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Fully Rendered Image Data Application for Yachting (F. R. I. D. A. Y)

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ABSTRACT: The main idea of the project is to develop the 3D indoor navigation system for the KCG college campus on the smartphone. This approach uses data from device's wireless adapter and inertial sensors to determine the user's precise location. Previous researches conducted in this field produced the output of two meter accuracy. After the user's location has been localised, a routing algorithm has been introduced to calculate the shortest path to make the navigation simpler. A database is maintained to store and retrieve the user's surroundings and locations. Then, the 3D design is imported to an app. This app is designed as a hybrid app. This approach for the 3D indoor navigation system shows the future assurance that it can be used in malls, hospitals, and college campuses.

KEYWORDS: Indoor Positioning, Inertial Sensors, 3D Navigation, Geomagnetic Field, Wi-Fi, Wireless.

I. INTRODUCTION

Smartphones has evolved and became a trend for nowadays. Due to its evolution, it has been the most usable device in the world. GPS has been introduced to make sure that the user never makes a wrong turn. ie) It helps the people to easily navigate to the desired location. GPS technology allows the user to pinpoint the exact the location using the small GPS receiver that is embedded on the device. But the problem arises that GPS cannot be used in indoor environment. It leads to the people to make search of new technology in indoor environment[1].

In existing technologies, GPS needed to calibrated with 4 satellites to show the position in 3-dimensions with latitude, longitude and altitude[2][3].

To track the location in the indoor environment, various technologies has been used. The technologies are Pseudolite GPS, A-GPS, Cellular Communication Network, Wi-Fi, Bluetooth, Infrared and Ultrawide Band. Pseudolite and AGPS requires the same as the GPS with high calibration. The accurate and which has wide band is the Ultrawide Band. But due to its cost, many people avoids it. Bluetooth produces high accuracy but it has the lower bandwidth than the other. The user has to set many beacons all over the buildings. [4]

There were many other solutions to track the user's locations. But it does not provide the precise location for the user and there is so much variation in the results. So, to make the device to work at full efficiency, we make use of inertial sensors in the smart phone to increase the accuracy.

II. RELATED WORK

Initially, we need to find the phone direction(i.e. How does the user keeps the phone to search for his/her location).[5] Wi-Fi alone produces a lot of issues since they have high interference with metals. So, we combine the Wi-Fi with the Geomagnetic location techniques to find the precise location.[6] Also, there are some disadvantages in the compass. So, in order to overcome that problems, we use some algorithm to the magnetometer sensor to increase its efficiency. The advantages are that it produces the navigation system with even more accuracy with no interference problems and

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almost work in every possible place with many types of interfaces. The only limitation is that it is hard to implement. [7]. By Wi-Fi Fingerprinting with single Wi-Fi, the user does not able to find out the accurate result. The user need to combine the results with multiple Wi-Fi and using Location Search Algorithm, the user need to filter out the result and get the best Wi-Fi signal.

III. PROPOSED METHODOLOGY

Our proposal is to develop the navigation feature in the smartphone for the KCG college of Technology in the indoor environment. Three objectives were identified in our proposal such as the device must able to determine the accurate location inside the building with the signal strength measurements, the device must guide the user along the optimal path to the destination using routing algorithm, the device must have an easy user interface and the database should be maintained to store all the user’s data.

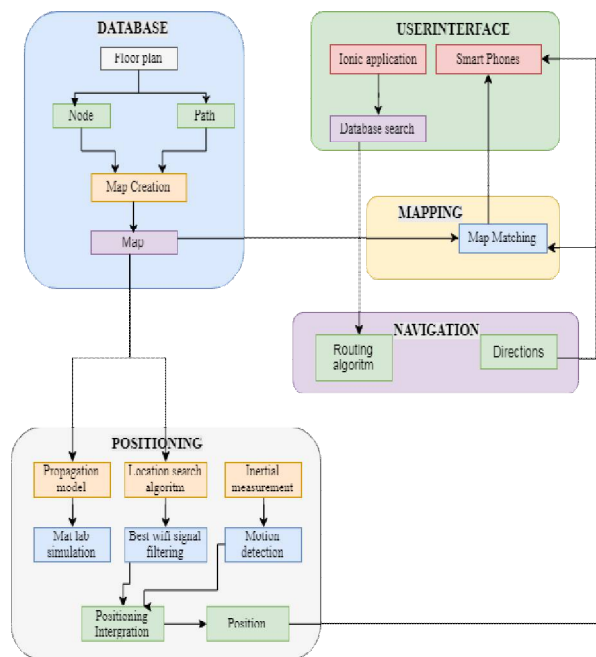


Fig.1. Architecture of Indoor Navigation System

Fig.1 consists of five subsystems. ie) Database, User interface, Mapping, Navigation and Positioning. Initially position of the user is being identified and sets the path in the map when user opens the application. Then user made the data search in the User interface, where data is being filtered from the Database. The filtered data is being mapped among themselves which construct the Navigation path. The Navigation Path is finally introduced in the application.

IV. MODULES

In Proposed System, there are five modules to implementing the Indoor Navigation System in the Smartphone.

