Organization name: Directorate of IT & Cyber Security, DRDO

Team Name : Code Clan

Problem Statement : Indoor Navigation App (CK139)

College Code :

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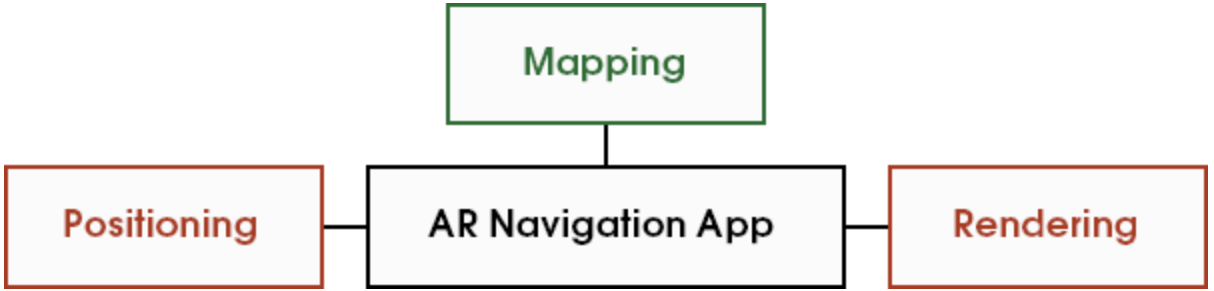
Category : Software

With a Smartphone in hand, it is pretty easy for us to find our way to the destination using outdoor GPS navigation mobile apps, even when we are in an unfamiliar city. However, it is possible to get lost indoors, with GPS navigation apps as it has an accuracy of 5 – 15 meters. Also, GPS isn't a suitable technology for this type of implementation. As navigating inside larger buildings like shopping malls, it faces a problem of determining a user's floor level, and it requires manual selection to work properly. It's easier to navigate indoors when you can see your surroundings. Therefore, We intend to develop an augmented reality application which consists of 3 independent modules: Mapping, Positioning, and Rendering. In the mapping module, we create a 3D model of the building where the app should be deployed. Then we include the navigation graph in the building model with all possible destinations. In the Positioning module visual markers are placed near each destination using which we determine the precise location of user. In the Rendering module the user needs to scan the marker to select a destination and the directions are shown in the surroundings using camera.

Technology Stack:

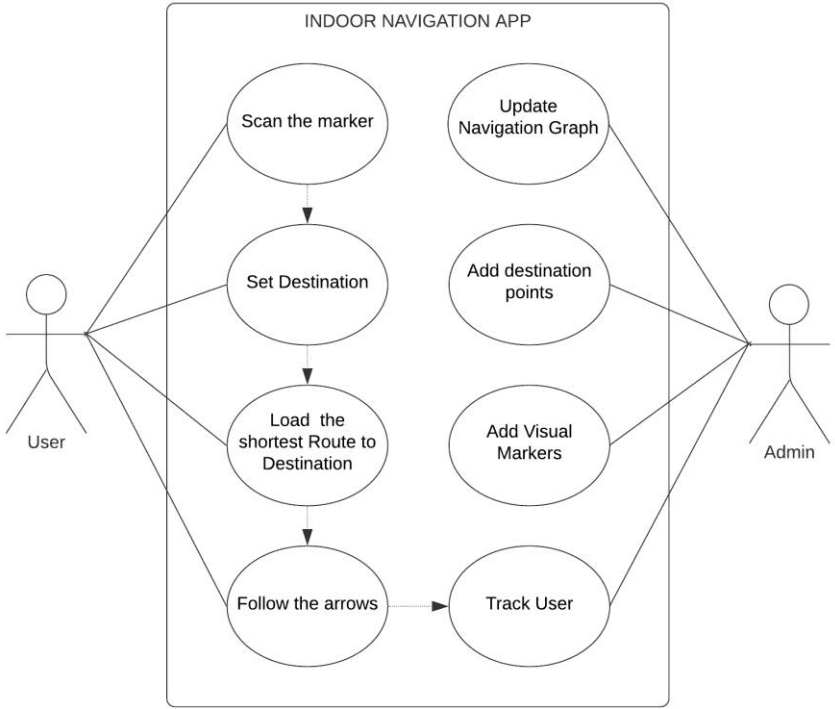
The first and foremost thing requirement to develop the indoor navigation app is the 3D model of the building. We create the 3D model of the building using **Blender 3D**. It is a free and open source 3D creation suite. It supports the entirety of the 3D pipeline - modelling, rigging, animation, simulation, rendering, compositing and motion tracking, video editing and 2D animation pipeline. After the 3D building model is ready, we can import it directly from Blender to **Unity**. Then we add the Navigation Graph including all the destination points within the model.



ARCore is Google's platform for building augmented reality experiences. ARCore uses three key capabilities to integrate virtual content with the real world as seen through your phone's camera: Motion Tracking, Environmental understanding, Light estimation. ARCore can be integrated with Unity with a plugin. Visual markers are placed near each destination point in the model and we integrate marker based AR with it so that when the user scans a marker we get the exact location of user. Then, user is asked to choose between the possible destinations from that location. After a destination is chosen, shortest path in the navigation graph is found using A* algorithm. Using marker less AR we show the animated directions on the surface as the user moves towards the destination. Internally C# scripts are written for the object movement i.e., the direction arrow based on the shortest path found.

Use Cases:

- The user is the primary actor for the Indoor navigation app. The user should scan the nearest marker, he will be asked to choose a destination based on his location. Once the destination is chosen, shortest route is loaded and animated directions are shown in the surroundings to reach the destination.
- As the user moves towards the destination his location is approximated by comparing the camera feed with the 3D model. So admin can track the user.
- Admin can update the navigation graph, add new destination points, and can also add new markers to the existing ones.



Dependencies / Showstoppers :

- The application requires to navigate the user to the destination with high precision.
- A large amount of the development goes into the prototyping and 3D models creation for the AR module.
- User is expected to use a smartphone having a good camera for rendering clearer and stable animations.