

Indoor Navigation System

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ABSTRACT

Today it is possible to position wireless devices such as smartphones in an outdoor environment, using GPS, global positioning system.[1] Unfortunately this technology does not work in indoor environments. Being able to navigate smartphones indoors could be beneficial in many different environments. In hospitals when tracking hospital beds and patients, in prisons in order to track prisoners, in malls when a customer is searching for a store etc.[1] Indoor navigation could also be used to analyze human behavior. There are many different methods and techniques existing today that could benefit to an indoor navigation solution, all of them providing different results. Some are friendlier towards larger scaled areas providing less satisfying precision, meanwhile others provide higher precision but increases significantly in cost for larger scaled areas. In this project a significant amount of time was spent on researching different techniques for indoor positioning as well as analyzing the current state of the art and the[2] market of existing indoor positioning solutions. It provided a fully working solution to position on device. It created by the structure of the building and different objects in the indoor environment, together with a set of maps use to navigate. The work has resulted in a fully working server together with an android application.[3] The solution is an interesting approach to indoor navigation. It is fast and easy to set up and performs reasonably well compared to similar solutions.[4]

Keywords : GPS, Human Behavior, QR code, ADT, GoogleMapsActivity

I. INTRODUCTION

The idea of navigation is not only to find some path from one point to another point, because some connection of two points exists almost every time on the real map, in the real world. The principle of navigation consists in optimizing the length of the found path to make it as short as possible. This results in other positives that are, for example, saving transition time from one point to another or saving costs for transit between these points. One option how to optimize this distance is to use algorithms from a mathematical

discipline called graph theory, i.e. specific algorithms for calculating the shortest path between two given points. Therefore, the beginning of this thesis introduces the basic algorithms for finding the shortest path.

To use the algorithms is not sufficient. Before applying the algorithms it is needed to know the position where one is and also the position where one wants to find the path to. If using a paper map somewhere outside mostly it is not problem.[5] The problem occurs, however, when at an unknown place and there is no knowing of how

to orientate at this place, nor is there knowledge of the position which could be given to the algorithm as a starting point. There are many techniques, devices and systems to locate the position some of which are to be described in the next part.

The main aim was to create an application which would facilitate visitor orientation in an unknown building and provide navigation to a given destination. Complicated electronic systems for localization consume a great deal of funds, therefore they are not too effective mainly in terms of finance. The application which is the content of this project uses recognizing two dimensional graphic codes for localization. For scanning these codes it is sufficient to have some device for 7 recording images, e. g. camera. The navigation application demands only to transfer the scanned image of graphic code from the recording device. This way, the navigation is financially and technologically very convenient. The system does not need any radio link for communication and thus it works very quickly, without connection drops and without interferences with other devices. Because the navigation is based on recognizing two dimensional codes, the project work contains also the basic description of the selected 2D code – description of QR code.

II. TECHNOLOGIES USED

A. Android Studio: Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is

available for download on Windows, macOS and Linux based operating systems.[5] It is a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development. Android Studio was announced on May 16, 2013 at the Google I/O conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered[6] beta stage starting from version 0.8 which was released in June 2014. The first stable build was released in December 2014, starting from version 1.0.

Android Studio supports all the same programming languages of IntelliJ (and CLion)[6] e.g. Java, C++, and more with extensions, such as Go; and Android Studio 3.0 or later supports Kotlin and "all Java 7 language features and a subset of Java 8 language features that vary by platform version." External projects backport some Java 9 features.[7] While IntelliJ that Android Studio is built on supports all released Java versions, and Java 12, it's not clear to what level Android Studio supports Java versions up to Java 12 (the documentation mentions partial Java 8 support). At least some new language features up to Java 12 are usable in Android.[7] .

B. Google Maps API: Maps can be added to any application by using Google Maps Android API. The API adds maps to the application based on Google Maps data. It handles everything required to display maps in the application from access to the Google Maps server to response to map gestures. To use the Google Maps Android API the developer must register his/her app project on the Google Developer Console and get a Google API key which can be added to the app.[7] The

API key is necessary to access the Google maps server. To incorporate Google Maps in our app we have made use of the GoogleMapsActivity provided by Android Studio. Using this activity android studio automatically generates all the files required for integrating Google Maps. We have to put the API key for the project in the google_maps_api.xml file generated.

