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Implementing A University Mobile Navigation System

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ABSTRACT

Mobile phones are nowadays, far more than merely communication devices. In particular, Smartphones and Tablets are products that help to make our works and everyday life easier. Along with the advance in technology and popularity of these devices, the use of mobile applications increased enormously in the last few years. Based on new techniques like Global Positioning System (GPS) and sensors, like compass and accelerometer, that can determine the orientation of the device, location-based applications coupled with augmented reality views are possible. In the context of this research work, a mobile navigation application for Osun state university is developed. The system architecture and design were presented. The technologies used for the implementation of the application include Google Map, Quick response scanner, Android development kit and Java. The resulting application which is downloadable from university website enables the user to find paths to specific locations and provide location-based information on buildings, road and other facilities in the campus. This application developed offers visitors the ability to explore university campus facilities via mobile devices
Keywords- Navigation System, Augmented Reality, Quick Response Code

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1. INTRODUCTION

Maps have been used for centuries to transit users from one place to another. In the last decade, navigation devices have used digital maps to locate the position of the user and assist in providing navigational directions. Recently, maps have become more than just visualization tool in navigation systems; they are now an aiding tool for enhancing the reliability of the obtained navigation solutions[1]. Navigation is a field of study that focuses on the process of monitoring and controlling the movement of a craft or vehicle from one place to another[2]. The field of navigation includes four general categories: land navigation, marine navigation, aeronautic navigation, and space navigation. The basic concepts in navigation are the longitude, latitude and altitude [3] .

A navigation system is an electronic map combined with route instructions, usually displayed on a dashboard video screen. Global Positioning System is one of the commonest navigation systems in the world. A geographic information system (GIS) is a system which is used to store, retrieve, map and analyze geographical data. These systems store any kind of information which is related to a geographical location. These spatial features are stored in a coordinate system which references a certain place on the surface of the earth [4]. An outdoor augmented reality system which can be connected to a GIS allow the human operator to move freely without restraint in its environment, to view and interact in real time with geo-referenced data via mobile wireless devices.

According to [5], one of the objectives of augmented reality is to enhance perception or the visibility of the physical world. The smartphone's screen acts as a window onto the real world whose video flow can be augmented this is made possible through mobile applications. Mobile applications consist of software or a set of program that runs on a mobile device and performs certain tasks for the user. Mobile application is a new and fast developing segment of the global ICT. Mobile application is easy, user friendly, inexpensive, downloadable and can run in most of the mobile phone including inexpensive and entry level phone[6]. Mobile application has wide uses for its vast functioning area like calling, messaging, browsing, chatting, social network communication, audio, video, game etc. The usefulness of mobile devices has increased greatly in recent years allowing users to perform navigation tasks in a mobile context[7].

The use of devices such as smartphones and tablets which come along with the excessive use of mobile applications is becoming more and more common, especially in the university domain. majority of these mobile devices have built-in techniques to determine geographical position. These devices combined with the right software can provide new users with location-based information on buildings and facilities etc in the university campus. In this paper a mobile navigation system architecture is presented , a Google map for the university was specified various buildings and roads within the main campus.

The University map specified and approved by Google was connected to Google play service software development kit using Eclipse Android Development Kit and the Navigation Augmented Reality was implemented using the quick response code scanner installed on the mobile devices with androids and blackberry platforms.

2. RELATED LITERATURE

The GPS is Global is a space-based global navigation satellite system (GNSS) that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United State government and is freely accessible by anyone with GPS receiver with some technical limitations which are only removed for military users. GPS is used on incidents in a variety of ways, such as [8]:

(i) To determine position locations; for example, you need to radio a helicopter pilot the coordinates of your position location so the pilot can pick you up.
(ii) To navigate from one location to another; for example, you need to travel from a lookout to the fire perimeter.
(iii) To create digitized maps; for example, you are assigned to plot the fire perimeter and hot spots.
(iv) To determine distance between two points or how far you are from another location.

