Gps Based Voice Navigation For Visually Impaired

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Abstract- *Navigation system for blind is a breakthrough technology in rehabilitative aids for the blind and visually impaired. It is designed to communicate physical location and object location using voice-based guide for users in order to have easy mobilization. This work provides the route for blind persons, by designing a cost-effective and more flexible navigation system. This allows them to move independently without any manual help or guidance. Many of the guidance systems which have been developed so far are either exorbitant or make use of Braille interface. The goal of this work is to allow the visually impaired persons navigate independently in the environment. The designed system uses GPS and voice recognition for guiding the visually impaired. The visually impaired person issues the input command and receives the output (direction response) using audio signals.*

Keywords- GPS, navigation system, voice recognition, PIC Microcontroller, Mel frequency cepstral coefficients

I. INTRODUCTION

Approximately there are about 38 millions of people around the world in developing countries who are blind and visually impaired, among them over 15 million are from India. Blind people who are unemployed is around two thirds of working-age visually impaired folks according to 2006 statistics. A March 2008 article in Forbes magazine cited discrimination as one of the biggest obstacles to employment for blind. This can affect the country's economic growth as well. Based on this real context or condition we focused the work on developing assistive technologies that may help blind individuals to contribute actively towards the development of the country. Blind person do not need pity, but require empathy, so as to mingle in the society and be independent for their routine chores (activity). Hence blind people require an assistive device that will allow blind user to navigate freely. Safe navigation is a critical aspect for blind people. In market, several navigation systems like guide dog, white cane and others are available. These systems guide them only in their regular places of visit. It is really challenging for the visually impaired people to navigate in an unfamiliar environment.

A number of systems to guide the blind for way finding around the world are designed and developed. MOBIC system is a prototype of a navigation system for the blind which consists of a Pre-journey System (MOPS) to assist users in planning journeys and the MOBIC Outdoor System (MOODS) to execute these plans by providing the users with orientation and navigation assistance during the journeys. DRISHTI is a wireless navigation system for pedestrians which combines different technologies including wearable computers, detection and analysis of voice, wireless network, geospatial information system (GIS) and global positioning system (GPS). NOPPA project is a personal navigation system that uses an information server as an interpreter between the user and internet information systems. CASBLIP project added images and maps of the surrounding environment to support navigation of people with visual impairment. SMART VISION project uses GPS for outdoor and WIFI for indoor navigation system with various modules such as GIS and database localization with radiofrequency identification (RFID) tags on the sidewalk. ARGUS project based on the global navigation satellite system and data coming from open street map and city network provides a virtual guidance rope for the blind and partially sighted persons or people working in environments with low visibility.

System for Wearable Audio Navigation which is abbreviated as SWAN, consists of a laptop, a tracking chip, GPS sensors, 4 cameras and headphones. The sensors and tracking chip send data to the laptop which is having the SWAN application which then calculates the location and the direction where the blind person is looking. A travel route is mapped and 3D audio cues are sent to the head phones to guide the person to the destination. The disadvantage of this system is that it needs many sensors, 4 cameras that makes the system complex and expensive. The Secure and Safe Mobility Network (SESAMONET) system make use of RFID micro chips which are embedded in the ground. This is used to guide the visually impaired through a predefined area. Each micro chip sends position signals through a walking stick to the smart phone. The drawback of this system is that it requires many RFID microchips and it is not possible to put so many chips for long distance. Hence the system is

expensive. Some of these systems uses audio interface which makes the navigation difficult for the blind in the crowded and noisy environments. The proposed system in this work use vibration to resolve the ambiguity. It also requires less complexity compared with other aid systems for the blind.

II. LITERATURE SURVEY

In the earlier days the assistive systems available for visually impaired included long cane, white cane, short cane, kiddie cane, guide cane, identification cane and support cane. None of these provided information about the obstacle until the user encountered them physically. [1] Alert and tracking system for Blind people was implemented Using ultrasonic sensors, GPS and GSM technology. This intended work was successful in providing low cost equipment for navigation but it involves too many modules to be integrated. [2] With the advent of voice recognition technology, Voice Based Guidance and Location Indication System for the Blind was developed using GSM, GPS and Optical Device Indicator. This method involves finding location of the user and obstacles in user's path. The main disadvantage is that they developed a new model that was too heavy to hold and inconvenient to carry around. [3]For providing obstacle avoidance an Outdoor Navigation system with Voice Recognition Security Application for Visually Impaired came into play. This application detects obstacles and guides the user through voice but the main disadvantage is that the application is initiated by comparing the user's voice with the sample user's voice collected at the beginning. The voice sample could not be matched against different tones of the user.

