RESEARCH ARTICLE OPEN ACCESS

# Voice and GPS Based Navigation System For Visually Impaired

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***ABSTRACT***
The paper represents the architecture and implementation of a system that will help to navigate the visually impaired people. The system designed uses GPS and voice recognition along with obstacle avoidance for the purpose of guiding visually impaired. The visually impaired person issues the command and receives the direction response using audio signals. The latitude and longitude values are received continuously from the GPS receiver. The directions are given to the user with the help of audio signals. An obstacle detector is used to help the user to avoid obstacles by sending an audio message.GPS receivers use NMEA standard. With the advancement in voice recognition it becomes easier to issue commands regarding directions to the visually impaired.
***Keywords*** GPS, navigation system, visually impaired, voice recognition, ARM7 processor, NMEA protocol

## I. INTRODUCION

The result of survey done in India shows that India is the home of the largest number of blind people in the world. Out of the 37 million blind people all over the world more than 15 million people are in India. For assisting to avoid obstacles visually impaired people regularly use white canes or guide dogs. Guide dogs are of limited assistance for finding the way to a remote location, known as "way finding".

At present several devices are available for providing guidance to a remote location but these are either expensive or make use of Braille interface. Blind people can get information from the unwilling contact with objects, persons or animals, by exploring the environment and using their hands to understand the shape of an object, moreover, blind people can perceive other features of the objects as temperature, texture, weigh and though the tact has certain limits in confront of sight, it has a very important function to reveal to blind persons the world around them.

There are many systems which are designed to help navigate the visually impaired. SWAN (System for Wearable Audio Navigation) consists of a laptop, a tracking chip, GPS sensors, 4 cameras and headphones. The sensors and tracking chip send data to the laptop having the SWAN application which then computes 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 along a path to the destination. The disadvantage of this system is that it needs many sensors,4 cameras that makes the system complex and expensive. Another system called SESAMONET (Secure and Safe Mobility Network) uses 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 disadvantage 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.

The system explained here provides the details to the users regarding where at present he/she is located and spoken directions to travel to a remote destination. The visually impaired often lack the needed information for bypassing obstacles and hazards and have relatively little information about landmarks, heading, and self velocity. This puts them into considerable disadvantage compared to sighted individuals navigating through familiar environments who have knowledge of these environments or who are navigating through unfamiliar environments on the basis of external maps and verbal directions to make a navigation system use friendly and accessible to the greatest proportion of vision impaired people, usability is a key focus of the project, and speech technology was identified as a priority feature of the system. Further, by replacing the Braille keyboard with a speech technology, the device will be more portable and less cumbersome to use while walking. Speech technology has been under development for more than three decades.

## II. METHODOLOGY

**PROPOSED SYSTEM BLOCK DIAGRAM**

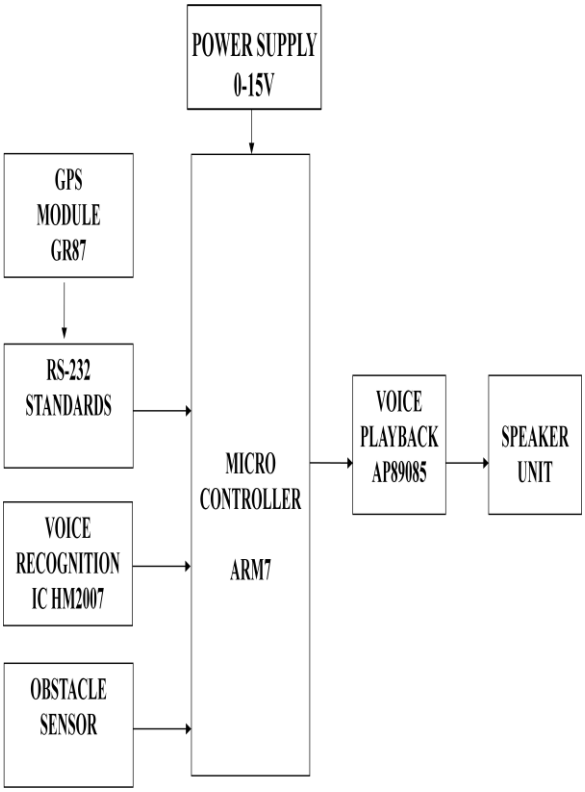


Fig: 2.1- Block Diagram of Proposed System

The block diagram of main board is shown in Fig.1. In this diagram the 32-bit ARM processor (LPC2148) is used, which is the heart of this project. The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.GPS receiver is used to get the current location in the form of longitude and latitude. The GPS used here is GR87.The output of GPS receiver is given to the processor using serial communication. In this system output is in the form of voice hence speaker/headphones are used.

## III. HARDWARE DESCRIPTION

### 1. MICROCONTROLLER

The Controller used will be ARM LPC2148 which is based on 32/16 bitARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. It has many important features like. 16/32-bit ARM7 microcontroller in a tiny package. It has on-chip static RAM and on-chip flash program memory. It offers real-time debugging and high speed tracing of instruction execution.

The features of LPC2148 are

- USB 2.0 Full Speed compliant Device Controller.
- 10 bit A/D converters.
- Multiple serial interfaces with two UARTs.
- Low cost, low consumption, easy handling and flexibility.

These features make the controller reliable for the project.

### 1. GPS RECEIVER

Global Positioning System (GPS) satellites broadcast signals from space which are used by GPS receivers, to provide three-dimensional location (latitude, longitude, and altitude) and precise time. 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, anywhere on or near the Earth.