Augmented reality (AR) is a live, copy, view of a physical, real-world environment whose elements are supplemented by computer-generated sensory input such as sound, video, graphics or GPS data [9] As stated by [10], The goal of an outdoor augmented reality system is to allow the human operator to move freely without restraint in its environment, to view and interact in real time with geo-referenced data via mobile wireless devices. This requires proposing new techniques for 3D localization, visualization and 3D interaction, adapted to working conditions in outdoor environment (brightness variation, features of displays used, etc.). AR systems are being introduced in industrial, commercial, medical and scientific markets for a variety of tasks such as computer-aided surgery and assisting in complex repair tasks (in airplanes, for instance).

QR Code is acronym for Quick Response Code. QR codes are 2D bar codes that were invented by the company Denso Wave, a subsidiary of Toyota, in 1994. Because Denso Wave chose not to exercise its patent rights, QR code is open to public. This means that, developers are free to create. QR Code is a matrix type symbol that has a cell structure arranged in a square. It consists of the functionality patterns for making reading easy and the data area where the data is stored. QR Code contains the following elements: finder patterns, alignment patterns, timing patterns, and a quiet zone [11].

QR Code data is stored into the data area. The data area is encoded into the binary numbers of '0' and '1' based on the encoding rule. The binary numbers of '0' and '1' are converted into black and white cells and then arranged. The data area has Reed-Solomon codes incorporated for the stored data and the error correction functionality. Decoding a QR code requires using a QR code scanner. Besides commercial scanners including hi-resolution, dedicated devices and handheld scanners, smart phones that have a camera and include a code reader software application can function as a scanner. Code reader software applications are freely available online for most devices. When the application is downloaded, the phone's becomes a QR code scanner. User points the phone camera toward the code and scans it. The reader application software decodes the code, converts it into readable text and displays [11]. Information decoded from the QR code is run through the background database for checking. If the information matches, then the desired output is displayed [12]

3. RELATED WORK

[13] presents techniques based on imagery and Augmented Reality (AR) which can prove to be of great help when discovering a new urban environment and observing the evolution of the natural environment. This paper itemized the various concept of pervasive augmented reality illustrated by indoor and outdoor applications. It also shows the use of augmented reality for helping visitors discover new environments. The use the geo-referenced data of objects can be used to inform users about their location. The use of the "Vision See through (VST) technique, which is widely, used in augmented reality applications. Just like the documented reality functionality relating to augmented reality, our video flow can be enriched with information identifying what can be seen with the camera. The layout of annotations informs users about the spatial location of POIs with regard to their geographical position.

The paper concludes that as mobile devices become progressively more powerful, we envisage transform recognition system from client server architecture to self-contained server architecture. Also, [14] developed a mobile AR application as a means of demonstrating how mobile AR technologies can be used in combination with other applications to produce a useful and practical tool. Thus, this study involves conceptual development that is demonstrated by a fully functioning campus event mobile app. The application developed is based on the Android soft-ware development kit (SDK) and the Metaio SDK. The architecture of the application is a client-server structure. A database is built for the application, and the Google Geocoding application programming interface (API) is used to address some difficult problems in the development of the application. [15] concludes that this is an excellent example of technological convergence, that is, the combination of previously separate technologies in such a way that they

interact with each other synergistically to enhance human capabilities and serve human needs.

4. METHODOLOGY

A. System Architecture

In this design, The user can have a satellite view of the campus, search for various buildings and have an augmented view of the campus. There are various gestures the user can perform which include a pinch, swipe etc. The system architecture is shown in Figure 1. It gives a quick overview of all components of the system environment and shows how they interact with each other. The main components are navigation module, Google Map data base(server) and QR Data server

(i) Navigation Module This module was developed using java program. and *Android development kit*

(ii) Google Maps Module is a desktop and mobile web mapping service application and technology provided by Google, Uniosun google Map depicted in figure 2 shows all the physical buildings available in the main campus of the university. In addition the latitude and longitude of a location can be determined through this module.

