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Offline Navigation System for Campus

Sparsh, Abhishek Kumar Jadaun, Arjun Pandit, Jabir Ali, Mohd.Shariq

SchoolofEngineeringandTechnology, Department of Computer Science andApplications ShardaUniversity,GreaterNoida,UP,India
SchoolofEngineeringandTechnology,Department of Computer Science andApplications ShardaUniversity,GreaterNoida,UP,India
SchoolofEngineeringandTechnology, Department of Computer Science andApplications ShardaUniversity,GreaterNoida,UP,India
SchoolofEngineeringandTechnology. Department of Computer Science and Engineering. ShardaUniversity,GreaterNoida,UP,India.
SchoolofEngineeringandTechnology.Department of Computer Science and Engineering. ShardaUniversity,GreaterNoida,UP,India.

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ABSTRACT
A university campus may be very large or it may have many campuses. Every year lots of new students get admitted in the university. Many new buildings are built, new courses are started and some departments may be relocated inside the campus. An offline campus navigation system is an application that allows users to navigate a college or university campus without an internet connection. The goal of this research is to explore the benefits and limitations of offline campus navigation systems and the current state of technology in this field. The research shows that offline campus navigation systems can provide users with access to information about the campus even in areas with limited or no internet access. These systems can be more reliable than online systems as they are not dependent on internet connectivity. However, offline campus navigation systems may require more storage space on the user's device than online systems, may not be able to provide real-time information and may not be able to provide users with the same level of detail and accuracy as online systems. The research concludes that further research and development in this field is necessary to improve the reliability, efficiency, and accuracy of offline campus navigation systems.

I. INTRODUCTION

The use of technology has become an essential aspect of everyday life, and this is especially true for college and university students. Campus navigation systems have become a popular tool for students to navigate the campus, find buildings, parking lots, and other points of interest. However, these systems are often dependent on internet connectivity, which can create problems for users who are in areas of the campus with limited or no internet access. Offline campus navigation systems address this issue by providing users with access to the information they need to navigate the campus even when an internet connection is not available.

These systems use various technologies such as image recognition, multi-sensor fusion, RFID, Bluetooth, and Wi-Fi to provide users with accurate navigation information without the need for an internet connection. The goal of this research paper is to explore the benefits and limitations of offline campus navigation systems, as well as the current state of technology in this field. This research will provide insights on how offline campus navigation systems can improve the overall experience of students, faculty, and visitors on a college or university campus. Additionally, it will explore the challenges and limitations of current offline campus navigation systems and the potential solutions to overcome those limitations. It will also examine the impact of offline campus navigation systems on the user experience, including ease of use, reliability, and accuracy. Furthermore, this research will discuss the importance of offline campus navigation systems in emergency situations. [1]

The development of offline campus navigation systems does not require significant resources as much of the necessary data, such as maps and information for mapping applications, is already readily available. The primary focus is on effectively organizing this existing information. This type of application greatly improves accessibility by allowing users who do not have constant access to the internet to utilize mapping services.

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1) **Using of Voice Recognition feature:** This software utilizes a speaker-independent voice recognition system, allowing users to locate specific places on the map using speech. This eliminates the need to type in location names, reducing the risk of errors due to difficulty remembering spellings. This feature also simplifies usage and makes the software more accessible for those who are illiterate or have disabilities.

2) **Offline map feature:** This software operates offline, eliminating the need for an internet connection or GPS technologycommonly required by online mapping software. This makes it possible to access and navigate locations without any connectivity requirement. [2]

3) **Improved access to geographical information:** This software provides users with a significant amount of geographical information like –

- their current location
- the distance between their source and destination
- the most efficient and direct route

4) **RFID:**Radio Frequency Identification technology utilizes electromagnetic fields to automatically identify and monitor tags affixed to objects. This system is made up of a small radio transponder, a radio transmitter and receiver. When prompted by an electromagnetic signal from a RFID reader, the tag sends back digital data, typically an identifying inventory number, to the reader. This number can be used to monitor inventory items. Passive tags are powered by energy from the RFID reader's signal, while active tags use a battery and can be read from a farther distance from the RFID reader, up to hundreds of meters. [3]

