Implementation of a Navigation Application for the Visually Challenged

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Abstract—People with Visual Impairment face many challenges while navigating both indoors and outdoors. Our aim is to address these challenges. The Tap Map Go application provides accessible navigation on a smartphone, both indoors and outdoors. Indoor navigation is provided with the help of Bluetooth Beacons and Indoor Atlas technology. This android application provides voice assistance to users to navigate to their destination. The outdoor component provides outdoor help for Visually Impaired (VI) individuals and guides them to the nearest bus stop. The application aims to facilitate a commuter to reach a bus stop of their choice, provide information such as bus numbers and different routes. The application even alerts the user when the arrival of a destination bus stop is expected. The application would be scalable and expandable to add more areas. This application enables VI individuals to travel with confidence and know where they are going.

Keywords —Visual impairment, navigation, beacons, smartphone, voice assistance

I. INTRODUCTION

It’s the last few steps that really help us decide whether we have boarded the bus or not. To carry out difficult task, we depend on one of the most important senses we have that is Vision. A slight discord in vision and things won’t be the same.

In today’s day to day life chores like buying grocery from the nearest shop, using Public Transport to travel from one point to another would not be easy for a person with low/ No vision, but with the use of different techniques and technologies we focus on developing a mobile application that just not helps in navigation but be the sight to the visually impaired who do not get to see the world around them.

TAP MAP GO -a navigation application is being developed for XRCVC (Xavier’s Resource Centre For Visually Challenged), an organization that helps VI individuals. This project helps the VI individuals to reach the nearest bus stop and also provide indoor navigation at any one XRCVC centre in Mumbai.

Our mobile application , TAP MAP GO will help each VI individual to locate the nearest bus stop and also alert them when the destination is nearby. This very own application navigates them to the XRCVC centre at Vivianna mall. The indoor component helps to assist the members of XRCVC. This institution was founded in 2003 at St.Xaviers College, one of the most renowned educational institutions in INDIA. Today the centre has become a national advocacy and support Centre for the visually impaired across Mumbai and we hope our application helps them in their endeavors.

It's an achievement and accomplishment to be the very first to make such an application for XRCVC-Mumbai. TAP MAP GO provides both indoor navigation as well as outdoor navigation. We aim to provide indoor navigation since it is a tedious task to get accurate position information in a simple way with fewer infrastructures and to create indoor maps. The whole process of making things easier is of prime importance to our team. We analyzed that buses were the best mode of transport but determining the exact location of a bus stop was a Herculean task.

In this project, we aim to help the VI to locate the right bus stop, since the bus stops are not clearly marked with non-visual indicators. The challenge of identifying a bus stop is tough if the location, and environment is unknown.

To solve this problem, we have come up with a solution to collect bus stop locations and landmarks using our application.

Changing the way of navigation to help the visually impaired is our way of contributing to society to help for a better future.

II. DESIGN OF THE NAVIGATION SYSTEM

The components of the entire system block diagram as shown in Fig.1 is divided into the following components

Determination of position and orientation: The sensors such as compass, gyro meter, accelerometer, Bluetooth Beacons will be used to find the location of the user indoors and Google Maps, GPS, Internet for Outdoors.
Tap Map Go System: The route to destination will be calculated from the source to destination for Indoors. Closest Bus Stops and the various buses coming to the bus stop will be found for Outdoors.

User Interface: Voice navigation will guide the user by speaking out the various Bus Stops, Timing, Destination Alert for Outdoors and directions for Indoors.

The components used in indoor system are explained below:

Determination of position and orientation: The sensors such as compass, gyrometer, accelerometer, Bluetooth Beacons and Indoor Atlas are inputted to determine the current location of the user and the floor id.

Tap Map Go System: On the user entering the destination, it uses Dijkstra's Shortest Path to compute the route from the current location to the destination.

User Interface: Voice navigation will guide the user by speaking out the directions.(such as Turn Left for 10 steps, Take a Right.)

The components used in outdoor system are explained below:

Determination of position and orientation: The sensors such as GPS, Internet, Compass, Bluetooth Beacons will be used to find the location of the user.

Tap Map Go System: On the user entering the destination, the closest bus stops and the various routes taken by the buses are found.

User Interface: Voice navigation will guide the user by speaking out the various Bus Stops, Timing, Destination Alert.

III. RESULTS

The screenshots of the implementation of the system are as given below:

A. Indoor Component

![Screen 1 and 2 of Outdoor Component](image1)

The first screen of the indoor component enables the user to select his destination within the indoor venue, which is Viviana Mall, Thane.

The second screen is the screen where the user gets to start navigation from current location and the current commands are displayed.

B. Outdoor Component

The different screens for the outdoor component of Tap Map Go are as follows:

![Screen 1 and 2 of Outdoor Component](image2)

Screen 1 above is the welcome menu screen which shows the list of possible input destinations. The input destination could either be user’s current location or any other location.

Screen 2 shows the user selecting an input location. The input location selected is Parel Railway Workshop.
Screen 3 shows the options for the destination locations. The destination selected above is Dadar TT. Once the destination is located, the different buses that go from start location to end location using real time information from Google is listed. The information listed includes the bus number, source bus stop, destination bus stop, estimated wait time etc. are shown in Screen 4.

Screen 5 tells the user how to go from selected starting location to the bus stop where the selected bus will come. The bottom of the page has a button which the user selects to let the app know that he has started navigation to bus stop. This leads the app into Screen 6 where the app will start scanning for the beacon at the bus stop. Hence, the app will lead the user to the bus top with greater accuracy.

Once the user reaches the start bus stop, an alert will be given to him and will lead him to screen 7, where has three options. He can check whether a particular bus comes to the bus stop or not, all the buses in the same route and an option to notify the app that he is in the bus. Screen 8 is an example of user checking if bus 66 comes to the stop or not. The app replies saying that the bus comes to the stop.

Screen 9 has the user checking if bus 67 comes to the stop or not. The app replies saying that the bus does not come to the stop. Screen 10 is shown when user clicks the button to see which all buses take the same route. The screen shows which all buses take the same route as bus 66.
IV. CONCLUSION

The Tap Map Go application seamlessly provides navigation both indoors and outdoors to users with Visual Impairment. It has been created by using latest technological advancements in the field of indoor positioning at minimal infrastructure costs. Unlike traditional navigation systems for the visually impaired, this application makes smart use of the smartphone and requires no hardware or sensors on the user, physically. The video of the implementation of this application can be found at YouTube at this URL https://m.youtube.com/watch?v=B2y29ROjmYM&feature=youtu.be We had implemented this project at Vivana Mall to demonstrate it to our clients at XRCVC. We helped the user travel from the West Court Entrance of the mall to the XRCVC centre on the first floor.

REFERENCES


Fig. 8 Screen 11 and 12 of Outdoor Component

As shown in Screen 11, the user notifies the app that he has boarded the bus. The app will now work in the background.

It will notify the user on reaching destination bus stop and give an alert for the same as shown in Screen 12.