the building, and he may use the game objects in Unity's NavMesh component to create the walkable and non-walkable routes. Furthermore, the same may be used to define many destinations. The map can also be deleted by the administrator. The user's position on the map is tracked by the SLAM technology. The AStar path finding algorithm is used to guide users along the route. SLAM has been featured on all modern touch phones with the debut of Apple's ARKit and Google's ARCore.

III. NAVIGATION

An interior navigation system's goal is to guide a user across massive buildings by creating a path from the user's present position to their desired destination in real time. We must choose the quickest approach among many paths for navigation within enormous structures. There are various algorithms for determining the shortest path, including Dijkstra's algorithm, the best first search algorithm, and the Astar path finding algorithm, among others. A star route finding method, for example, provides a more optimum and precise path in a short amount of time. As a consequence, we applied the A * path finding algorithm for indoor navigation. The Euclidean distance between the beginning place where the user begins navigation and the intended ultimate location of the user is the heuristic function, which decides whether or not something is true.The overall time complexity of this approach for determining a route is O. (n log n).

Unity NavMesh Navigation

Unity offers a slew of built-in features that make it simple to use and offer slew of other benefits. One of the functions is NavMesh components. This may be used to create a robust mesh and to discover a passage through a structure. These NavMesh components are free to use and modify. Using navigation meshes, the navigation system will produce augmented reality characters that can be readily place and moved inside the mapped are. These navigation models are generated automatically from scene geometry. There is a potential that the user will come into impediments or hindrances in the course of the real path as he/she progresses through the building. So, by modifying the location of these augmented reality items, such as guiding arrows, the NavMesh attributes may assist recognize these obstructions and present an alternate way to the user A* is one of the best path-finding algorithms available and it is also one fot he most efficient.

Augmented Reality Path Showing

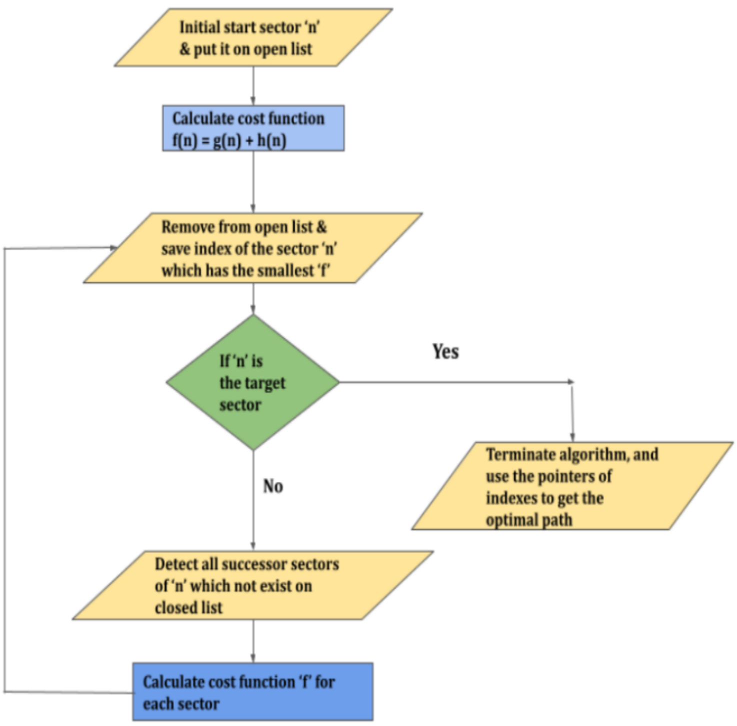

Fig -6: Flowchart of A* Algorithm

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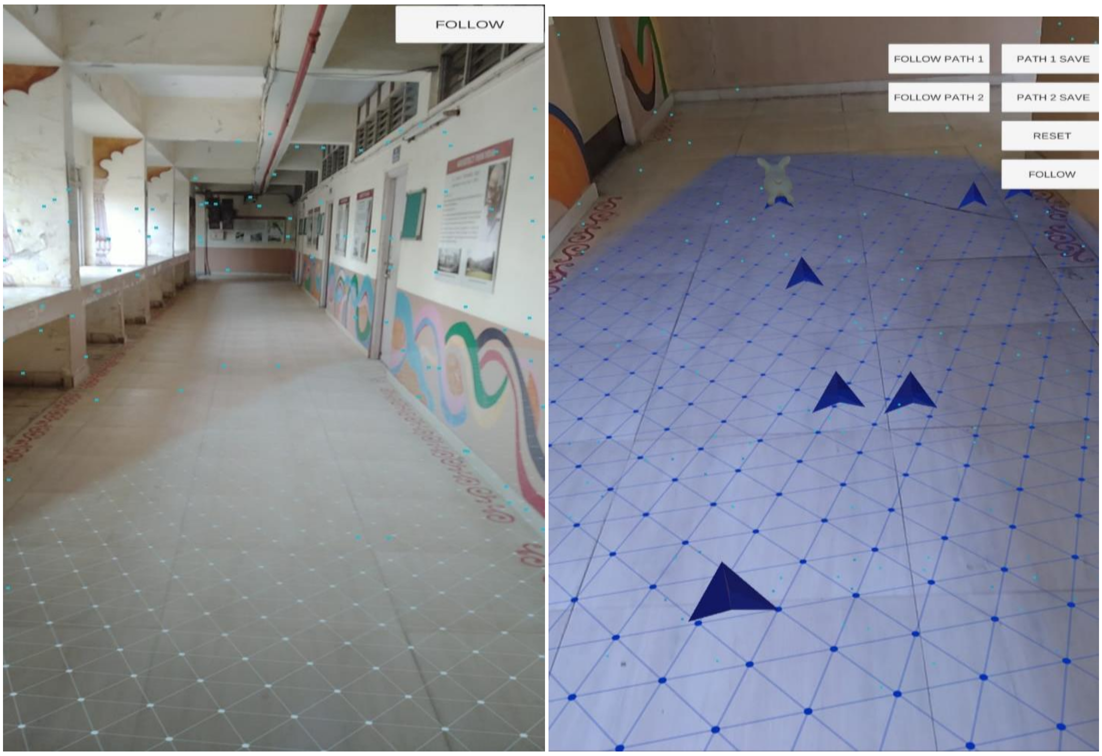
In the end, our inner navigation app shows the path to take using AR (2) objects (arrows). When the client needs to place a 3D object in the terrain where they can move around, they should elect the Tracking Type option for gyration and position. However, also it'll If the position option is named get the stylish localisation. And 3D objects may not be stable in their position. Hence, they cannot be easily visible. The major thing of this part is to produce an arrow in front of the client that guides them in the direction they need to go after a destination is chosen. There exists a defined mesh girding the arrow and every time the blue fleck exits the mesh, the former arrow (AR- object) gets removed and a new bone comes in before the client appears at the exact angle. The old arrow can't be seen presently as the client passes by that region.



