

## A WALKING AID FOR VISUALLY IMPAIRED PEOPLE BY VOICE GUIDANCE SYSTEM IN MOBILE AND FREE NAVIGATION

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**Abstract-** As our society farther expands, there has been many supports for second-class citizens such as disabled person. One of many supports that i.e urgent is the guarantee of mobility for blind people. There has been many efforts but even now, it is not easy for blind people to independently move. In this paper, we construct and materialize the navigation system for blind people in order to provide precise location information, using Android base Smart Phone. The navigation system uses TTS (Text-to-Speech) for blindness in order to provide a navigation service through voice. Also, it uses Google Map API to apply map information. The research also hypothesizes a smart walking stick that alerts visually-impaired people over obstacles, pit and water in front could help them in walking with less accident. This paper proposes the creation of smart white cane for increasing the independency of visually impaired people which is robust, low cost and user friendly.

**Keywords:** Visually impaired persons, A walking stick, Arduino, TTS, Ultrasonic sensor.

### 1. INTRODUCTION

As our society farther expands, there have been many supports for second-class citizens, disabled. One of many supports that is urgent is the guarantee of mobility for blind people. There has been many efforts but even now, it is not easy for blind people to independently move [1].

The objective of this project is to guide blind people with voice navigated GPS using an Android Phone. This app is an innovative and cost effective guide system for blind people.

In this paper, a research of a navigation system for blind people is written in order to provide more precise location information. To identify the position and orientation and location of the blind person any of those solutions rely on Global Positioning System (GPS) technology [2]. The application suggested in this paper uses TTS program and Google Maps APIs in order to provide navigation with voices. Obstacle detection unit works as a wireless system that is one Bluetooth module sends data from ultrasonic sensor to another Bluetooth module to activate the speaker by voice module and this programme run via Arduino IDE. This suggested system uses Smart Phone and ultrasonic sensor which is less tiring to use, and it is fairly cheap and provides an easier mobility.

Voice recognition technology is the process of identifying, understanding and converting voice signals into text or commands. This voice recognition technology consists of two different technologies such as speaker

recognition and speech recognition, which are both considered to be emerging areas of research. Speaker recognition is the process of identifying the exact user who is speaking. It involves two systems – speaker's voice identification and speaker verification. Speaker identification involves identification of the unique speaker's voice from a set of other voices. This is done by inputting a user's voice into the recognition system. This recognition system stores a set of all known user's voices. From the input voice, the system needs to identify who is the speaker from the available list of voices. Thus the speaker identification system works within a closed set of data. In speaker verification system, a user's given voice sample is verified to check whether the user is valid or not. This is done by comparing the user's new voice features with the stored voice features. This is carried out for the purpose of authenticating the user [3].

### 2. EXISTING SYSTEM:

Finding an ROUTE or branch near to us is possible through GIS. A geographic information system is a system designed to capture, store, manipulate, analyse, manage, and present all types of geographically referenced data. The locator to find the services you require-simply enter your postcode, town or city and click on 'Search' to see all ROUTES in your area. GIS is the merging of cartography, statistical analysis, and database technology. In a general sense, the term describes any information system that

integrates, stores, edits, analyses, shares, and displays geographic information for informing decision making.

To avoid obstacle on the way of routing, master mode Bluetooth module sends data to slave mode Bluetooth to activate the speaker for creating awareness by voice recorded module.

### **3. PROPOSED SYSTEM**

#### **3.1. ANDROID:**

Android is a software stack and mobile operating system that includes the operating system for portable devices, middleware, user interface, and a standard application, multimedia message service (MMS). Android developers were able to write applications in the Java language, a runtime library that can run the compiled byte code. In addition, it provides the required application through the Android Software Development Kit (SDK) to develop a variety of tools and APIs. Android works on the Linux kernel and the Android system uses C / C++ libraries, etc. are included. Android, unlike existing Java virtual machines, uses an Java application made of Dalvik Virtual machine that runs on a separate process. In 2005, Google acquired Android Inc. and in November, 2007, Google announced to freely open Android platform to the public. A construction of Android is shown in figure 1 as followed. In these construction components, it is divided into a total of 5 class of application, application framework, library, Android runtime, and Linux kernel. Handset layout platform is adaptive to expand 3D graphic library based on OpenGL ES1.0, VGA, and 2D graphic library, and it uses SQLite database software for a purpose of data storage [4].

