Voice Controlled Smart Assistant and Real Time Vehicle Detection for Blind Peoples

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Abstract. The world is now like a global village with the help of modern technology. Normal people are taking huge facility from this modernization. But because of blindness and visual impairment lot of people facing problems in their regular normal life. By using technology here proposed a system which will help them to make their life easier by giving instruction when they are outside from home. This system is totally voice controlled. Blind people can know the current location; can travel by walk and by bus to different places by using this system. They will get continuous instruction through speech which will ensure the service perfectly. In this paper, here explained their problems, related work, full process and model of the proposed system. This system helps them in their daily life to travel independently.

Keywords: *Expert System, GPS, Location Finding, Vehicle Detection, Recognize.*

1 Introduction

Globally, it is estimated that approximately 1.3 billion people live with some form of vision impairment [1]. With regards to distance vision, 188.5 million people have mild vision impairment, 217 million has moderate to severe vision impairment, and 36 million people are blind [2]. There are 826 million people with near-vision impairment [3].

Every five seconds one person in the world goes blind. One child goes blind every minute. It is estimated that over seven million people become blind every year [4]. Just think about the number. There 89% of vision impaired people live in low and middle-income countries [5]. It can be assumed that most of the blind people are from the lower middle country.

Generally they face problems when they go outside from home. They need other persons help to know current location and direction information to go a destination.

They can't visit any places through buses without the help of other people. They always need assistance of people when they are outside. But sometimes it becomes quite impossible to stay someone behind them. On the other hand, they also feel that they became a burden to the family.

There is some existing system which has tried to help blind peoples on outside, but they are not user friendly. Those systems are made for blind peoples, but in some cases blind peoples can't operate it. It needs another person to operate those cases. This is not the symbol of independence. And none of this system included travelling facility by bus.

In this paper, here introduced a system which will help blind peoples to travel outside independently. In this system, easy interaction gets full priority as this is made for blind peoples. All the interaction with the system will be completed through voice command. This system takes voice command as input and gives response through speech by using system speaker. This ensures targeted instruction available by following some easy steps.

The main challenge of this system is to give the bus travelling facility to the blind peoples. It needs to select the exact bus, which is coming toward blind people and going to the destination asked by the blind peoples. Here real time bus location information also the main purpose. Blind people will get the bus location information as like as alarm, so this should make ensure. It gives the announcement about the distance of the bus from the user.

The main technology is used here different Google API's like: maps API, places API, route API and other. For bus detection here developed an algorithm which is explained below.

2 Literature Review

Over the recent decades, researcher tries to help blind peoples to navigate the route and identify bus by using modern technologies. Kumar Yelamarthi el at [6] built a Smart Robot which used RFID and GPS. This can drive user to a predefined destination by avoiding obstacles. It uses ultrasonic and infrared sensor to avoid obstacles. This robot is successfully implemented and operational. Dragan Ahmetovic el at [7] proposed Navcog a smart phone based turn by turn navigation assistance based on accurate real-time localization over large spaces. The system also informs them the point of interest of the accessibility issues. They use GPS, Accessibility technology, Map server and BLE. This system can guide the visual impaired person in an unfamiliar environment and this has been checked by the inventor.

Loomis el at [8] develop a navigation system which can guide blind peoples on the familiar and unfamiliar environments. They use differential GPS, Compass, Inertial Sensor, Velocity detector to detect the position and orientation of the user. Geographic Information System contains a detailed database of software for route planning and for obtaining information from the database. This has some drawback to get virtual sound, traveler needs normal directional hearing, they should worn compass and earphone which also makes them dependent.

Steven Edwin Moore [9] developed Drishti: an integrated navigation system for the visually impaired and disabled. It is a wireless pedestrian navigation system. He uses

wearable computers, voice recognition and synthesis, wireless networks, Geographic Information System (GIS) and Global positioning system (GPS) to develop the system. As it is wearable so it create a problem and audio has some problem and navigating prompt is slower than the pedestrian normal pace.

Hangrong Pan el at [10] develop a primary travelling assistant system of bus detection and recognition for visually impaired people to assist them travel independently. They design a computer vision-based system to detect and recognize bus information from images captured by a camera at a bus stop. They also use text detection algorithm to select the bus route. This has the accuracy of 80.93% in detecting the bus existence in a scene image.