IV. PERFORMANCE ANALYSIS

The figure below shows the comparison of the trip trails from the living room to kitchen, considering the six way points. According to fig7 the launch and end points are given as blue-colored blotches. The green line indicates shadwing by GPS. The blue line represents inner navigation using labels. The red line represents tracking by SLAM, which is at the core of our design. From fig7, its apparent that in navigation by GPS, the path shown by GPS is veritable inaccurate inside a structure due to low signal strength. GPS signals get blocked and they're also reflected by walls. As a result, it was unfit to enter the room. Due to this debit, satellite signals are entered inaptly. So it can't be used to calculate the position of a person or an object inside any structure. Some GPS bias can admit satellite signals by being placed near a window. But virtually, this can't be done everyplace in the structure and, especially in an inner terrain.

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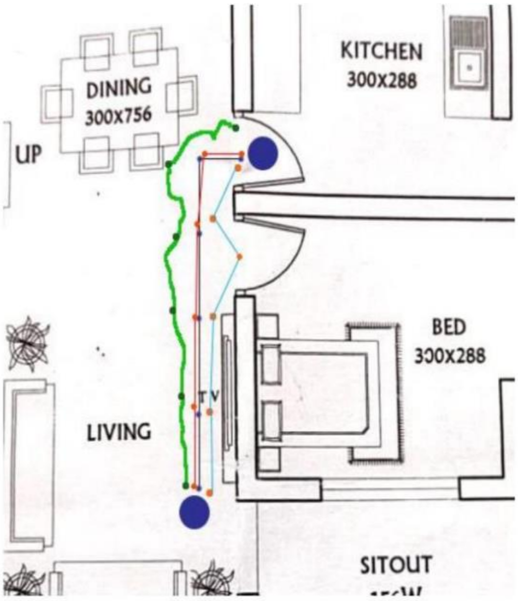

Fig-7: Path from living room to kitchen

Since all these ways have downsides, we decided to use the QR law only for the original scanning in order to elect the destination. After that, the client will be directed along the path by the way- points created. The technology comparisons for three different technologies, videlicet GPS, labels, and AR SLAM, are shown in the below table. The comparison is performed at six different locales, starting with the living room and ending with the kitchen. From the below table, It's egregious that ARCore SLAM is more precise because the total variation is 0.08, whereas for GPS and labels, it's0.85 and0.8, independently.

Waypoint v/s Technology	GPS	Marker	AR SLAM
Waypoint 1: 0m	0m	0m	0m
Waypoint 2: 0.75m	0.1m	0.1m	0.025m
Waypoint 3: 1.5m	0.2m	0.1m	0.01m
Waypoint 4: 2.25m	0.15m	0.25m	0.015m
Waypoint 5: 3m	0.3m	0.3m	0.02m
Waypoint 6: 3.75m	0.1m	0.05m	0.01m
Total Variation:	0.085m	0.8	0.08

V. CONCLUSION

We were suitable to successfully design and develop an effective and cost-effective system for indoor-navigation using ARCore's SLAM process. We faced the challenge of chancing alternate paths for navigation in the presense of any mishaps in the way of User. Using the NavMesh factors and functionalities, we anticipate the system to perform well indeed if there's an unknown mishap that isn't predefined in the bottom-plan. Our system was discovered to give a further interactive way of guiding people inside complex structures. Likewise, the stoked reality features make it simple and keeps User from interacting with other people in the Covid-19 Script. Also, the mobile operation can fluently be installed by public. The operation is free to all User and may be attained from the most recent Android performances similar as Android 8.1 with Google ARCore drag-harbourage. The system is erected in such a way that it may simple be gauged to meet the requirements of different structures.

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