III. PROPOSED WORK

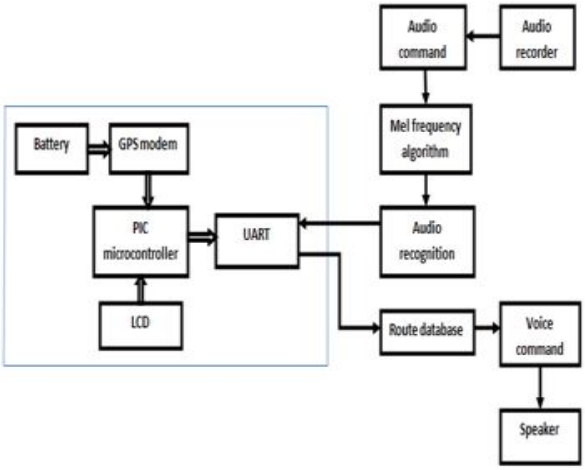

FIG 1. Overall Block Diagram Of The System

WORKING OF THE SYSTEM - The whole circuit is powered with regulated DC power supply as shown in block diagram. The GPS receiver used in this project is capable of receiving the signals from 65 GPS (Global Positioning System) satellites. These received signals (longitude, latitude, altitude and timing data) are transferred send to the microcontroller unit. These values are continuously processed in microcontroller.

Mel frequency algorithm recognizes the user spoken words and correspondingly sends those signals to microcontroller. Microcontroller compares that spoken place values (longitude, latitude and altitude) with signals from GPS receiver. Based on this comparison microcontroller unit drives the voice playback unit for providing voice navigation to the user. Predefined voices are stored in this module as navigating commands to the blind persons. The destination values for each voice of spoken command can be stored in the microcontroller for recognizing the destinations.

IV. HARDWARE DESCRIPTION

A) GPS RECEIVER

Global Positioning System (GPS) is a network of orbiting satellites used to locate positions anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. GPS can be used for these purposes: perfect timing, trilateration, positioning of satellites and error connection. This system can be used universally for 24 hours. GPS receiver is used to provide latitude, longitude, and altitude information. Reliable positioning, navigation, and timing services are provided by the GPS receivers to users all around the world continuously in all weather, day or night. The Global Positioning System (GPS) offers the capability to accurately determine location anywhere on earth in addition to speed, altitude, heading, and a host of other critical positioning data. The GPS receiver requires a successful lock onto at least four GPS satellites to gather an accurate signal for calculating position and velocity. The module triangulates its position with relation to three satellites, using a fourth satellite 2s a clock source.

B) RS232 STANDARDS

RS232 is a standard protocol is used for connecting computer and its peripheral devices to allow serial data exchange between them. As it obtains the voltage for the path used for the data exchange between the devices. It is used in the serial communication up to 50 feet with the rate of

1.492kbps. Low power consumption is needed for the small size and high-end GPS functionality.

Both the LVTTL-Level and RS232 signal interface are present on the interface connector and supply voltages. Universal Asynchronous Data Receiver & Transmitter (UART) is used in connection with RS232 for transferring the data's. The microcontrollers are not able to handle such kind of voltage levels, connectors are connected between the RS232 signals.

C) VOICE RECOGNITION

The words spoken by any human being cause vibrations in air, is known as sound waves. In sound waves, analog waves are digitized and processed and then decoded to appropriate words and sentences. This is the principle of voice recognition.

The pre-processed speech is stored in the memory for the purpose of speech recognition. The computer or the system consists of pre-defined speech patterns already stored in the memory, to be used as the reference for matching. The unknown speech signal is compared with the reference speech pattern to determine the actual pattern of words.

A speech analysis is done after the user speaks in a microphone and inputs are thus taken. These input audio signals are manipulated at the system level. Different operations are performed at different levels such as Pre-emphases, Framing, Windowing, Mel Cepstrum analysis and recognition of the spoken words. The speech recognition system consists of two phases. The first one is training session, in which the speaker has to

Provide samples of their speech to train the system. The second one is operation session or testing phases, in which the speaker has to give samples of the speech to match with the existing database and provide exact match.

