Design and Development of Mobile Campus, an Android based Mobile Application for University Campus Tour Guide

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Abstract: android is an open source mobile operating system based on Linux with java support. It comes under free and open source software licenses. As per first quarter Report of the year 2012, 400 million people are using Android based devices worldwide and 59% of smart phone market is occupied by android based smart phones [1]. Android provides the support of mobile map and GPS localization. Android based mobile tour-guide application can provide valuable information on different landmarks of a university campus and guide students/parents/visitors to find the desired places in campus with more ease. In this paper we are proposing a tour guide application called Mobile Campus on android based mobile platform for SRM University campus. Near field communication (NFC) is a set of standards for smart phones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters. This tour guide application includes functionality such as locating current location of users, showing university campus map, route direction of university shuttle and gives small description & contact information of important places on campus.

Index Terms: Android, Android Beam Bluetooth, Global Positioning System (GPS), Near Field Communication (NFC), (NFC Data Exchange Format (NDEF).

I. INTRODUCTION

Nowadays usages of mobile are very common and play an important role in day to day activities of people. Mobile phones are coming with so advanced features that we can refer the current time as the era of smart phones. Android provides the support of mobile map and GPS localization. Android is an open source mobile Operating System based on Linux with java support and it comes under free and open source software licenses. As per first quarter report of the year 2012, 400 million people are using android based devices worldwide and 59% of Smartphone market is occupied by android based smart phones. This Android based mobile tour-guide application can provide valuable information on different landmarks of a university campus and guide students /parents/visitors to find the desired places in campus with more ease. Student/visitor can get current event information automatically when his/her NFC enabled

phone comes into range of another NFC enabled server/phone. Moreover, this application should explore current innovation technologies as many as possible and put them as building blocks like Google Map, Google API, and NFC. Rest of the paper is organized as follows: the section II represents some related works in the field of android based mobile tour guide, section III gives an architectural view of the proposed Mobile Campus tour guide with a detailed discussion; section IV discusses technologies used; section V tells about functional requirements, section VI tells about development environment and section VII concludes with future work plan.

II. RELATED WORKS

Literatures on the prior research work done by accredited scholars in the Ubiquitous Computing domain/ Android and Mobile computing are reviewed. Challenges and solutions proposed are in specific to context aware location based service are presented here. Khawlah A.AI-Rayes , Aise Zulal sevki, Hebah F.Al Moaiqel developed a Android application for guide a tourist for a trip planning on a Android phone. This application is able to suggest a trip plan in smart way. This application suggest a trip plan by taking spot, weather condition, current location of tourist and current time consideration. That application introduce VNS algorithm for trip planning Solution of trip plan is formed by using permutation of spots. The total cost of trip is calculated by adding straight length distance between all sequential spots in this solution [3]. R. A. Abbaspour* and F. Samadzadegan developed a Context- Aware mobile tourist Guide system based on service oriented architecture(SOA). PTG send a request based on the context of user to a catalogue. Service brokers collaborate to find the right services and then, PTG and service provider negotiate as to format of the request and some other protocol issues. At the last step, tourist may utilize the provided services .The key component of Service Oriented Architecture (SOA) is services. A service is a collection of actions. When the tourist wishes to requests a service using the predefined analysis of PTG, the related functions are called and requests are sent to the service catalogue. Since the catalogue has on-line and real time connections with service providers the catalogue finds suitable resources of services according to the specifications of user and bind them to him/her. Using this architecture empower the user to find more suitable resources with less effort [4]. The mobile tourist guide system for Android Mobile Phones that is able to provide tourism information to the mobile users conveniently.

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This system takes advantage of light-weighted mashup technology that can combine more than one data sources to create value-added services, while overcomes the limitations of mobile devices. The application aims to develop detailed texts, pictures, videos and other guidance information are provided, and so people can better understand the tourist attractions and make decision objectively. That system is based on request and response, so there is no continuous acquisition of the bandwidth. A mash up can combine two or more data sources (content or service) to provide several new services or contents to the users. It is a lightweight web application program. Furthermore, no matter what the mobile client is a Web browser or not, it is able to understand the format of the data or contents [5].