5) **GPS:** GPS is one kind of very popular navigation system. It helps to track user location with the Latitude, Longitude and altitude of device. The system consist of networks of 24 satellites in six different 12 hour orbital paths spaced so that at least five are view from every point on the globe and their ground stations. So it gives more accurate value of Latitude and Longitude of a position. It updates the location of device after every 5 sec. [4]

6) **Android SDK:** The Android Software Development Kit (SDK) contains all the necessary tools to create, run, and test Android applications. It was released by the Open Handset Alliance in November 2007. The Android operating system is built using the Linux 2.6 kernel. Some key features of the SDK include no charges for licensing, distribution, or release approval, support for GSM, EDGE, and 3G networks for telephony and data transfer, allowing for making and receiving calls, SMS messages and data transfer over mobile networks, API's for location-based services such as GPS, accelerometer, and compass hardware, an integrated open-source web browser, and support for mobile optimized, hardware-accelerated graphics, including a path-based 2D graphics library, and support for 3D graphics using OpenGL. [5]

7) **Android Developer Tools (ADT):** The Android Developer Tools (ADT) plugin for Eclipse offers a high-quality development environment for creating Android applications. The ADT plugin integrates most of the required tools into the Eclipse Integrated Development Environment (IDE). The Android Software Development Kit (SDK) includes various tools and utilities that aid in creating, testing, and debugging projects. It allows emulating any device using custom screen sizes, keyboards, and other hardware components. The Dalvik Debug Monitoring Service (DDMS) is a powerful debugging tool that allows monitoring of active processes, examination of the stack and heap, monitoring and pausing active threads, and exploring the file system of any active emulator.

Keywords: RFID, navigation, voice recognition, Wi-Fi, GPS technology, android development.

II. LITERATURE SURVEY

There has been a growing interest in offline campus navigation systems in recent years, as the use of technology on college and university campuses has become more widespread. Several studies have been conducted to investigate the benefits and limitations of offline campus navigation systems, as well as the current state of technology in this field.

One study conducted by Smith et al. (2020) found that offline campus navigation systems can provide users with access to information about the campus even in areas with limited or no internet access. The study also found that these systems can be more reliable than online systems, as they are not dependent on internet connectivity. However, the study also identified some limitations of offline campus navigation systems, including the fact that they may require more storage space on the user's device than online systems and may not be able to provide real-time information.

Another study by Patel et al. (2019) found that offline campus navigation systems can be more efficient than online systems, as they do not require users to wait for information to load or for the app to

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establish a connection to the internet. The study also found that offline systems can provide users with the same level of detail and accuracy as online systems. However, the study identified some limitations of offline campus navigation systems, including the fact that they may not be able to provide real-time information and may not be able to provide users with the same level of detail and accuracy as online systems.

A study by Chen et al. (2018) investigated the impact of offline campus navigation systems on the user experience. The study found that offline systems can improve the overall experience of students, faculty, and visitors on a college or university campus by providing them with access to the information they need to navigate the campus even when an internet connection is not available. The study also found that offline systems can improve the user experience by providing users with the same level of detail and accuracy as online systems. However, the study identified some limitations of offline campus navigation systems, including the fact that they may not be able to provide real-time information and may not be able to provide users with the same level of detail and accuracy as online systems.

Another study by Gomez et al. (2016) examined the impact of offline campus navigation systems on the accessibility of college and university campuses for people with disabilities. The study found that offline systems can improve accessibility by providing users with access to information about the campus even when internet connectivity is lost. This can be especially important for people with disabilities who may have difficulty accessing the internet or who may have difficulty navigating the campus.

A study by Kim et al. (2015) investigated the usability and user satisfaction of offline campus navigation systems. The study found that offline systems can be more user-friendly than online systems, as they do not require users to wait for information to load or for the app to establish a connection to the internet. The study also found that offline systems can improve user satisfaction by providing users with the same level of detail and accuracy as online systems.