(iii) QR code Database: The user scan the QR code displayed on a certain building with a code reader at the entrance to verify information. The reader has the function coding QR code. Information decoded from the QR code is run through the background database for checking. If the information matches, then the user can get desired output i.e. description of the buildings

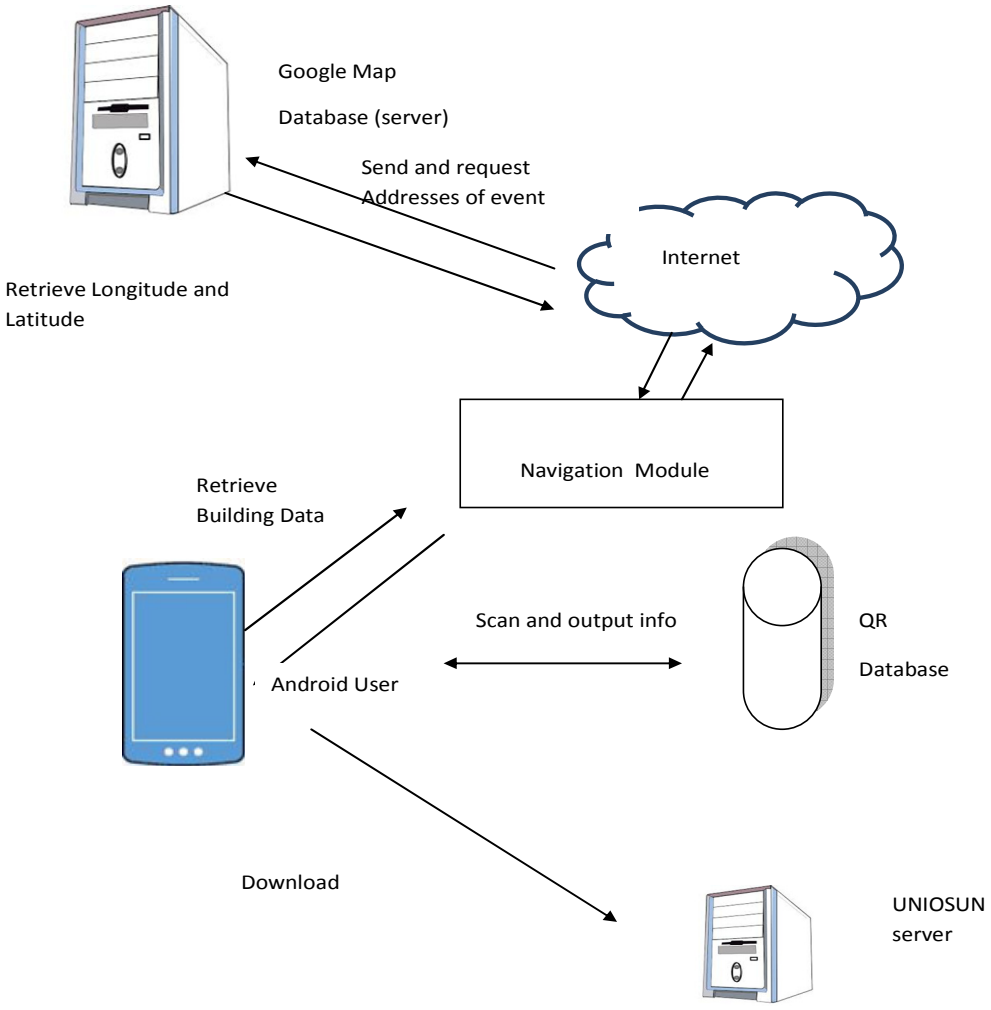

Figure 1: System Architecture of the UNIOSUN Navigation System

Figure 2: Google Map view of UNIOSUN Main Campus

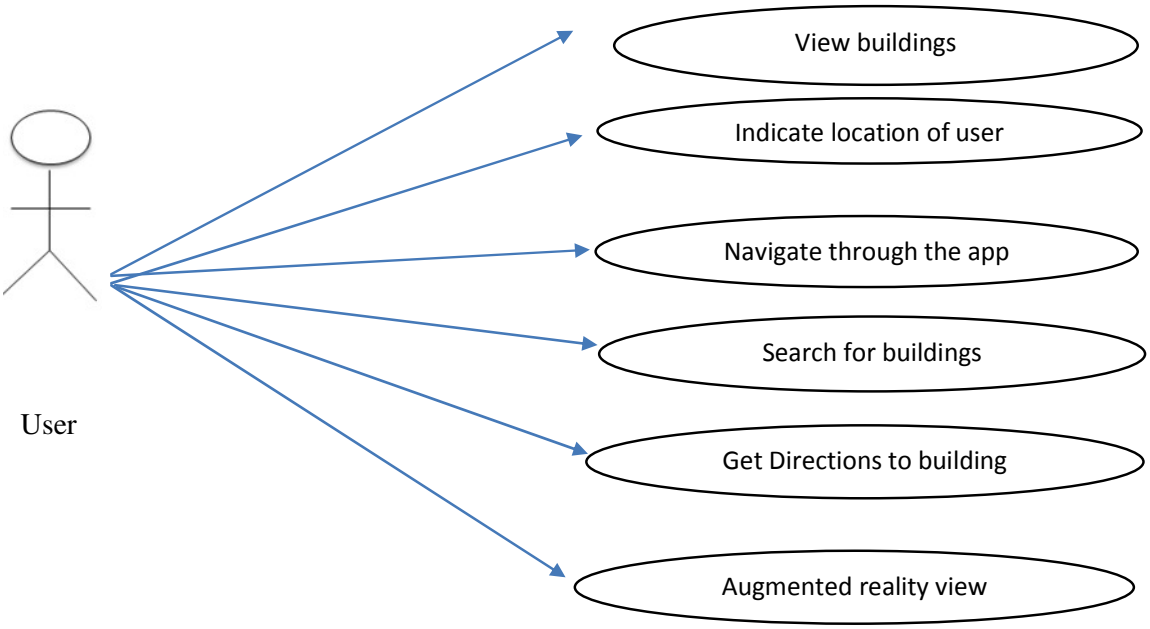

Figure 3: Use Case Diagram of the Mobile Navigation System

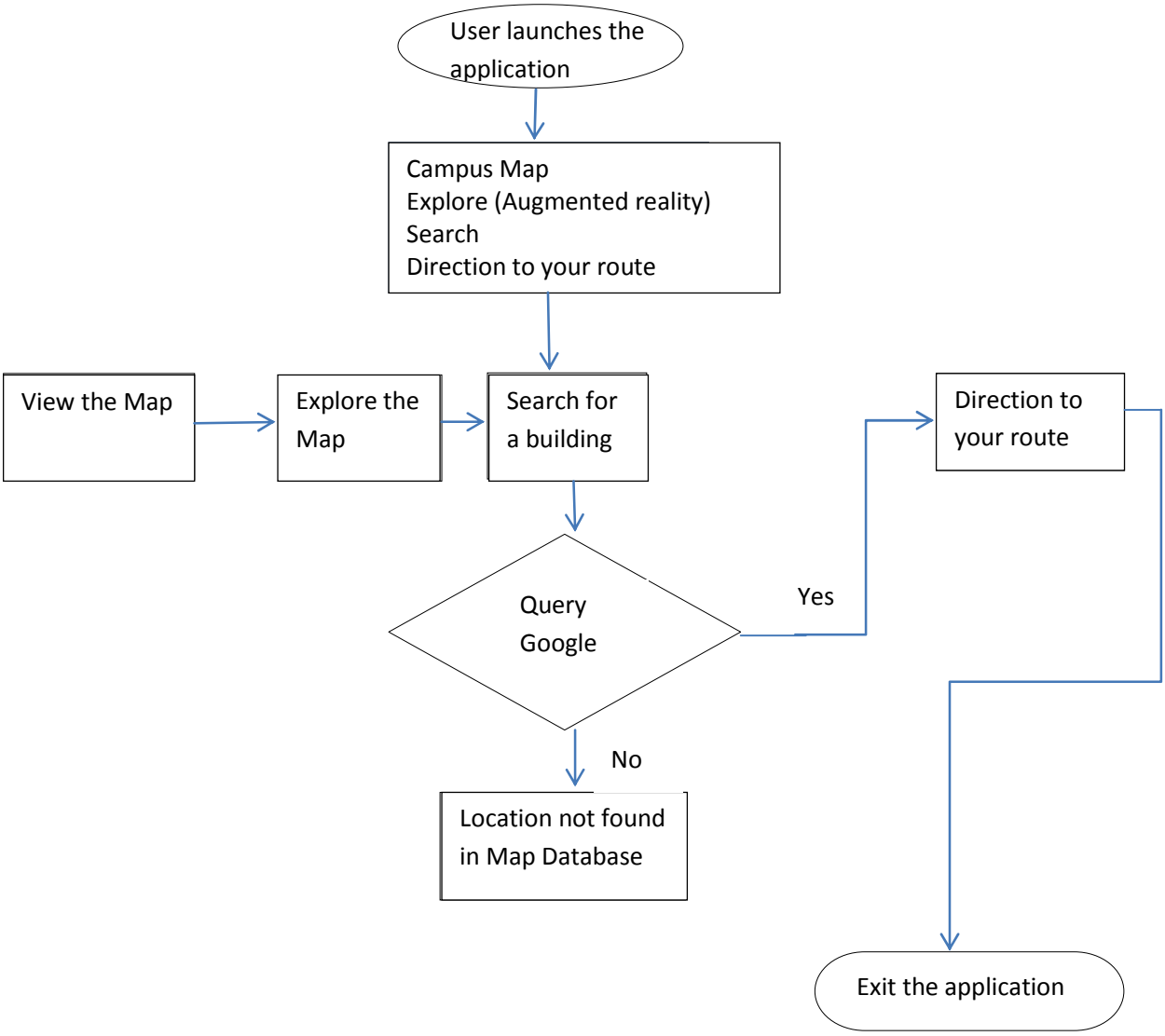

Figure 4: Flowchart of UNIOSUN Mobile Navigation System

4. IMPLEMENTATION

System Interface

The application was developed using Java, eclipse and android development kit(ADK). The basic element of a user interface on Android is the *Activity* class. It takes up the entire area of