International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 3 421 - 425

Secure Navigation System for Visually Impaired

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***Abstract*—**a cane is commonly used to help blind people navigate on a path. A stick is used to inform them about any pits, obstacles or elevation. This paper presents a secure system which detects any obstacles using an Ultrasonic sensor. GPS-GSM module is used that gives us the location of the person and sends a message alert on the phone of their families on regular intervals. Also, obstacle detection warning is given through a voice command using speaker or headphones. This system is designed to help visually impaired navigate a path safely and without much difficulties. In the present ongoing systems the security and safety of the visually impaired person is not adequately taken care of. So we will be preparing an Electronic Travelling Aid (ETA) with ultrasonic sensor and GPS for increasing the security and safety of the visually impaired person. This system will be more efficient and cost effective as compared to its former systems.

Keywords-*ARM7, Global Positioning System (GPS), Global System for Mobile Communication (GSM), Short message service (SMS), Ultrasonic sensor.*

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I. INTRODUCTION

According to the World Health Organization, approximately 0.4% of the inhabitants are blind in developed countries while the percentage is rising to 1% in developing countries. The simplest and most widely used travelling aid used by all blinds is the white stick. It has provided those people with a better way to reach destination and sense obstacles on ground, but it cannot give them a high guarantee to protect themselves and being away from all level of obstacles. With the recent advances in assistive technology, it is possible to extend the support provided to blind people taking into consideration the concept of the white cane.

Wearable devices are allowing hands-free interaction, or at least minimizing the use of hands when using the device, while portable assistive devices required a constant hand interaction. Despite efforts and the great variety of wearable assistive devices available, user acceptance is quite low and the white cane will continue to be the most assistive devices for the blind. On the other hand, to enhance the means that assist blind persons to navigate quickly and safely in an unfamiliar environment, various projects were introduced using different technologies like GPS, RFID, Ultrasonic, Laser and GSM. Ultrasonic technology is used in the same principle as laser technique; it used different tones to indicate the distance of the object. Each tone signifies a particular distance from the obstruction. GPS system is used by blind persons to determine and verify the correct route. We aim to develop a low-cost intelligent system capable of assisting the blind and visually impaired without taking the help of sighted person. The system is a GSM-GPS based so that it takes the advantages of the GSM network such as the popularity and cost-effectiveness. Additionally, GSM-GPS module have been used in different areas of human activity, such as the navigation of vehicles and navigation aids to guide visually impaired pedestrian and let them to avoid obstacles and reach their destination.

The reminder of this paper is organized as follows. Section 2 comprises Literature Survey. Section 3 consists of system description and explains function of each part of the system. Section 4 states applications and future scope. Section 5 gives us the result of the system. Section 6 and 7 comprises acknowledgement and conclusion of the system.

II. LITERATURE SURVEY

Abdel Ilah Nour Alshbatat [1] designed system for *Automated Mobility and Orientation System for Blind or Partially Sighted People.*The framework is connected with a GSM-GPS module to stick point the area of the visually impaired individual and to set up a two way correspondence way in a remote manner.

G.Gayathri *el.at.* [2] designed system for *Smart Walking Stick for Visually Impaired.* The study guesses a savvy strolling stick that alarms outwardly hindered individuals over deterrents, pit and water in front could help them in strolling with less mishap.

Kher Chaitrali S. *el.at.* [3] proposed *An Intelligent Walking Stick for the Blind.* In this paper, they proposed a route gadget for the outwardly weakened which is centred around giving voice yield to impediment avoidance and route utilizing infrared sensors, RFID innovation, and android gadgets.

Naseer Muhammad *el.at.* [4] explains about *Design of Intelligent Stick Based on Microcontroller with GPS Using Speech IC.* This paper proposes another thought adding to an astute stick outfitted with GPS route framework, which recognize the hindrances in way and gives data about their area utilizing GPS facilitates.

M. Naveen Kumar *el.at.* [5] is designed for *Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator.* This framework is

planned to give general measures –object recognition and ongoing help by means of Global Positioning System (GPS). Satyajit Pokale *el.at.* [6] has designed the *Multipurpose Gadget for Blind Person using GPS, Obstacle Detection, GSM Modem and ARM7.* This framework is a gadget that measures and declares temperature, recognizes impediment and cautions client by declaration, peruses position and report it, peruses time and declare.

The above mentioned researches have been done in the field to help the visually impaired persons. But the security and safety of the visually impaired person is not adequate in the above systems. So we will be preparing an Electronic Travelling Aid (ETA) with ultrasonic sensor and GPS for increasing the security and safety of the visually impaired person. This system will be more efficient and cost effective as compared to its former systems.