III. WORK PLAN

We have selected the approach of QR Codes for our system as proves to be the most cost-effective solution.[8] Our system would work in the following way: Firstly, the Administrator application is provided for any person who wants to implement the system for his infrastructure. In the Administrator application, the administrator would create a new project site by uploading map images related to the building. He would define the north direction of the building. He would then set the scale by giving a measure of suppose the width of a particular room. Also, he would define the various rooms in the image.[8] Finally, he would define the possible paths between the rooms. All this data will then be passed to the server APIs as JSON objects.

The client side application will be used by the people who want to navigate inside the building.[9] In this application, the user first selects the site on which he wants to navigate. If related map images and data are already present in the local database, they do not need to be downloaded. If they are not present, then they need to be downloaded to the device. The Internet would be used only for this download. After this, all further operations can be carried out offline. This is an important feature as one enters

the building, the mobile network is not always strong, and hence accessing only local database for further operations solves this problem. Then a map image is displayed on the next screen. Here an option of “Scan QR Code” is provided, wherein the user can scan a particular QR Code and the application will then show him the corresponding location by using a pointer on the map image. A separate option for navigation will be provided. Here, the user needs to provide the source and destination by either scanning respective QR codes or by entering through keyboard.[9] He will then be shown the corresponding path. A list box would be provided where the user will be able to see the list of all rooms for the particular site, and can check their location of map by clicking on it. These operations would be implemented for every floor of the building. The user will be provided with an option to select the floor. This is how our system would cater Indoor Navigation for the users by the Client Application, who can reach their desired destination on their own not requiring anyone else’s help. Also, the availability of Administrator application ensures that anyone who wants to implement this system can do so.[10]

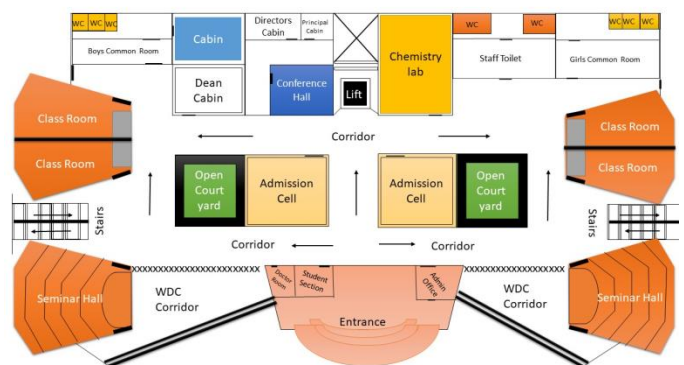


Fig:4.1.1. Ground Floor of GHRIET

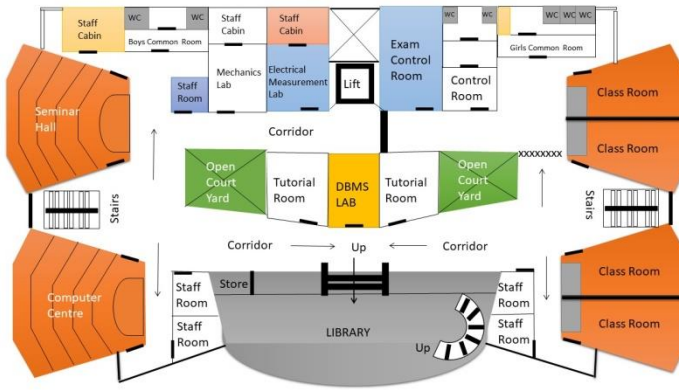


Fig:4.1.2. First Floor of GHRIET

Both figure 4.1.1 and figure 4.1.2 shows the mapping of ground floor and first floor of G H Raisoni Institute of Engineering and Technology. In ground floor we have Admission Cell, Director’s cabin, Dean’s cabin, Conference Hall, Chemistry lab, etc. In First floor we have, computer center, Seminar hall, Control Room, class rooms, etc.