III. PROPOSED SYSTEM

Proposed university campus tour guide application will work on NFC enabled smart phones on Android platform. It can be used by visitors/ students/ parents. Fig1 represents proposed architecture of the tour guide application.
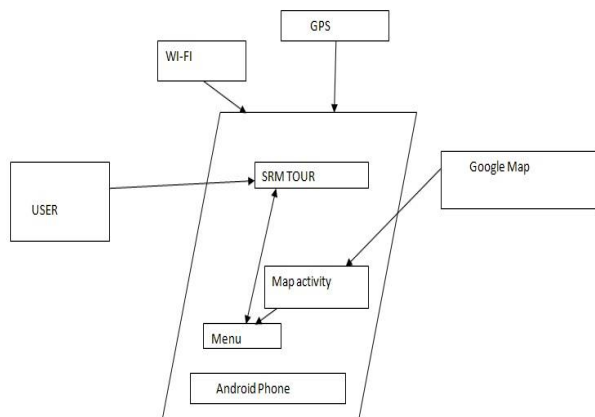

Fig 1: Architecture of the proposed System

User will interact with SRM Tour guide application which can be activated from menu bar of android phone. It will use GPS feature and Google Map functionality of the smart phone. This University campus tour guide application has practical significance. This application include basic functionality such as showing map of university campus, showing route between from source to different location, can locate user current location. Map can be zoom-in/out. User is able to view the all important landmarks based on categories e.g. Hotel, Bank, Cafeteria, Principal's room etc. In addition user gets information about current event e.g. coming sports event, information on coming music festival etc. User can also search important landmarks in campus using map. The most significant feature which distinguishes this application from other similar applications is implementation of NFC. It has the ability to connect automatically with other NFC devices when other smart phones/devices come into close range. **N**FC is a set of standards for smart phones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity. It offers a low-speed connection with extremely simple setup, and can be used to bootstrap more capable wireless connections. An example of this is in Google's Mobile Phone OS Android 4.1. In order to achieve a file transfer over Android Beam (an NFC sharing service), the software automatically completes the steps of enabling,

pairing and establishing a Bluetooth connection when doing a file transfer via Android Beam. The same principle can be applied to the configuration of Wi-Fi networks. Nokia has used NFC technology to pair Bluetooth headsets and speakers with one tap in its NFC enabled devices.
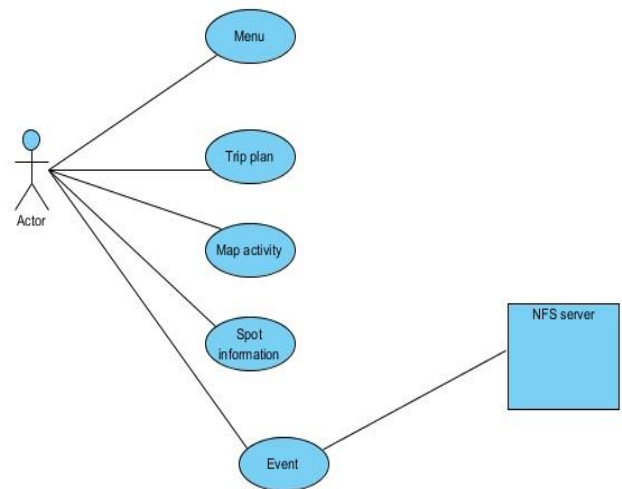

Fig 2: Use Case Diagram

In this scenario, actor is Android phone user. The application starts at the component Map Activity. Map Activity imports Google Map, retrieves points of interest (POIs) data from Server and store it in Local Sights Database that is created when application starts and destroyed when application finishes, calls Map Overlay which is overlay object of Google Map to draw POIs mark on map or further through Driving direction is to show route between user's current location and any sight in tour plan on map, and create Menu, which has 5 options:

1. Search is to enable users choose what kind of POIs to show on map such as bank, hotel and so on; it retrieves POIs data from LocalSightsDatabase.
2. Exit is to exit from the application
3. My Trip plan is to show Tour plan list; it retrieves data from My Tour Database storing tour plan. We make tour plan starting from Add to Tour View containing two functions of showing brief description information about place.
4. Get My Location is to get user's location data from GPS_PROVIDER, which is system service, provided by Android platform and providing the location data of current position of user.
5. NFC enable phone /server provide current event information automatically when another NFC enable phone came together.