The GPS receiver used in this project is GR87.Its main features are

- On chip 1Mb SRAM
- Low power consumption
- Multi path mitigation hardware
- Reacquisition time 0.1 seconds

**WORKING**

GPS GR87 is a highly integrated smart GPS module with GPS patch antenna that is ceramic. The antenna is connected to the module through the LNA. The module has 51 channel acquisition engine and 14 channel track engine, which is capable of receiving signals from up to 65 GPS satellites and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port. 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 a supply voltage of 3.6V~6.0V is supported. The smart GPS antenna module is available as an off-the-shelf component which is 100% tested. The smart GPS antenna module can be offered for OEM applications. Also, the antenna can be tuned to the final systems conditions.

### 3. VOICE RECOGNITION

A speech analysis is done after the user speaks in a microphone and inputs are thus taken. The manipulation of the input audio signal is done at the system level. Different operations are performed at different levels on the input signal such as Pre-emphasis, Framing, Windowing, Mel Cepstrum

analysis and Recognition (Matching) of the spoken word. The speech recognition system consists of two distinguished phases. The first one is training session, while, the second one is referred to as operation session or testing phase. During training phase, speaker has to provide samples of their speech to train the system. During recognition phase, speaker has to give samples of his speech to match with existing database and provides exact match. The voice recognition IC used here is IC HM2007.

**IC HM2007**

It is a single chip CMOS voice recognition LSI circuit with on-chip analog front end, voice analysis, voice recognition process and sound control functions. An intelligent recognition system can be built using a 40 isolated –word voice recognition system is composed of external microphone, keyboard, 64K SRAM and other components combined with the microprocessor.

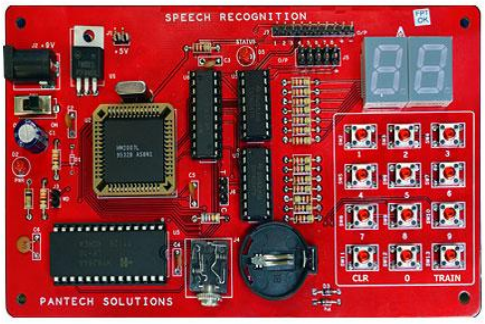


Fig: 3.1 – Speech Recognition Kit

**FEATURES**

- A CMOS LSL Single chip voice recognition.
- Recognition system is isolated-word speaker-dependent.
- An external 64K SRAM can be connected directly.
- A maximum of 40 words can be recognized for one chip.
- A maximum of 1.92 sec of word can be recognized.
- Multiple-chip configuration can be done
- Direct connectivity for a microphone is available
- Two control modes manual mode & CPU mode are supported
- Response time is less than 300ms
- 5V single power supply is needed
- 48-pin PDIP, 52 pin PLCC, 48 pad bare chip

**4. VOICE PLAYBACK**

AP89085 is high performance voice OTP which is fabricated with standard CMOS process with an embedded 2MB EPROM. It can store voice massages up to 85 sec with 4-bit ADPCM compression at 6 KHz sampling rate. 8-bit PCM is available as user selectable. There are three triggers modes: Simple Key trigger mode, Parallel CPU triggers mode and CPU serial command mode, which provide different user interface. User selectable triggering and output signal option provide maximum flexibility to various applications. The number of external components is minimized by using a built-in resistor controlled oscillator, 8-bit current mode D/A output and PWM direct speaker driving output. PC controlled programmer and developing software are available.

## IV. SOFTWARE USED

1. Embedded C
2. Keil IDE
3. Uc-Flash

## V. CONCLUSION

As we have discussed that India is now home to the world's largest number of blind people and India’s current population is over 1.22 billion. Earlier majority of visually impaired people prefer to not use electronic aids, and use only canes or guide dogs. The underlying reasons for this include the relatively high costs and relatively poor levels of user satisfaction associated with existing electronic systems. 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. In this project we have used ARM processor which contains more memory and its operating speed is high. We guide or navigate the blind people using voice.

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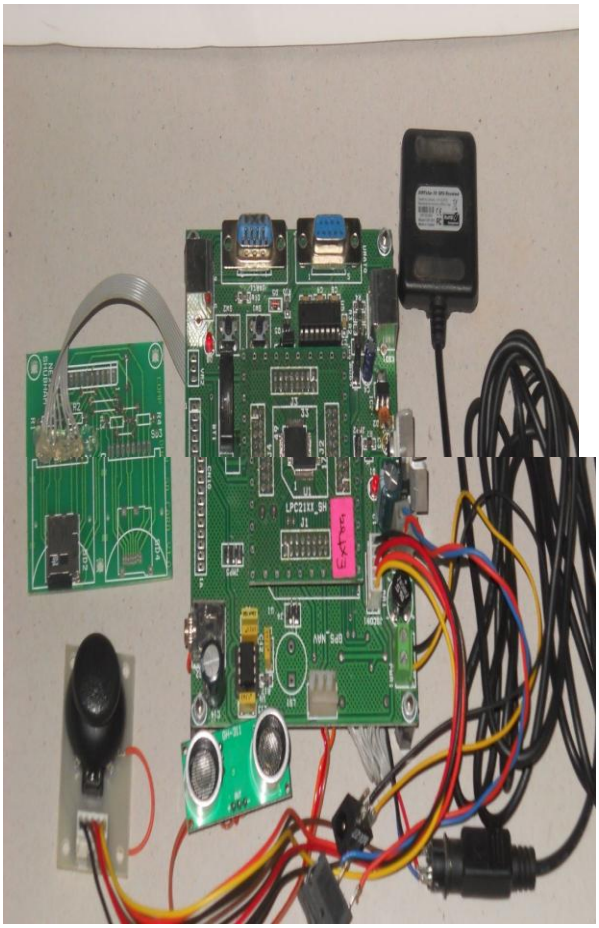

Fig: 5.1- Image of completed system

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