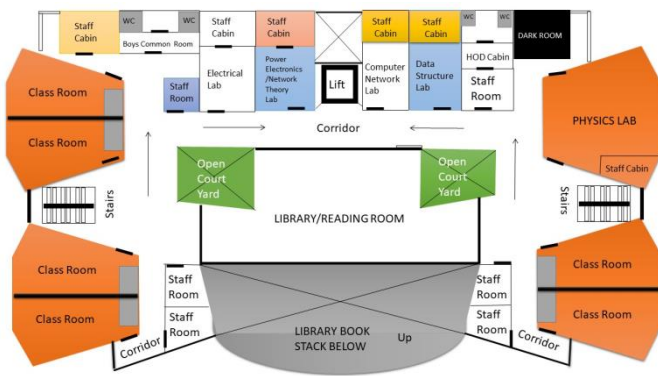


Fig:4.1.3. Second Floor of GHRIET

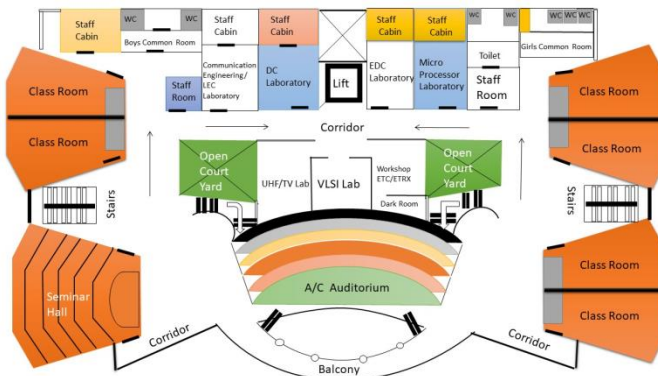


Fig:4.1.4. Third Floor of GHRIET

Both figure 4.1.3 and figure 4.1.4 shows mapping of 2nd and 3rd floor of GHRIET Nagpur, In 2nd floor we have both CSE and Electrical department, Library, class rooms, physics lab, and other labs. In 3rd floor we have Auditorium, Seminar hall, class rooms and other labs.

IV. RESULT



Fig: 6.1.1 Direction from college entrance to director’s cabin

- Open the application
- Select your current location, Map is appeared to show your location
- Select destination location, map is appear with direction from its current location to its destination
- Read the instruction like:
 - walk straight for 20-25 steps, click next
 - turn left & walk 10-15 steps, click next
 - turn right & walk 5-10 steps, click next
 - turn right & walk 5 steps, click next
- Your destination on your left.

V. CONCLUSION

An application has been developed with the name of “Indoor Navigation System” using Android Studio. Besides that, the Photoshop software has been used to make photo for indoor navigation[10]. All the pictures are stored in database to make smaller application size.

In this application, user just needs to install 2 applications in order to navigate in GHRIET. The marker can be set on the map because some faculty information does not build inside map database. Besides that, the proposed application is more convenience to the user who is familiar with the Google map services.[11] The indoor navigation only applies in GHRIET building. Most of the points in GHRIET building have been given a QR code so user can scan to know the position and search for the destination. The navigation only show pictures which are similar to the conventional map, but it can be accessed using phone and it shows the route to the destination. It only consists of a mobile application and no hardware was used. User needs a phone installed with this application and bar code scanner application.[11] GPS system in phone needs to be enable for outdoor navigation and the Internet service need not to be enable when using indoor navigation service. This indoor/outdoor navigation application has successfully done by using the Android Studio, other software etc. It can improve the effectiveness of the application in the future by making indoor navigation for all buildings. Besides that we also can replace QR code indoor

navigation with difference navigation method such as use ARCore Technology, etc.

VI. FUTURE SCOPE

- This project will be used to navigate in a large companies, shopping malls, universities, huge complex, etc.
- It can be used to track all paths in an huge building.
- It can be used to identify indoor fields in any particular building by using AR Core technology.

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