III. SYSTEM DESCRIPTION

In the following subsections, we will describe the system architecture, hardware components and software architecture.

A. System Architecture

Above fig show the block diagram of secure navigation system for visually impaired person. It consist of various block the main block of this system is ARM-7 (LPC2148) this block is heart of this system though which controlling and monitoring of system is carried out. Various different blocks are connected to ARM-7 which is as follows:-

a. Global Positioning System (GPS)

b. Global System for Mobile (GSM)

c. Ultrasonic sensor

d. Speech IC

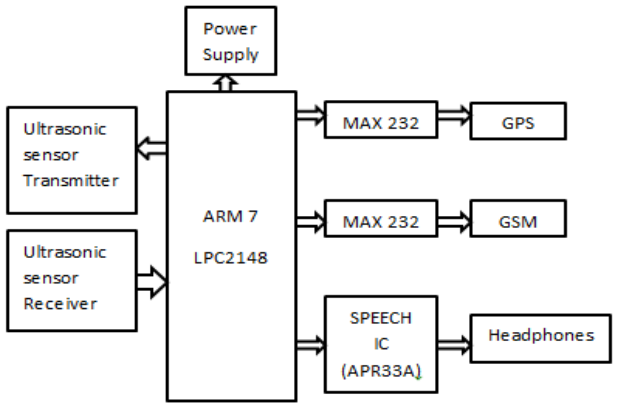


Figure 1 Block Diagram of the system

B. Hardware Components

1. Arm 7 (LPC2148):

The LPC2141/42/44/46/48 microcontrollers with real-time emulation and embedded trace support are based on a 16-bit/32-bit ARM7TDMI-SCPU, that combine the 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.
Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

2. MAX232

RS232 (Recommended standard-232) is a standard interface approved by the Electronics Industries Association (EIA) for connecting serial devices. In other words, RS-232 is a long established standard that describes the physical interface and protocol for relatively low speed serial data communication between computers and related devices.

3. Ultrasonic Sensor

This sensor is used to detect the obstacle in front of the visually impaired person. This sensor module has a transmitter (Tx) and receiver (Rx) in the board. The transmitter part sends the ultrasound waves towards the obstacle and the receiver interprets the reflected wave from the obstacle.

Ultrasonic sensor is used for detecting obstacles. It works on the principle of Doppler Effect. It has two parts: transmitter and receiver. The transmitter transmits the ultrasonic signals which collides with the obstacles and reflects back to the receiver part. By this we can measure the distance of the obstacle.

Figure 2 Ultrasonic Sensor

4. Speech IC

This IC contains pre-recorded audio files which will be played according to the need. A maximum of 8 recorded audio files can be stored in the IC.

The aPR33A series are powerful audio processor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The aPR33A series are a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing and analog output functionality. The aPR33A series incorporates all the functionality required to perform demanding audio/voice applications. High quality audio/voice systems with lower bill-of-material costs can be implemented with the aPR33A series because of its integrated

analog data converters and full suite of quality-enhancing features such as sample-rate convertor.

The aPR33A series C2.0 is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch, It is suitable in simple interface or need to limit the length of single message, e.g. toys, leave messages system, answering machine etc. Meanwhile, this mode provides the power-management system. Users can let the chip enter power-down mode when unused. It can effectively reduce electric current consuming to 15uA and increase the using time in any projects powered by batteries.

5. GPS (Global Positioning System)

This module is interfaced to the microcontroller using RS-232 protocol. GPS is used in the system to track the coordinates of the visually impaired person. The GPS module will require +12v power supply for its operation.

GPS receivers use a group of satellites and ground stations to compute position and time almost anywhere on earth. Notice the moving point on the globe and the number of visible satellites. At any point of time, there are at least 24 active satellites orbiting over 12,000 miles above earth.

The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary purpose of the 12 visible satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz). With this information and some math, a ground based receiver or GPS module can calculate its position and time.

6. GSM (Global System for Mobile):

This module will send the coordinates received from GPS to the prefed number of a relative of visually impaired person.

The GSM/GPRS Modem accompanies a serial interface through which the modem can be controlled utilizing AT commands. A radio wire and a force connector are given.

The diverse working of the modem is as said beneath:

- Voice calls
- SMS
- GSM Data calls

Voice calls: Voice calls are not an application region to be focused on. In future if interfaces like a receiver and speaker are accommodated a few applications then this can be considered.