Jalila Al Kalbani el at [11] develops a bus detection system using RFID technology that aims to ease the traveling and movement of blind peoples. This system has two parts, one is on the bus and another at the station. Announcement announced on the station so if blind peoples remain around the station then they can travel. Lamya El alamy el at [12] proposed a bus detection system for visual impaired peoples using RFID and wireless sensor networks. This system will allow VIPs to safely catch buses with the help of an audio device and a tactile interface through a wireless communication system (Wi-Fi) between the transmitter and the receiver. This system need braille keyboards and some other things which actually cost some money.

3 System Architecture

The architecture of the proposed system is an expert system for giving service to blind peoples through voice command is shown in Fig. 1.

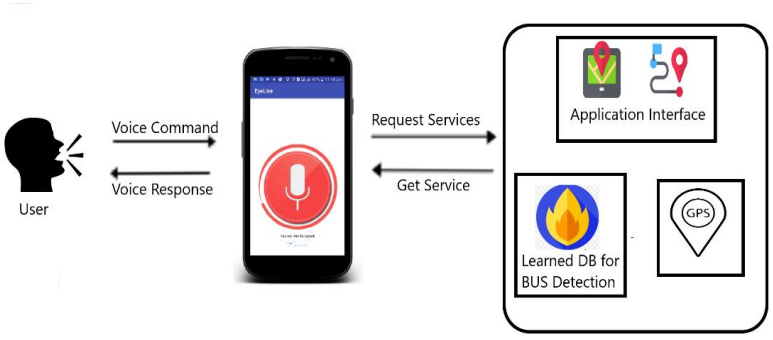

Fig. 1. System Architecture of the Proposed System. *User* give the command and *system* received this command and perform the internal operation. If needed, then request service to *Application interface, Learned DB, GPS. Etc.*

It creates with the hypothesis that blind peoples, i.e. a blind people give voice commands to the proposed system which should install on the user mobile phone. Proposed system recognizes the voice command and send it to the backend. When

backend receive the command, it analyzes the command and call application interface, GPS and learned database to collect the information according to voice command. After collecting the information it converts collected information to speech. Finally the system uses user mobile phone's speaker to give speech output.

To get the facility of this system everyone have to equip with below listed tools or gadget.

1. Android Mobile (First time developed this system for the Android platform)
2. Internet connection.
3. GPS Enable
4. System Installed on the mobile.

The main concern is to give all the facilities to the blind with easy interaction, that's why the application is controlled through voice. Hope every blind person can easily interact with this system and grave all the feature through some easy voice command.

4 Methodologies

In this section, here explained the implementation process of this voice controlled assistant. It has been precisely trying to explain main three services of this system. The system uses lots of Application interfaces, machine learning concept and newly developed algorithm to implement it the services properly. As it is controlled through voice command, so it's use voice recognition application interface to detect the voice.

4.1 Current Location

In fig. 2, it is shown that blind people can know their current location by asking to the system through voice command. When blind people give "Current Location" command, then system recognizes it first. Then the system calls Google places API which collects latitude and longitude from the mobiles by using the phone's GPS. The API determines the current place name which is corresponds to the latitude and longitude of blind people. Finally resulted text convert to the speech and then give the output to the blind people.

4.2 Travel by Walk

Blind peoples can travel a desired destination by walk. User get continuous direction instruction through speech output before reaching the destination. In fig. 2 it is depicted that, to get direction it is needed to give voice command "Walk". Then the system asks user to know the destination place. After telling the destination in the system, it gives some suggestion by calling places API and matching with destination place name. After that, user need to confirm specific destination by using voice command from the suggestion list. Now direction API is called by the system and direction instruction text is converted to speech and give output.