#### **3.2. GPS (Global Positioning System):**

GPS is a radio navigation system using satellites and it is developed by USA Department of Defense for military use navigation but it can be used by citizens with a limited range. It predicts radio coverage from satellites to a receiver, then it shows the exact 3D location, speed and time. This system can be universally used for 24 hours, and many people can use it. This GPS system can be divided into 3 different segments; SS (Space Segment), CS (Control Segment), and US (User Segment). SS (Space Segment) represents the location of 24 satellites that rotate around the Earth every 12 hours. As of April, 2007, there is a total of 36 GPS satellites with 30 of them are active and 6 of them are preparatory satellites in case of malfunction. CS (Control Segment) represents a general observation post that manages and tracks GPS satellites. US (User Segment) represents GPS users and GPS receiver [4].

#### **3.3. LBS (Location-Based System):**

LBS service indicates a wireless contents service that provides certain information based on the location change of user. Developers of mobile handset have voluntarily tried to install LBS within their devices. However, LBS was originally developed by telecommunication companies and mobile contents providers. Main benefit of the system is the fact that the users don't have to directly insert location as they move. GPS positioning technology is one of important

technologies that allows easier excess of wireless internet service. However, in order to materialize LBS, there are more related technologies other than GPS and satellite based technologies. Within mobile communication network, there exists a management mechanism in order to manage a mobility of cell phone and there are many GPS LBS service based on the mechanism. Movements of LBS can be seen in three different parts; Positioning technology, lay-administered platform and location application [5].

1) Positioning Technology: Service provider can predict any location using GPS chip within wireless device. In this case, the positioning technology directly manages a calculation of location using received signal from satellite. Once the calculation is done, a variety of information can be received through mobile communication network. Depending on Mobile communication network or location information service, the system sometimes uses a single base station based information, rather than multiple base stations. Since mobile communication network, characteristically, constantly manages the mobility of cell phones, this positioning technology method can be a method of providing LBS without any additional position technology and any calculation from requests of location. The accuracy of location estimation is at the maximum when the location was estimated using GPS and the matching satellite based location prediction method. On the other hand, a base station method has the lowest accuracy of predicting location since it only allows predicting a certain part of region rather than a coordinate. LBL service can be materialized using other methods other than what are currently shown. Within current mobile communication network, there exists a variety of end terminals that have different method of predicting location. Therefore, normal mobile communication companies combines GPS, A-GPS and a base station based method to provide LBS [5].

2) Lay-administered Platform: A lay-administered platform is a general word for LBs service components that achieves and process user location from position technology and provides information to application through an interface with network. Within network models based on GSM, CDMA, GMLC (Gateway Mobile Location Center) has been defined as a facility that request a base station based routing information by interlocking with management system in the inner part of mobile communication service and functions as a gateway of interlocking with LBS application within IP network. These GMLC can be sorted out to be one of LBS platforms within mobile communication network [5].

3) Location application: This application represents a service that provides already processed contents based on locations of individual user or an object through communicating with lay-administered platform or that can manage collected location information [5].

## **4. MODULES**

### **4.1 Voice Information Storage:**

During the transactions, first transforms the user's voice information into digital signals and stores the digital signals in specialized voice database. Then the server will send new voice to a voice recognition system, where the voice will be

denoised and the voice features will be extracted. After the voice features extracted successfully, the features information will be automatically sent to the voice features database for subsequent voice recognition [6].