User Interface

In this phase, user installs the application in their smartphone. Since it is build as Ionic application, it can be installed in

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any type of smartphone. User opens the application and make a database search.[8] (Refer Fig.2)

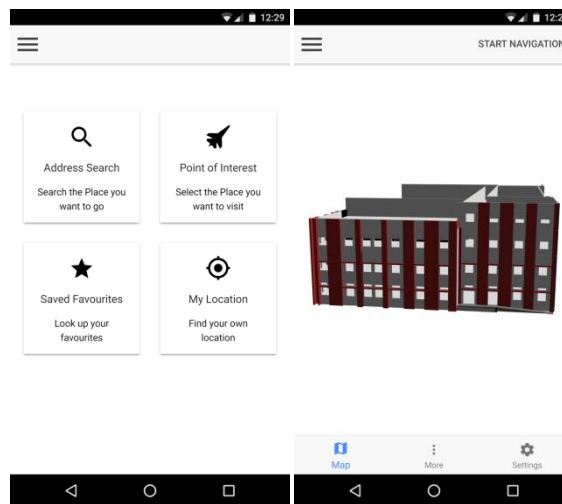


Fig.2. User Interface

Positioning

Positioning consists of the two subsystems, the propagation model and the location search algorithm. The New Empirical propagation model is performed on the computer to pre-generate an estimate of the Wi-Fi signal strengths within the building using MATLAB[9]. The location search algorithm is implemented on the mobile device, and combines data from all detected wireless access points and filters the best signal. To increase the accuracy of the positioning, Inertial Navigation System has been used.[10]

Mapping

To calculate the distance from one path to another, Euclidean algorithm is used.[11] After the distance is being identified it is being mapped using Map Matching algorithm[12] where all the paths and nodes is interconnected with each other. To increase the efficiency, Dead Reckoning algorithm is being utilised[13].

Database

Database holds all the nodes and path map information. Whenever the user search for the destination, it retrieves the information from the database.

Navigation

From the database search result, user selects the destination. With that information, Dijkstra algorithm is being applied and shortest path is calculated and then Directions is displayed.[14] (Refer Fig.3)

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Fig.3. Navigation

RESULTS AND PERFORMANCE ANALYSIS

When the user opens the application, the first thing which takes much time to load is the map of the building. It's loading time is being reduced to the multiple times to make the application optimize (Refer Fig.4)

THREE.ColladaLoader: DOMParser: 164ms	ColladaLoader.js:3530
THREE.ColladaLoader: File version 1.4.1	ColladaLoader.js:3537
THREE.ColladaLoader: Parse: 432.000244140625ms	ColladaLoader.js:3583
▶THREE.ColladaLoader: Invalid opaque type "null" of transparent tag.	ColladaLoader.js:1591
▶THREE.ColladaLoader: Invalid opaque type "null" of transparent tag.	ColladaLoader.js:1591
▶THREE.ColladaLoader: Invalid opaque type "null" of transparent tag.	ColladaLoader.js:1591
▶THREE.ColladaLoader: Invalid opaque type "null" of transparent tag.	ColladaLoader.js:1591
▶THREE.ColladaLoader: Invalid opaque type "null" of transparent tag.	ColladaLoader.js:1591
THREE.ColladaLoader: Build: 220ms	ColladaLoader.js:3598
THREE.ColladaLoader: 839.999755859375ms	ColladaLoader.js:3613

Fig.4. Map Loading Time

The Map will be automatically resized on the required resolutions. The user can use the application either in the portrait or landscape. (Refer Fig.5)

THREE.ColladaLoader: Build: 220ms	ColladaLoader.js:3598
THREE.ColladaLoader: 839.999755859375ms	ColladaLoader.js:3613
onResize: 380, 535	map.ts:177
onResize: 343, 542	map.ts:177
onResize: 328, 515	map.ts:177
onResize: 368, 551	map.ts:177

Fig.5. Map Resize

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Using the navigation, the user navigates. If it is a dead end, it will give the indication that it is a dead end with what is behind it. Also, using this we can set the camera to other direction to continue navigation. (Refer Fig.6)

onMouseDown	map.ts:136
Scene has 414 objects	map.ts:149
1 intersected objects found	map.ts:150
	map.ts:152
Mesh {uuid: "C6BDFB4A-8E45-47C3-9DB7-A387F1EF72BD", name: "Basic Wall Generic - 8" [324210]}, type: "Mesh", parent: Group, children: Array(0), ...}	
onMouseUp	map.ts:168

Fig.6. Raycaster

Since it is a hybrid app, it works on android, ios or windows. (Refer Fig.7)

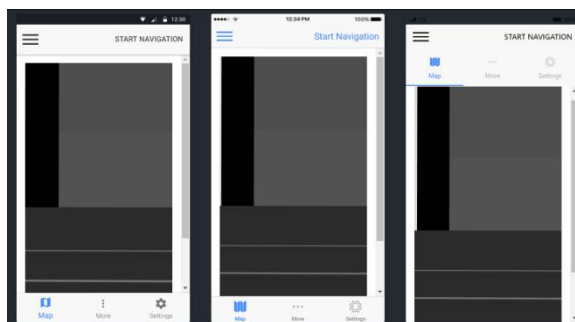


Fig.7. Hybrid Output

The user does not need any internet to load off the map. Everything is offline to make the user feel comfortable.

V. CONCLUSION

Three objectives were identified that embody the functionalities necessary in an indoor positioning system. First, the device must be capable of determining its location in the building. Second, it must be capable of determining the optimal route to a destination. Third, an intuitive user interface must provide the user with access to these features. These features were being developed and tested in the android system.

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