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Voice Based Navigation System for the Blind People

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ABSTRACT

This main aim of this project to provide voice-based navigation system for blind people using voice recognition module and it is intended to provide overall measures object detection and real time assistance via Global Positioning System (GPS) and ultrasonic sensors. This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the stick of the blind people. When the object is detected near to the blinds stick it alerts them with the help of vibratory circuit. The blind person will give the destination's name as the input to voice recognition module. GPS module continuously receives the latitude and longitude of the current location. GPS compares it with the destination's latitude and longitude. The blind person receives the pronounced directions which he needs to follow to reach his destination.

Keywords : Global Positioning System, Electronic Travelling Aid, Navigation System, Latitude and Longitude.

I. INTRODUCTION

Visual impairment can limit people's ability to perform everyday tasks and can affect their quality of life and ability to interact with the surrounding world. Blindness, the most severe form of visual impairment, can reduce people's ability to perform daily tasks, and move about unaided. Good quality rehabilitation allows people with different degrees of visual impairment to fully profit from life, achieve their goals and be active and productive in today's society. Ample efforts have been made to aid the blind by innovating and improving technologies. According to [23] "The emerging ethics of human centric GPS tracking and monitoring", the main factors focused while tracking a person are privacy, accuracy and accessibility.

By the introduction of a basic sensor, the provisions to the aid of blind people have remarkably increased. Many universities and companies like IBM have given a part of their focus to the development of aids for the blind people. Some of the popular ones are smart canes and obstacle sensors. Recent development includes self-driving cars and smart glasses. In the last 30 years, various other strides that have been developed are the text or speech softwares and smartphone apps. Moreover the systems that are being developed on robotics and artificial intelligence will be very advantageous to them as well.

One of the major factors in developing these technical aids is the compatibility with the user. He should not have trouble getting acquainted with the product. The features of the product should not be too difficult to use. Even the notification systems used to alert the blind should be comfortable and

reliable. Another major factor is the cost of such products. Since they are already paying for treatments or other nursing cares, the price of the product should be in the range that is reasonable. Other feature of these products should be the durability. The users might not be able to charge the system. So, appropriate measure should be taken for it.

To aid visually impaired and to provide a compact and complete solution, a smart stick can be developed which will include a GPS system, obstacle detection mechanism and an audio module, so that the stick can instruct the directions to the user. The obstacle detection mechanism is combined with navigation and location detection using GPS-GSM and an audio module with Bluetooth transceiver to provide a better solution than the already existing solutions.

The technologies we plan to use are sonar technology, GPS navigation, GSM network, voice recognition and notification. Sonar technology is used for obstacle detection. The principle of the system works in the way that the detector sends and receives a signal. Upon the reception of the signal, the distance is calculated using the time it took for the signal to reflect back. It is a simple procedure which works with the properties of electromagnetic waves. This is mainly used to find distances in various fields.

Obstacle detection is done by ultrasonic sensors attached to the stick. The sensors are selected to satisfy their criteria of sensor angle, distance and other parameters. When the sensors come across some obstacle, it sets off a voice announcement from the set of announcements already recorded, according to their semantics and alerts the person about the obstacle in the path. In order to reduce the noise and sound dissipation, an earpiece is attached to give the audio announcements. The GPS system is used to detect the current location and helps the user to reach the destination by announcing the current location name whenever required by the user and also in case of an emergency, the location of the blind person can be sent to a relative or friend via SMS.

II. METHODOLOGY

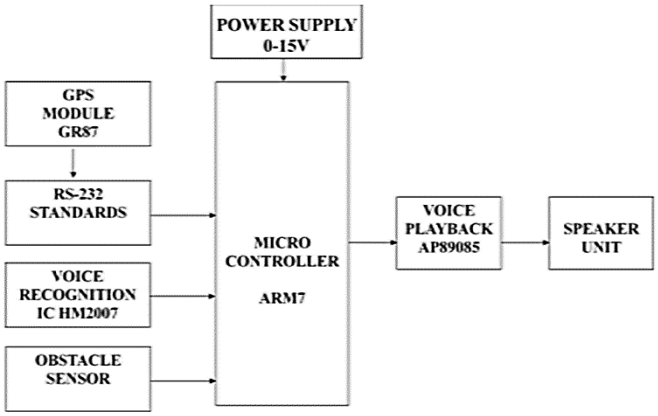

Figure 1 : Block Diagram

The block diagram of main board is shown in Figure1. 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 reduce 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.

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.

III. HARDWARE DESCRIPTION

3.1 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.

3.2 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

3.3 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.

IV. CONCLUSION

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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