#### **4.2 Voice Recognition:**

Voice recognition mainly consists of following steps:

- Receiving the user voice signal
- Using normalization to denoise
- Extracting feature and
- Comparing the voice features.

#### **4.3 Reset Module:**

Maps and GPS receivers show latitude and longitude angles. Maps usually show bold lines marked in degrees (whole numbers) plus possibly intermediate lines marked 15, 30, 45 minutes or 10, 20, 30, 40, 50 minutes. GPS receivers typically show degrees plus minutes and decimal fractions of a minute. e.g. 45 : 23.1234 .You can normally alter the display options on a GPS using the setup menu. Latitude is used to express how far north or south you are, relative to the equator. If you are on the equator your latitude is zero. If you are near the north pole your latitude is nearly 90 degrees north. If you are near the south pole your latitude is almost 90 degrees south. Longitude shows your location in an east-west direction, relative to the Greenwich meridian. Places to the east of Greenwich have longitude angles up to 180 degrees east [6].

#### **4.4 Route navigation:**

Route navigation services help people get from one place to another. Navigation tracking, often with a map "picture" in the background, but showing where you have been, and allowing "routes" to be pre programmed, giving a line you can follow on the screen [7].

#### **4.5 Track user:**

A track is a trace of somewhere that you actually been. The GPS unit periodically send details of the location which are recorded by the software, either by taking a reading based on a set time interval, based on a set distance, based on a change in the direction by more than a certain angle, or a combination of these. Each point is stored together with its date and time. The resulting track can be displayed as a series of the recorded points or a line connecting them retracing your steps is a simple matter of following the track back to the source [8].

#### **4.6 Arduino:**

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. The project is based on a family of microcontroller board designs manufactured primarily by Smart Projects in Italy, and also by several other vendors, using various 8- bit Atmel AVR microcontrollers or 32-bit Atmel ARM processors. These systems provide sets of digital and analog I/O pins that can be interfaced to various extension boards

and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C and C++ programming languages[9].

#### **4.7 Ultrasonic sensors:**

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions [9].

#### **4.8 Bluetooth Module:**

These small size Bluetooth TTL transceiver modules are designed for serial communication (SPP - serial port profile). It allows your target device to both send and receive TTL data via Bluetooth technology without connecting a serial cable to your computer. The modules with the HC-03 and HC-05 firmware are the Master and Slave integrated Bluetooth serial modules with firmware which allows you to modify master and slave mode at any time [9].

#### **4.9 Speaker:**

Loudspeaker, mini, Mylar Cone, Power rating RMS 1W, Impedance 8ohm. Sound level distance 10cm, Sound Level SPL 94db. It has two connection. One is connected to the digital pin of Arduino and another is ground pin of Arduino [9].

## **5. SYSTEM ARCHITECTURE**

This research has two parts. One for Navigation System and Another for sensing Obstacle.

The application developed in this paper functions through voices. A voice recognition security authentication is done to authenticate the user. After a successful login. Smart Phone recognizes the voices, search for destination, routes, and provide the route to the user through voice. Figure-1 shows a architecture of proposed approach. The functions of the application developed in this paper are as followed.

The first function is to search destination through voice recognition and Google TTS service. After voice authentication, users say the wanted destination according to the instruction. In case of unclear voice, the message saying 'speak once more' will pop up and users say the destination once more clearly. If the application asks for confirmation of destination, the users say, 'yes', if the destination is correct. The second function is route research

using Google Map. After users have confirmed the destination, the application materializes the map after searching for route from the current location of the user to the destination.

The third function is to guide the users with voice. Using Smart Phone, it sees the route to the destination and it begins to guide by saying travel range, and direction for each section of the route.