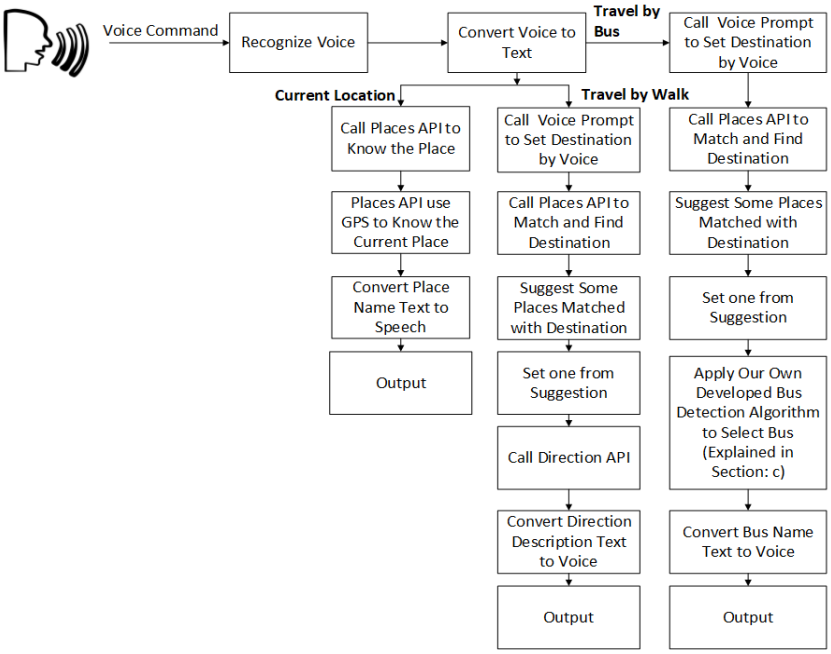

Fig. 2. Operational architecture of the proposed system. The system has three main operations *first* (*Current Location*), *second* (*Travel by walk*) and *third (Travel by bus*). This architecture, explains the operation when individual command is given by blind peoples.

4.3 Travel by Bus

This is the most challenging part of this paper. Blind peoples can travel through public bus. After setting a desired destination, he/she will able to know which bus is coming to him/her and will get continuous information about exact bus through speech output.

In fig. 2, shows that voice command "BUS" need to tell by blind people. The system recognizes the command and call voice prompt to know the destination place name from blind people. After receiving the destination name, system call places API to find all the matched places name and give suggestion through speech with those names. Blind people select one place from the suggestion by command. After that *algorithm 1* will apply to detect the actual bus for blind people. Finally the system will give continuous notification about bus coming through speech output.

To apply this algorithm for bus detection, every bus route has to learn by the system. When it is avail with the learned database, then the system can apply the algorithm.

Algorithm 1 Bus Detection Algorithm

```
Initialize:  mL = my location, dL = destination location, bL = bus location , bRP = bus route point, pD = past distance, cD = current distance, m = meter
if distance(mL_bL) < 1000m  then
    add those bus in a list
end if
if mL == bRP && dL == bRP then
     keep them in the list
Else
    delete them from the list
end if
if distance(mL_bL) < distance(dL_bL)  then
    add them in the table with bus ID
Else
    delete them from the list
end if
while(distance(mL_bL > 100m)):
    if (pD(mL_bL) > cD(mL_bL)) && (pD(dL_bL) > cD(dL_bL))  then
        keep them in the table
    Else
        delete them from the table
    end if
end while
while (distance(mL_bL)< 100m) && (distance(mL_bL) !=0):
    give speech alarm to be ready for the bus
end while
```

5 Experimental Evaluation

The proposed system takes voice command as input and gives response to the user through speech message. When voice command is received by the system, then it convert the speech into text and perform the other operation in backend to make sure the service for the user.

The system is able to perform mainly three operations and those are current location, travel by walk with real time direction and travel by bus which ensure expected bus. To get the service of current location, the user gives voice command "current location" then the system converts the speech as text. System backend then call the places API to know the latitude and longitude of current places of user by using GPS. Name of the place is converted to speech and give the output through user phone speaker.

When the user wants to go to a destination by walk, he/she gives the command "walk". The system then ask for the user to tell the name of destination place. After receiving the destination name, it searches through the places API to match the name. The system gives some suggestion to the user with the matched places name and request user to select one from them. The user selects one name from the suggestion through voice command. Then the system calls route API and receive the route instruction. The system converts the instruction to speech and gives continuous output through user phone speaker.

Travel by bus is the most challenging portion of this research and this is also a very special service to blind peoples. The user sets destination like travel by walk. But here without calling route API it apply a bus detection algorithm to detect the exact bus. This algorithm is a bus detection algorithm which is developed to detect exact bus is coming towards blind people after selecting a destination.