the display. Typically each *Activity* represents one screen. Internally *Activities* are stored on a stack. Whenever a new *Activity* is created it gets pushed on top of the stack. The back button on Android devices pops the top *Activity* off the stack and resumes the previous one.

To create a new *Activity* for the map screen, a class has to be implemented which extends *Activity* . *Code snippet is shown in appendix 1.* In order to add Views to an *Activity* a layout XML file is created. For each View a specific XML tag is added to the XML structure. XML attributes define the behavior (e.g. position, color, visibility) of those components. XML tags can be arranged in view containers such as Linear Layouts for single row or single column presentation or Table Layouts for a table structure.

The basic XML layout of the *MapActivity* used in the application is shown in appendix 2.The different pages and functionalities developed are explained below:-

Home view
This is the first page that the intended user sees. The logo of Osun state university is displayed, then a voice welcomes user to uniosun navigation system. When the user clicks on it, it takes he/she to the menu page. This is shown in Figure 5.

Figure 6: Menu Page of the mobile application

Map view
It displays the satellite view of Osun state university. The user can zoom and scroll this map with multi touch gestures. The building map is the basic layer of this screen. If zoomed in, it shows the label on various buildings as well. It also provides the coordinates of users location. This is shown in figure 7

Search view
The search view can be accessed by a click on the search button. It section contains a form where the intended user can input interested location and click on the search button search for location and get similar possible locations as output. The user can also search through the voice search mechanism.