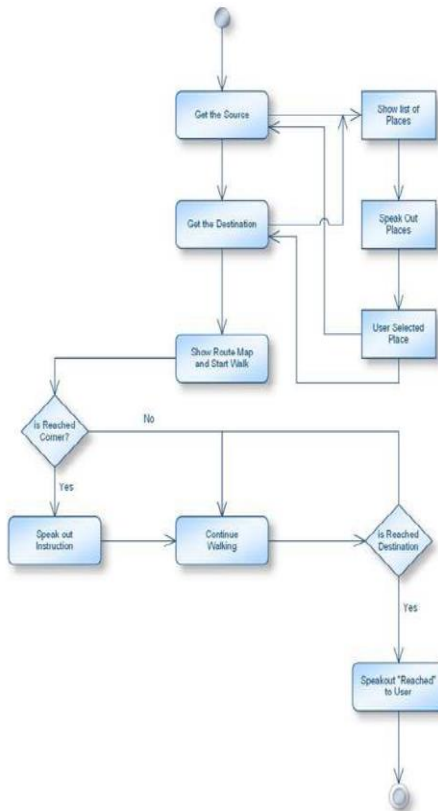


Fig.1: The hierarchy of Service [4]

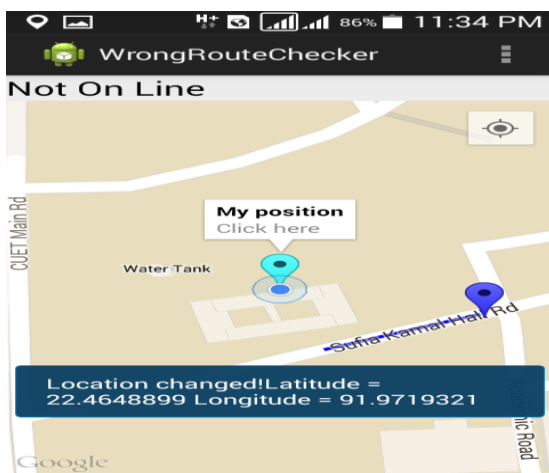


Fig.2: App for Navigation

Another application for avoiding obstacle by ultrasonic sensors in three sides within the angle of 90 degree. Three ultrasonic sensor is connected with HC-05 Bluetooth module which works as a master. When the distance between these three sensors are 20cm, HC-05 sends data to another HC-05 Bluetooth module which works as a slave. That Slave mode Bluetooth receives data and send to Arduino. Arduino makes voice module ISD1820 activate and that runs the speaker (shown in Figure-2).

## 6. RESULT

For the manufacturing of a white can Arduino, Google maps, Bluetooth, ultrasonic sensor are used. After construction of white can several data have been collected based on the location in the google map and sensing obstacle. Then the collected data have been analyzed to find the correction of this project (Table-1). Several data have been collected so that a reliable conclusion can be made on this project.

During the study of this project obstacle sensing data is calculated by measuring distance between without presence of obstacle and presence of obstacle.

Location position are measured by checking different longitude and latitude with google maps and checking the output of voice module.

Table 1: Calculation of Measuring Error with Ultrasonic Sensor.

No	Measure Distance (cm)	Sensor Detected Distance (cm)	Error (cm)
1	0	0	0
2	5	4	-1
3	10	9	-1
4	15	14	-1
5	20	20	0
6	25	24	-1
7	30	29	-1
8	35	33	-2
9	40	38	-2
10	45	43	-2
11	50	48	-2
12	55	54	-1
13	60	59	-1
Average Error			-1.154

## 7. CONCLUSION

In this paper, it designed a navigation system for blind people in order to provide precise location information. Suggested system, as an independent program, is fairly cheap and it is possible to install onto Smart phone held by blind people. This allows blind people to easy access the program. The developed service utilized Smart Phone in order to search route between the current locations of user to the destination and provide a voice-navigation. The test of the application functions were done by using Android 4.1.2. As the result, voice support on route was successfully proven to work without any troubles.

Further researches have to be continued in order to provide the users about the information on the obstacles using sensors connected to Android mobile. The navigation system uses TTS (Text-to-Speech) for blindness in order to provide a navigation service through voice. Also, it uses Google Map API to apply map information.

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