Fig 3: DFD Level 0

- Here, user can request for spot information to university campus tourist guide application.
- User can request to track current user location from this application.
- User can request to display the map of university campus.
- Application displaying map.
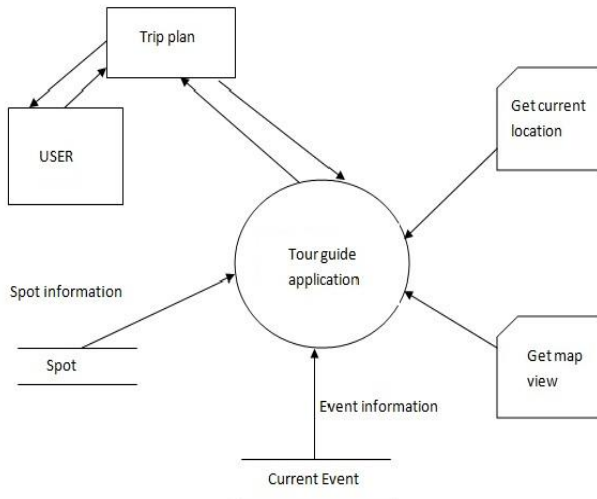- Application display brief describtion of spot.
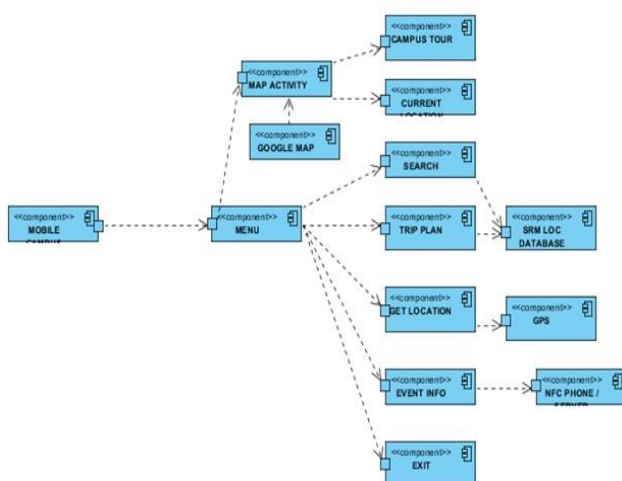

Fig 4: DFD Level 1

Fig5: Component Diagram

The component diagram above contains all the components in the system. .The application starts at the component Map Activity. Map Activity imports Google Map, retrieves points of interest (POIs) data from Server and store it in SRM Loc Database that is created when application starts and destroyed when application finishes, calls Map Overlay which is overlay object of Google Map to draw POIs mark on map or further through Driving direction is to show route between user's current location and any sight in tour plan on map, and create Menu, which has 5 options: Some of the process described above.

IV. TECHNOLOGIES USED

Near Field Communication or NFC is the next generation short-range high frequency wireless communication technology which enables the exchange of data between devices build with this technology. Mobile handsets are the main targeted devices for this technology. Services built on top of NFC enabled mobile handsets enable users to share and receive information instantly, interact with other NFC enabled devices, and even make fast and secure mobile payments. The technology is built up on the existing RFID standards. However, there are minor differences, and NFC devices cannot interact with some of the legacy systems. Near filed Communication devices are operating at at 13.56 MHz and can transfer data at up to 424 Kbits/second. Communication between two NFC enabled handsets is started and completed with a simple proximity wave or touch of the two devices to each other the communication can also imply passive parts also in the form of an NFC tag. These tags gain power for the communication from the RF fields emitted by an active NFC device. The real power of NFC relies in combining with contactless smart card infrastructure. The mobile handset user can make transactions just by touching his phone to a NFC credit card reader or ticket gate. Payment information, such as credit cards, loyalty cards, or your travel ticket is securely stored in the integrated smart card chip inside your phone. NFC technology enables all these legacy applications to be used on a mobile phone, providing more convenient, fast, and secure way of shopping or travelling. When using an NFC enabled phone with a NFC tag the phone can read small amounts of data from the RFID service shortcut tags, so for example the service shortcut contained inside the tag is launched just with a simple touch or tap.