To apply bus detection algorithm to detect bus, firstly the system need to save the route of the bus to the database. Here named the database as learned database where latitude and longitude of bus route is stored with the distance of 5 meters from each to another point. To learn the latitude and longitude here needs another system on the bus. After learning the database, system on the bus only give the bus real time current location information.

Explaining Bus Detection Algorithm. In the previous section, bus detection algorithm is written but not properly explained. Here it is explained with pictorial examples.

Step. 1. Initialize the value of mL, dL, bL and bRP by collecting the data where mL = my location, dL = destination location, bL = bus location, bRP = bus route point

Remark 1. My location is collected from the user which is also the location from where user want to travel. Destination location is selected through voice command. Bus current location is collects from the subsystem on the bus. The bus route point is the route of the bus, which is stored in the database.

Step. 2. If mL_bL < 1000 meters, then add those buses in a list

Remark 2. Here mL_bL is the distance of my location to bus location. If my location to bus location is less than 1000 meters, then add all of those buses in a list.

Step. 3.
Match 2 Point. If mL == bRP AND dL== bRP

Remark 3. Every bus route is learned and stored in the database. Here if mL and dL match with bRP of the same bus from the learned database, then keep them in the list either delete from the list.

Step. 4. If (distance(mL_bL) < distance(dL_bL)) then add those buses in the table

Remark 4. If the distance of my location to bus location is less than the distance of destination location to bus location, then add those buses in a table either delete them from the table.

Fig. 3. This is the animated view of the *bus with ID.* This shows the *distance* (*mL_bL*) and *distance (dL_bL)*. In this figure only calculation showing for the **A-7** bus.

Table 1. Table of the selected bus after *Step 3* conditions with ID and other information.

Bus ID	distance (mL_bL)	distance (dL_bL)
A-7	700m	2000m
B-7	500m	1800m
C-7	500m	900m
D-7	700m	600m
E-7	800m	500m

In table. 1, it can be assumed that **A-7**, **B-7**, **C-7** meet the condition and **D-7**, **E-7** don't meet the condition. So **D-7** and **E-7** will be deleted from the list.

Step. 5. If pD(mL_bL) > cD(mL_bL) And pD(dL_bL) > cD(dL_bL) then update the table with proper bus and this will continue till mL to bL is less than 100meter.

Remark 5. In this step first calculate the distance of mL to bL then dL to bL and save them on a table. After a specific time system calculate the same distance and save them on another table. Now the previously created table is pD = past distance base table and next created table is cD = current distance base table which has different values than previous. If previous mL to bL distance is less than current mL to bL and previous dL to bL distance is less than current dL to bL. Then add those bus on the table either delete them. This loop is ongoing to detect the perfect bus. Because bus will move from one place to another so here need this calculation. Every time if "I" become the current table then "I-1" is the previous table.

Table 2. Previous location based table.

Bus ID	distance (mL_bL)	distance (dL_bL)
A-7	700m	2000m
B-7	500m	1800m
C-7	500m	900m

Table 3. Current location based table.

Bus ID	distance (mL_bL)	d (dL_bL)
A-7	800m	2200m
B-7	90m	1090m
C-7	200m	1100m

Remark 6. In table 2 and table 3 shows us the previous and current location based table. By applying the condition it can be assumed that only **B-7** is fulfill the condition. This condition checks again and again to filter the exact bus.

Step. 6. If mL_bL < 100 then notify to the user.

Remark 7. If the distance of mL to bL is less than 100 then the system now notify to the user about bus through speech message by using phone speaker.

5 Conclusion and Future Work

In this paper, here presented a voice controlled assistant for blind peoples to give them the facility to travel outside independently. The proposed system is totally controlled through voice command mean, take command through voice and give instruction as speech by using the phones speaker.

The facilities include current location, travel by walk and travel by bus with real time instruction through speech. For current location and travels by walk implementation help of Google API are taken, but for travel by bus our developed algorithm is used to detect the bus and used learned database where the bus route is saved according to ID of bus.

The future plan of this research is to make the application more efficient and accurate. Give blind peoples the suggestion to go into shorter route and make available this application in different language is also notable future plan of this research.

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