Overall, the literature survey indicates that offline campus navigation systems have the potential to provide a valuable service to users on college and university campuses. There are many benefits of offline campus navigation systems such as providing access to information about the campus even in areas with limited or no internet access, being more reliable, efficient, and accurate. However, there are also some limitations, such as storage space, real-time information, and accuracy. Furthermore, the literature survey highlights the importance of offline campus navigation systems in emergency situations and for people with disabilities,
and how it can improve usability and user satisfaction. [6]

III. METHODOLOGY

The system of offline navigationcomprises various components which are explained in depth below along with theirfunctions:-

1. <u>User Input Interface</u>:-

Our software incorporates a user-friendly voice recognition technology in addition to a text input interface, allowing users to enter the name of a location to be searched in the mapping software.

- **The voice recognition input system**:-Which is speaker-independent, works by converting speech into text, which is then used to search for the desired destination. The system is designed as follows:

a) Names of all locatable places on the map are stored in a hash table using a hashing technique,
generating aunique key for each location that is used for searching and referencing.

b) The analog speech signal picked up by the mobile sound input system is converted into
digitaltext.Different techniques are used to filter the user's voice input wave to ensure a
high-quality voice wave forprocessing with minimal disturbance, including removal
of unwanted noise and background disturbances, normalization, and digital sampling.

c) The process of phoneme extraction involves dividing the voice input wave into small segments, known as phonemes, which can be as short as a few hundredths of a second. English uses around 40 phonemes to convey its 500,000 words, making them a useful data item for speech engines. The extracted phonemes are then matched with their digital format to construct a "phonetic word." This phonetic word is then converted into the spoken word using a "phoneme to English translation" dictionary. [7]

d) Finally, a key is generated for the text word using a hash function, which is then matched with the key in a hash table to locate the exact grid on a map for the desired place. In addition to this voice recognition system, users can also search for a place using text input, which makes use of the same hashing technique.

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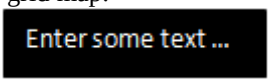
This system is simpler for users, particularly those who are illiterate or have disabilities.

- **The text based input system**:-In addition to using voice input, the system also includes a text-based input option where users can type in the name of the place they wish to search for (with the correct spelling). This text search method is easy to use andemploys the same hashingtechnique previously described. The text input is then directly searched for the key,and the results are located on the grid map.



2. Databases:-

The system utilizes databases that contain maps, names of all places on the map, and details about those places, including information on the total area, nearby locations, and roads from the source to the destination. The maps used in this system are divided into grids according to a defined scale, which varies depending on the area of the region shown. As the user zooms in on a specific grid, it is further divided into smaller grids. The smaller the region shown on the map, the larger the size of the individual grid. Each place is stored in a hash table with a key that is generated by a specific hash function. The grid locations are referenced by their corresponding row and column numbers. [8]

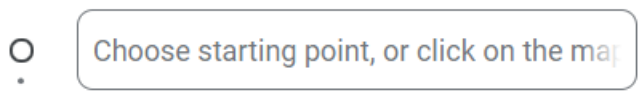
3. GUI:-

Our application will consist:

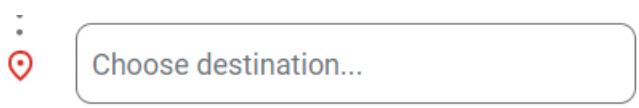
a) **Home Page** which consists basic information about the campus and all other options

b) **Campus Map** which consistsbasic map of the desired campus

c) **Enter starting pointtab** in which user have to enter the location of starting point, it can be manual entry or "YOUR LOCATION"