D) PIC MICROCONTROLLER

The pic microcontroller PIC16f877a is one of the most renowned microcontrollers. The controller can be easily programmed and is also convenient to use. One of the main advantage is that it can write and erase as many times as possible because it uses FLASH memory technology. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data.

The pic microcontroller consists of 40pins in which 33pins for input and output. It consist of two 8bit and one 16bit timer. Capture and compare modules, serial ports, parallel ports, and 5 input/output ports are also present in it. In case of analog modes, the pins or the ports can only act as inputs. There is a built in A to D converter which is used in this case, but in digital mode there is no restriction. Ports can be configured as input/output.

'TRIS' is a register which controls the direction of the ports. For different ports there are different registers such as TRISA, TRISB etc.

- If a bit of the TRIS register is set to 0, the corresponding port bit will act as the digital output.
- If a bit of the TRIS register is set to 1, the corresponding port bit will act as the digital input.

E) MEMORY ORGANIZATION

The memory module in the architecture of pic microcontroller consist of RAM (Random Access Memory), ROM (Read Only Memory) and STACK.

- RAM- Store the data's temporally in its registers and classified into two types: Special Function Register (SFR) and General Purpose Register (GPR).
- EEPROM- Write the program for only once we cannot use the microcontroller again for multiple times.
- FLASH memory- Programmable Read Only Memory (PROM) in which we can write, read and erases the programs thousands of times.
- STACK- PIC Microcontroller has to execute the interrupt and the existing process address.

F) ROUTE DATABASE

Presents a map database system for route navigation. The system contains database describing roads, interest points (such as a bus stop, store, etc)... Given a set of candidate destination points and a set of candidate transit points, the system generates an index for shortest path query dynamically. Then, a computer system gets a starting point, and the system makes the shortest path that includes one of the candidate destination points and one of the candidate transit points and a set of candidate transit points, the system generates an index for shortest path query dynamically.

Then, a computer system gets a starting point, and the system makes the shortest path that includes one of the candidate destination points and one of the candidate transit points.

G) MFCC AS A VOICE RECOGNITION ALGORITHM

Mel frequency Cepstral coefficients algorithm is a technique which takes voice sample as inputs. After processing, it calculates coefficients (from fig.2) which are unique to a particular sample. In this project, simulation software called MATLAB R2013a is used to perform MFCC. The procedure for implementing MFCC is very simple thus making it the most preferred technique for voice recognition.

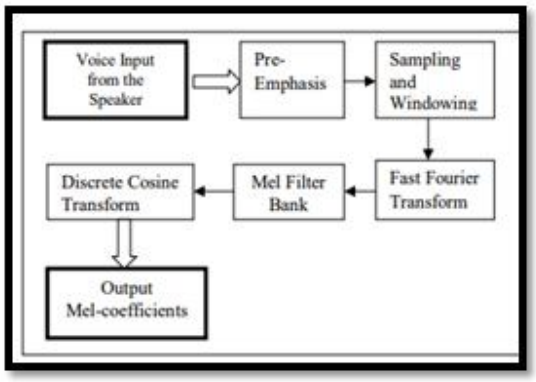

FIG2. Block Diagram For Obtaining MFC coefficients

The following are the major steps involved in the implementation of the MFCC algorithm:

- Recording and sampling
- Mel filter bank
- Mel frequency cepstral coefficients

H) SPEAKER UNIT

The speaker is used for guiding the visually impaired persons to navigating them based on the signals or recorded sounds from these units. Many speakers trying to give speech input at the same time cause overlapping of the signals and interruptions.

V. CONCLUSION

In earlier days majority of blind people didn't prefer electronic aids and used only canes or guide dogs. The underlying reasons for this include the relatively high costs and relatively poor levels of user satisfaction. So we tried to develop a low cost and user friendly system for blind people with greatest possible accuracy. This method offers innovative solutions in order to replace the conventional methods of guiding visually impaired person. Also, it can be easily applied anywhere where it can handle places like mall, airports etc. We guide or navigate the blind people using voice. The main disadvantage of this system is that a map has to be made and if any changes are made in the architecture then the entire map has to be changed. Also changes have to be made in the recorded voice directions. This can increase the cost of the system.

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