A. Essential specifications:

- NFC is a set of short-range wireless technologies, typically requiring a distance of 4 cm or less.
- NFC operates at 13.56 MHz on ISO/IEC 18000-3 air interface and at rates ranging from 106 Kbit/s to 424 Kbit/s.
- NFC always involves an initiator and a target; the initiator actively generates an RF field that can power a passive target. This enables NFC targets to take very simple form factors such as tags, stickers, key fobs, or cards that do not require batteries.NFC peer-to-peer communication is possible provided both devices are powered.
- NFC tags contain data and are typically read-only, but may be rewriteable. They can be custom-encoded by their manufacturers or use the specifications provided by the NFC Forum, an industry association charged with promoting the technology and setting key standards.
- The NFC Forum defines four types of tags that provide different by Google in November 2007. Initially, Android's goal is to deploy the mobile phone sector, including smart phones and cheaper flip phone. However, Android comprehensive computing services and rich functional support have the ability to fully extend beyond the mobile phone market. Android can also be used other platforms and applications, and its prospects are very bright .Android system uses a layered architecture, from the top to the lower are the application communication speeds and capabilities in terms of configurability, memory, security, data retention and write endurance. Tags currently offer between 96 and 4,096 bytes of memory.

- As with proximity card technology, near-field communication uses magnetic induction between two loop antennas located within each other's near field, effectively forming an air-core transformer. It operates within the globally available and unlicensed radio frequency ISM band of 13.56 MHz's Most of the RF energy is concentrated in the allowed ±7 kHz bandwidth range, but the full spectral envelope maybe as wide as 1.8 MHz when using ASK modulation.
- Theoretical working distance with compact standard antennas: up to 20 cm (practical working distance of about 4 centimeters)
- Supported data rates: 106, 212 or 424 Kbit/s (the bit rate 848 Kbit/s is not compliant with the standard SO/IEC 18092)
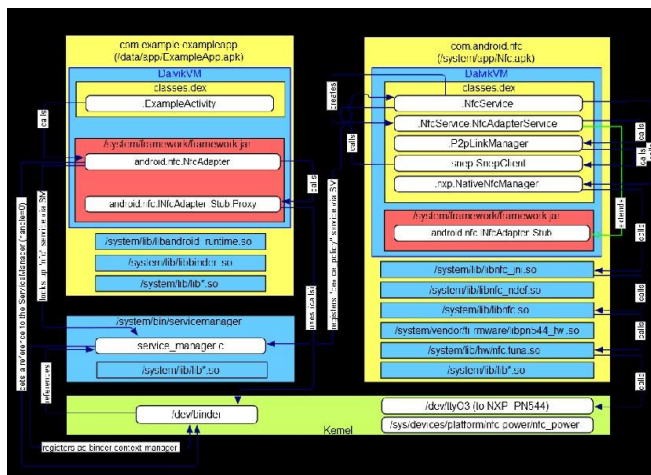

