INDOOR AR NAVIGATION USING TILESETS

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ABSTRACT

This paper demonstrates the methodology and findings of creating an augmented reality navigation app that uses tilesets to create the navigation. It illustrates the method in which the app was created - using vector data and uploading it to MapBox, then accessing that data in Unity through the MapBox API and map editor and then overlaying the camera input with the navigation path layer. The application was tested by creating multiple arbitrary navigation scenarios and checking them for various factors. The main finding of this research is that this navigation solution works better than GPS indoor navigation.

CCS CONCEPTS

• Networks~Location based services • Human-centered computing~Information visualization • Information systems~Environment-specific retrieval

KEYWORDS

tilesets, augmented reality, indoor navigation

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1 Introduction

The objective of this paper is to demonstrate the operation of an indoor augmented reality navigation app that uses vector tile sets in a 3D game object platform to create the navigation. The main aim of conducting this research and creating the app is to determine whether the use of tilesets is a viable option for indoor navigation, as current methods such as GPS signals pose issues in buildings and other such structures. Pertinent research showed that visitors that used some sort of visual aid were better at navigating new places[2], and that they were less like to make mistakes and take less time to navigate[4] .However, not many applications have been created as these preceding researches illustrate that the effectiveness of such technologies needs to be improved. This research also aims to display and determine the effective of another indoor navigation solution through experimenting with the solution in a private museum. It incorporates the use of tilesets - which contain vector data about room properties, corridors and so on with a high level of accuracy - and creates a 3D map of the place using the data. Then, the application scales the map into the actual world scale using the camera and creates the navigation which it displays on the screen over the camera input as superimposed layers. The main finding of this solution is that the navigation using tilesets instead of the traditional GPS signal navigation works better and more smoothly in building where such signals are weak. However, their accuracies depend on various factors and further research should be done to not only make it more accurate, but to reduce the number of factors affecting the accuracy

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2 Methodology

The research question that can be inferred from the research is - Can tilesets be used to provide indoor navigation to visitors in buildings with the current technology and solutions? To determine this, we created an indoor navigation app for a private museum and the lab building.

2.1 App creation.

2.1.1 Vector data and Tilesets: First, the data that would need to be uploaded into MapBox API is created. After uploading the floorplan and adding rooms, walls, navigation paths, sync-points and destination points to QGIS, a mapping software, the data is saved as a GeoJSON file and uploaded to MapBox APIs to create a tileset. A minimum of 10 destination points and 9 sync points is required along with their heading values.

2.1.2. MapBox APIs and SDK for Unity: Once data is uploaded onto the MapBox dashboard the data is into a tileset, the tileset is imported into unity using the MapBox SDK for unity. This SDK allows the developer to access the MapBox APIs using the published links and use them in their application. The data in the tilesets are read using MapBox provided factories. These factories enable the developer to create a hierarchy to load the data and edit the data as convenient.

Once the factory is set up and the map ID is changed to the desired tileset, we can publish the app to the desired platform. However, all assets need to be downloaded to ensure the navigation works. The assets can be used from the sample open-source navigation project uploaded by MapBox (Indoor navigation in one of their offices) [1]. Furthermore,we implemented a custom user interface for better user experience.

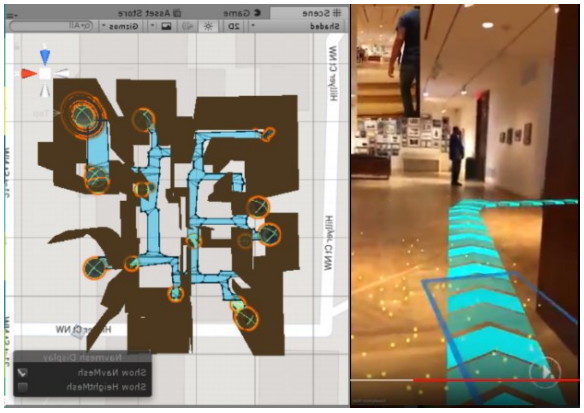

Figure 1 and 2: (Left) Map regenerated in unity and scaled to actual world and (Right) navigation in the museum.

2.2 Application testing

Once the app was generated, the navigation was tested multiple times between arbitrary sync points and destination points. These navigations were tested for ease of access, accuracy, errors in headings, motion tracking and a couple more factors that might have affected the navigation. Each navigation operation was recorded and compared with each other. Furthermore, a detailed log of the device was taken every time the application would have an issue in the process, such as the disappearance of the plane and so on.

3. RESULTS AND CONCLUSION

The primary results showed that the application would take less than a second to register and process all the data it receives from MapBox. Furthermore, since the data is uploaded on a web mapping service, the application was not slowed down due to huge data files. Furthermore, the app did not slow down on initialization as the files are on an API and are loaded tile by tile which does not occupy much memory. When the application had GPS signals enabled, the navigation line would jump around and did not stay constant as the user moved around. This could be due to the fluctuations in GPS signals available in the building.

In terms of accuracy, the results showed a better accuracy with the Wi-Fi and a better motion detection as there was location updates from the GPS signals.

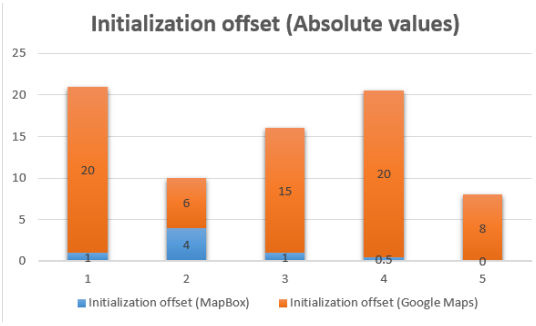

Figure 3: Graph showing the accuracy of the navigation systems for the initial starting point

Overall, our results showed that the navigation was smooth and was ideal for indoor use in buildings, but it also highlighted various factors that affect the accuracy. The data upload to MapBox depends on the latitude and longitude values for the building. While the accuracy of these values can be increased to higher decimal points, a slight difference occurs in the actual location due to discrepancies in the software used to upload the data. That cause the navigation to veer by a meter right in this project. In addition, this navigation app is not capable of working with changes in elevation.

Thus, the main findings of this research is that such a solution works better than GPS based indoor navigation in buildings. However, with current technology, their accuracy depends on a plethora of factors, and research should be done to reduce such dependencies. Finally, since most buildings have multiple floors, research needs to be done to provide a solution for multi-level navigation.

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