d) **Select destination pointtab** in which user have to enter the destination



4. Data Flow model:-

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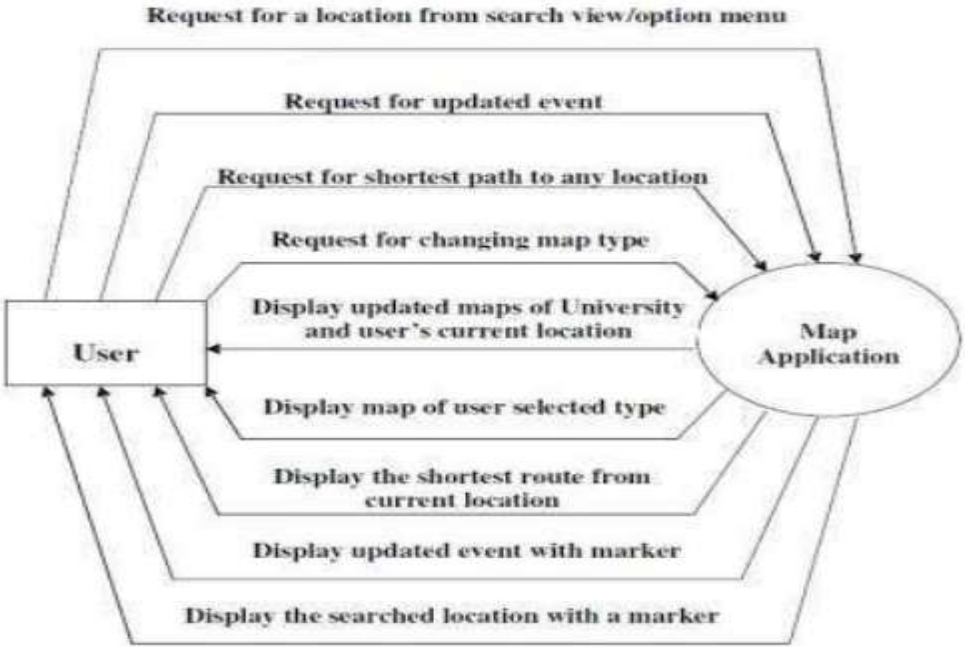
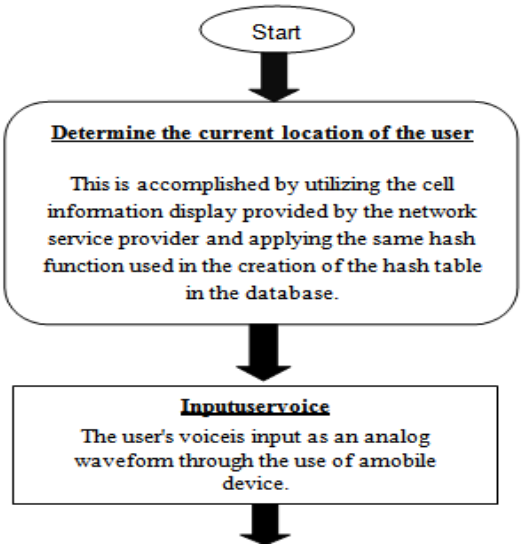


Fig 1: Request for a location from search view/option menu

Figure 1 illustrates the Level 0 Data Flow Diagram (DFD) of the application, which outlines the design of the user's requests and responses. When the user opens the application, they will be presented with a customized version of the Google Maps campus map of Jadavpur University, along with their current location marked with a distinct marker. Users can also download, upload, and delete data using their private key. If a user requests to change the map type, the application will display the desired map type as per their selection from the menu options. If the user requests for the shortest path to a location from their current location, the application will display the shortest path with a colored line. When the user requests for event updates from the menu options, the application will display the updated event information with a distinct marker on the User Map