Fig 6: NFC on Android Architecture

Android is based on Linux ® V2.6 kernel of the open-source mobile phone operating system announced layer, application framework layer, system runtime library and Linux kernel layer. The Android architecture and its main components are shown in below. Application layer provides a wealth of core applications, including email client, SMS short message programs, calendar, maps, browser, etc. All applications are written using the JAVA language. Application framework layer simplifies there use of components, any application can publish or use other applications released block. System runtime library contains a set of core runtime libraries and the Dalvik virtual machine. Linux core layer which use of YAFFS2 file system is used to provide services underlying systems, and it locate between hardware and other software layers .Google provides major updates (typically incremental in nature) to Android every six to nine months, which most devices are capable of receiving over the air. The latest major update is Android 4.1 "Jelly Bean". Compared to rival mobile operating systems, namely iOS, Android updates are typically very slow in reaching devices, often taking several months from the official Google release date to actually being distributed to devices. This is caused partly due to the extensive variation in hardware of Android devices, with each update requiring tailoring to the specific hardware, as the official Google source code only runs on their flagship Nexus phone. Porting Android to specific hardware is a time- and resource-consuming process for device manufacturers, who prioritize their newest devices and often leave older ones behind. Hence, older smart phones are frequently not updated if the manufacturer decides it is not worth their time, regardless if the phone is capable of running the update. This problem is compounded when manufacturers customize Android with their own interface and apps, which must be reapplied to each new release. Some commentators have noted that manufacturers have a financial incentive not to update their devices, as lack of updates for existing devices fuels the purchase of newer ones. Further delays can be introduced by wireless carriers who, after receiving updates from manufacturers, customize and brand Android to their needs and conduct extensive testing on their networks before sending the update out to users.

V. FUNCTIONAL REQUIREMENTS

Map in Functional Requirements

ID	Requirement	Priority
1	The Tour guide can show map of a city.	H
2	The map can be zoomed in and out	M
3	Users can move around the map	H
4	The city guide can show user's current position on the map	H
5	The city guide can show the route between different locations on the map	H
6	The map can show points of interest	H
7	The map only shows the points of interest users are interested in	M

Information Retrieval in Functional Requirements

ID	Requirement	Priority
8	The city guide can retrieve information of points of interest	H
9	The city guide can retrieve information of events, which will happen right now.	H
10	Users can select what kind of POIs to show on map (i.e. different classifications. e.g. hotels, shuttle, restaurants events, and so on).	M

Trip Plan in functional requirement

ID	Requirement	Priority
11	Users can make a tour plan. (I.e. users can choose any POI and add it into their tour plan.)	M

Non-Functional Requirements

According to the goal of the project, the resulting prototype should be extendible, tailorable, and explore and put existing innovational technologies as many as possible as building blocks in the project. And user interface should be readable, easy to understand, and easy to operate.

Usability-Product should be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use

Operability -The whole industrial installation should be in a safe and reliable functioning condition, according to pre-defined operational requirements.

Reliability-The specified components should be able to perform its required functions under stated conditions for a specified period of time.

Availability-Availability of a system should be optimized under a set of constraints, such as time and cost-effectiveness.

Performance-Focus should be kept on monitoring and managing the performance and service availability of software of applications..

VI. DEVELOPMENT ENVIRONMENT

For developing MOBILE-CAMPUS, we selected Java programming language, which is used for Android platform application. Eclipse is the editor environment for our project, we also used SDK Android with version 9.0.0 to provide an Android emulator with requirement libraries to build Android application and SQLLite database, which is lightweight database engine that provides a small storage size and needs small memory so it is suitable for Android application. Finally, we deal with some APIs. The Google Map API is one of the most important APIs in our application. It provides to create and to call to MOBILE-CAMPUS map with located spots. In addition, it helps to show tourist current location via GPS on the map and helps to find the nearest spots to current location of tourist. IGoogle Weather API is used to get the current weather state of Chennai. The application may need this information when a trip plan is generated.

VII. CONCLUSION

In this paper, we presented the design and implementation of a mobile application called MOBILE-CAMPUS, with which mobile users can get valuable information on different landmarks of a university campus and guide students/parents/visitors to find the desired places in campus with more ease anytime and anywhere. By Mobile-campus, users can get an detailed information about important landmarks in text and pictures. In particular, this application can provide users location-based information of an university campus which can be browsed or queried through a map. Student/visitor can get current event information automatically when his/her NFC enabled phone comes into range of another NFC enabled server/phone.

VIII. ACKNOWLEDGMENT

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