Menu view
This is the second page that the intended user sees. It contains major links to other pages showing various information about the system. These links include navigation, place search and augmented reality. This is shown in Figure 6

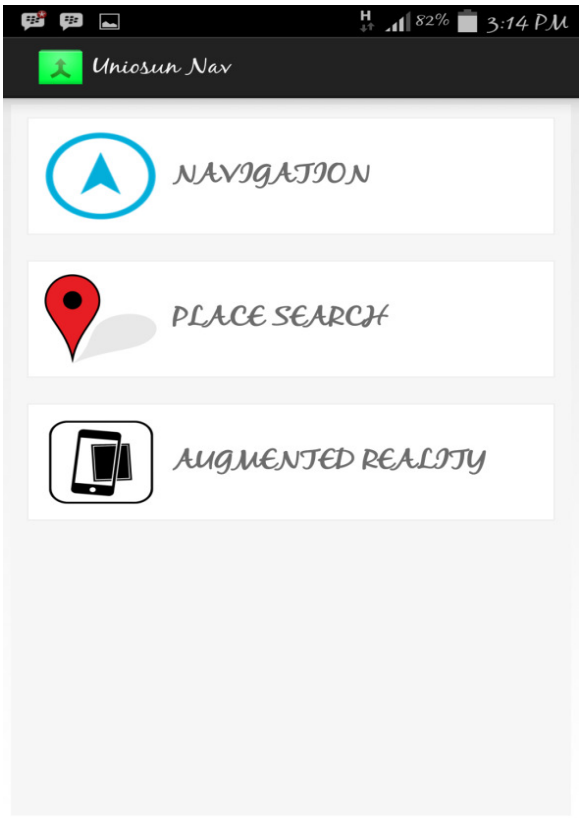

Figure 7: Menu

Augmented reality view

This section works with an already installed QR code scanner, the rear camera comes on and the user focuses on the QR code so the scanner can read the code then output the building details the intended wants to know. Code Snippet for Android XML Layout of CampusMapView in Figure 7. The following screenshots show the interactions of the user with application and how the application responds to different request.

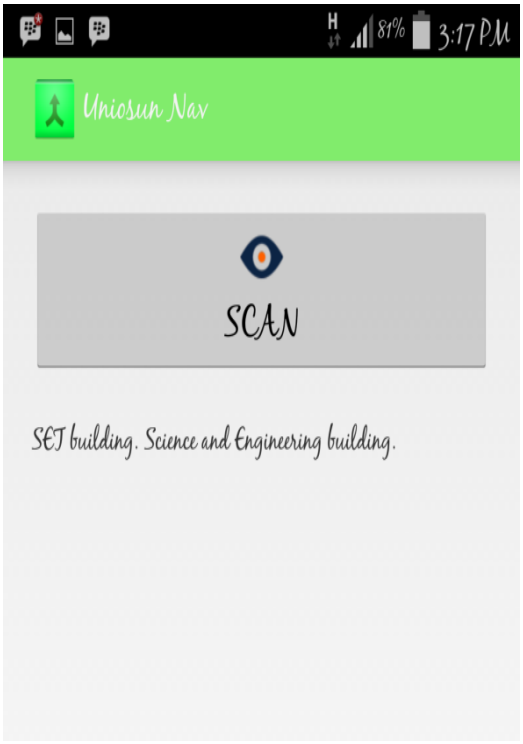

Fig 8: SCAN Output

5. CONCLUSION

The goal of this research work was to develop a mobile application which helps people to locate buildings and roads in Osun State University campus. A navigation system architecture was designed using UML software engineering techniques.The implementation of the system was carried out using tools such as Eclipse ADT . Connection to google play service was carried out and the implementation of the Graphic user interface of the system was done. The output of the various procedures is an android application developed with eclipse and Android SDK implemented with google map.

The QR code added to the system allows intended users to scan a code and get necessary information about a building within the university main campus. The application is an effective and efficient navigation system for the university. The application has reached a steady state where all bugs have been eliminated. Further works are ongoing to expand this to other university campus buildings .

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