SMS: SMS is a region where the modem can be utilized to give highlights like:

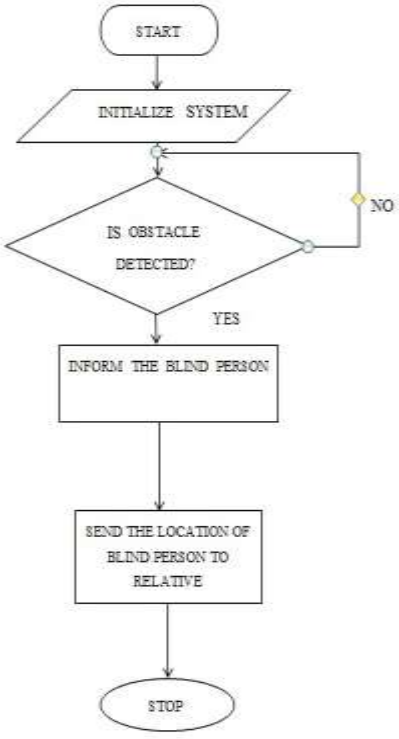
- Pre-stored SMS transmission.
- These SMS can be transmitted on certain trigger events in a mechanization framework.
- SMS can likewise be utilized as a part of territories where little content data must be sent. The transmitter can be a mechanization framework or machines like vending machines, gathering machines or applications like situating frameworks where the pilot continues sending SMS at specific time interims.
- SMS can be an answer where GSM information calls or GPRS administrations are not accessible.

C. Software Overview

i. Algorithm

1. Start
2. Initialize system
3. Detect the obstacle
   - If obstacle detected then inform the visually impaired person (including the distance of the obstacle).
   - If not detected then continue the process.
4. Send the coordinates of the visually impaired person to the relative of the person.
5. Stop

ii. Flowchart



IV. APPLICATION

Application:

- Used for visually impaired peoples.
- Used for aged persons.
- Can be installed in vehicles also.

V. RESULT

Table 1. Table of Evaluated conditions of the System

Sr. No.	Distance (in cm)	System output
1.	150-200	Recorded audio of track1 played on speaker
2.	100-150	Recorded audio of track2 played on speaker
3.	50-100	Recorded audio of track3 played on speaker
4.	<50	Recorded audio of track4 played on speaker and location of the person sent through SMS

When distance between obstacle and system will be in between 50 to 200 cm, track1, track2, and track3 will be played on the speaker accordingly. And when distance will be less than 50cm GPS location will be send to the concerned person and track4 will be played on the speaker.

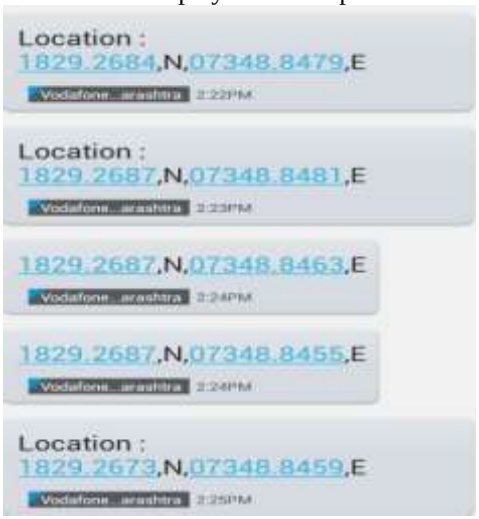


Figure 3 Location obtained through SMS

CONCLUSION

The multipurpose gadget has the potential to assist the blind person on a daily basis. This device will resolve many problems for a visually impaired person and make their path easy.

With the proposed system, the blind people will able to move from one place to another without others help.It will act as a basic platform for the generation of more such devices for the visually impaired in the future which will be cost effective. as far as the localization is concerned, with help from the GPS it will be able to provide accurate details of the location of the blind person if in case they get lost. It will be real boon for the blind. The developed system gave good results in detecting obstacles placed at distance in front of the user. The solution developed will be a moderate budget navigational aid for the visually impaired.

FUTURE SCOPE

- By using a camera and the concept of image processing we can build a virtual image of the obstacles.
- Artificial Intelligence can be used in this system for developing the desire path on its own.
- By using external memory (EEPROM), database of previously visited places can be stored.
- For an indoor environment, wall detection function can be added to help the blind walk straight along a corridor.

ACKNOWLEDGMENT

We have great pleasure in presenting the paper on “Secure Navigation System for Visually Impaired” under the guidance of Prof. S.S.Lavhate, H.O.D. of Electronics Department and the entire staff for their valuable guidance and encouragement. We would like to express our gratefulness to Dr.R.S.Jahagirdar, Principal of Pravara Rural Engineering College.

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