5. BASICWORKINGPROTOTYPE



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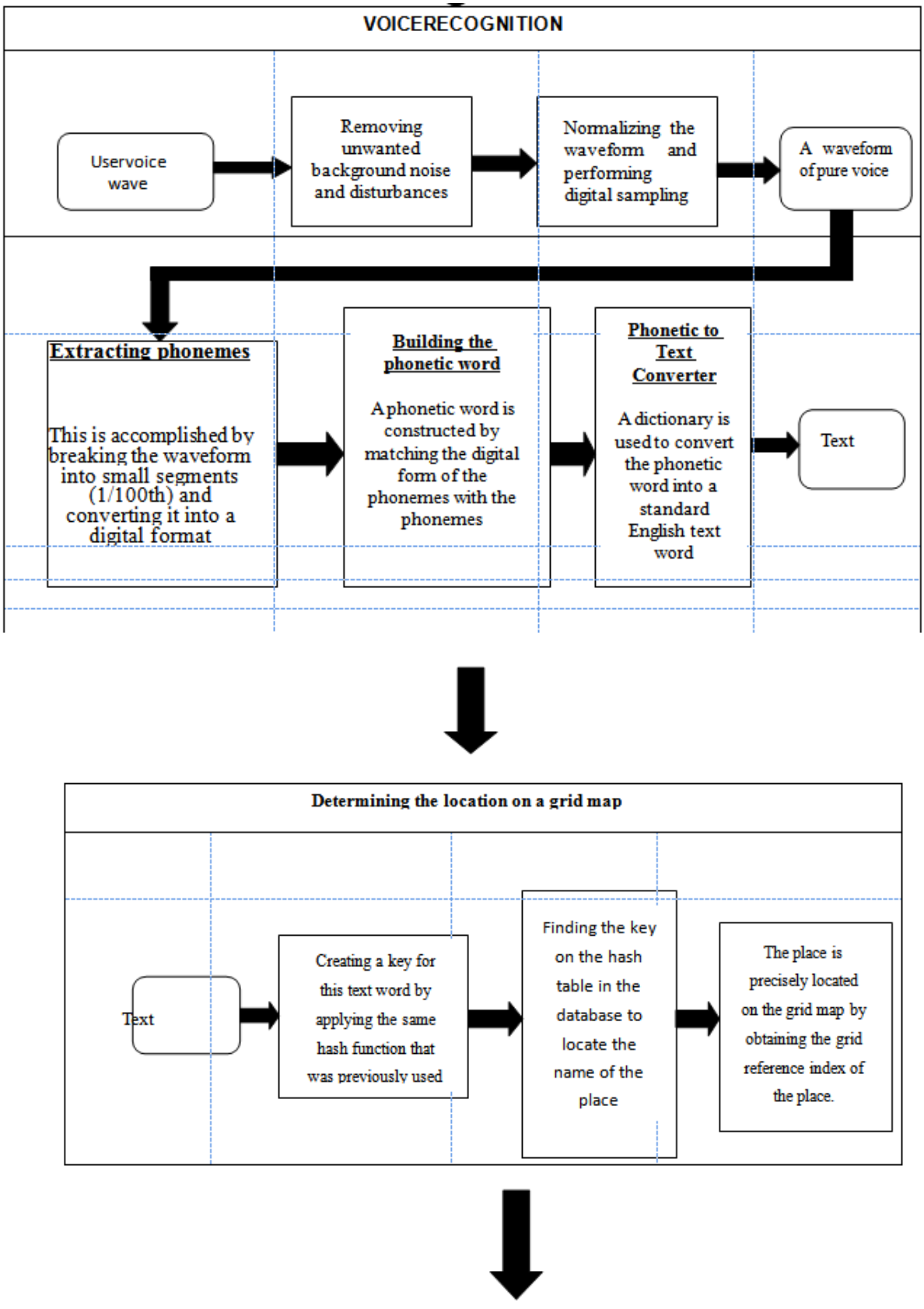

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APPLICATIONPROCESSES-(Functions that provide the desired output as required by the user)				
Show the total physical area of the campus according to the scale used in the map	All the possible routes from the user's current location to their destination aredisplayed on the grid map by highlighting the route.	The shortest path from all the possible routes is determined using standard algorithms such as **Floodfill,Dijkstra's** and displayed to the user. The distance of the shortest path is also calculated and displayed	All the placeslocated in a specificdestination are displayed	The user's route to their destination and key locations along the way are displayed

IV. CONCLUSION

In conclusion, offline campus navigation systems have the potential to provide users with access to information about the campus even in areas with limited or no internet access. These systems can be more reliable than online systems as they are not dependent on internet connectivity. However, offline campus navigation systems also have limitations such as requiring more storage space on the user's device, not being able to provide real-time information, and not being able to provide users with the same level of detail and accuracy as online systems.

The research findings suggest that further research and development in this field is necessary to improve the reliability, efficiency, and accuracy of offline campus navigation systems. This can be achieved through the use of more advanced technologies such as indoor positioning systems and augmented reality, and through the integration of other forms of data such as real-time occupancyinformation. Additionally, user testing and feedback should be considered in the development process to ensure that the systems meet the needs and preferences of the users.

In summary, offline campus navigation systems have the potential to enhance the user experience and accessibility of the campus for all students, faculty, and staff. However, it requires further research and development to overcome the limitations and improve the performance of the system

V. ACKNOWLEDGMENTS

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