Location Finding for Blind People Using Voice Navigation Stick

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Abstract— **Navigation device for the blind people focus on travelling from one location to another. They are avail with navigation stick which provides obstacle detection. The other novel features of the navigation stick are staircase detection and nonformal distance scaling scheme. It also provides information about the floor status. It consists of low power embedded system with ultrasonic sensor and safety indicators. While in navigation mode the stick reaches the destination by avoiding obstacles using ultrasonic and infrared sensor inputs.**

This dissertation proposes a new navigation stick that constructs the logical map of the surrounding environment, to deduce the priority information to the subject by using audio or voice feedback. The working of the system incorporates three stages, first the location based audio recording stage, second the navigation of the blind person using signal from the GPS receiver and third sending of the location of the blind person to his or her relative GSM mobile number. The user can choose the location from the set of destinations stored of the memory and will lead in the correct direction of the stick. GPS technology is integrated with pre-programmed location to determine the optimal route to be taken. This voice navigation stick will be proved has a boon for blind peoples. It is based on the use of new technology to improve visually impaired persons mobility.

Index Terms— **RFID, GPS, GSM, Ultra Sonic Sensor, IR Sensor, Accelerometer**

I. INTRODUCTION

Blindness or visual impairment is a condition that affects many people around the world. This condition leads to the loss of the valuable sense of vision. Worldwide more than 160 million people are visually impaired with 37 million to be blind. The need to for assistive devices was and will be continuous. There is a wide range of navigation systems and tools existing for visually impaired individuals. The blind person truly requirements and identifying objects.

A. Background

There are 285 million people worldwide that have some level of visual impairment.

The blind navigation system catering needs of the blind people who are not able to move from one place to other place without the help of others. Recent survey source India is now become the world's large number of blind people. There are

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37 Million blind people across the globe, over them 15 million people are from India. The usage of the blind navigation system is very less and not efficiently used for Indian environment. The blind traveller should depend on any other guide like blind cane, people information, trained dogs, etc. Visual function can be classified by four tiers: normal vision, moderate visual impairment, severe impairment, and complete blindness. Legally blind refers to a person who has less than 20/200 vision in either eye, or a limited field of vision. Many virtually impaired people use walking sticks and guide dogs to move from place to place. For this group of population; the goal is often to complete tasks in the least obstructive method. A guide dog is trained to guide its users to avoid the accidents from objects and barriers. When a visually impaired person is using a walking stick, they waving their walking stick and finds the obstacle by striking obstacles ahead of them.

B. Motivation

God gifted sense to human being which is an important aspect in our life is vision. We are able to see the beauty of nature, things which happen in day-to-day life with the help of our eyes. But there are some people who lack this ability of visualizing these things. They face many difficulties to move on with their daily life. The problem gets worse when they move to an unfamiliar location. Visually impaired people face many challenges when moving in unfamiliar public places. Hence a system has to be found to minimize the difficulties of virtually impaired people to reach their destination. Studies indicate that there are approximately 10 to 11 million blind and visually impaired people in North America, and this number is growing at an alarming rate. As many of these people have difficulty knowing where they are or where they are going, frequently feeling totally disorientated or even isolated, supplemental navigational guidance is very important for them. Navigation involves updating one's position and orientation while he or she is travelling an intended route, and in the event the person becomes lost, reorienting and re-establishing a route to the destination.

C. Objective

The paper main objective is to provide a talkative assistance to blind people. We are going to develop a intelligent system that works efficiently good in both indoor and outdoor. Current navigation device for the visually impaired focus on travelling from one location to another. This focuses on designing a device for visually impaired people that help them to travelling independently also it must be comfortable to use. The proposed device is used for guiding individuals who are blind or partially sighted. The device is used to help blind people to move with the same ease and confidence as a sighted people. The device is linked with a GPS to identify the

location of the blind person. Moreover,

it provides the voice alert to avoid obstacles based on ultrasonic sensors. An emergency button is also added to the system. A RFID can be installed into public building and it is also integrated into blind persons walking stick .The whole device is designed to be small and is used in conjunction with the white cane.
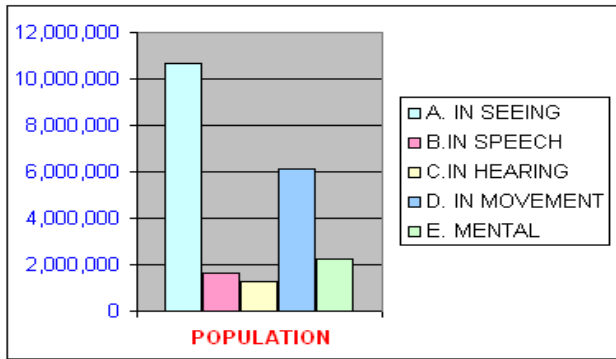

Fig 1: Statistical analysis

II. LITERATURE SURVEY

There are several methods and devices used to guide visually impaired persons. Several research works are being performed by many institutions throughout the world to offer the best navigational robot in terms of cost effectiveness. This section gives a brief review on various navigational aids for blind individuals.

A. Literature Survey

Blind and visually impaired people are at a disadvantage when they travel because they do not receive enough information about their location and orientation with respect to traffic and obstacles on the way and things that can easily be seen by people without visual disabilities. The conventional ways of guide dog and long cane only help to avoid obstacles, not to know what they are. Navigation systems usually consist of three parts to help people travel with a greater degree of psychological comfort and independence. Sensing the immediate environment for obstacles and hazards, providing information about location and orientation during travel. Today in the market different technologies like GPS, GPRS, etc are used to navigate visually impaired people. The studies of various published international papers have been done. Before more technologically advanced solutions to mobility aids are discussed it is useful to outline basic properties of the traditionally used primary aids and explain their main properties and limitations.

1) White can: The most popular mobility hand held aid. It is usually foldable and adjustable to the height of the user. A blind person using swing-like movements, "scan" the path in front in approx. 1 m distance (near -space protection).The cane requires about 100 hours of training for skilful use, e.g. detecting drop-offs, walking up and down the stairs.
Advantages: cheap, light-weight constructions available, effectively informs of shorelines, landmarks and obstacles at ground-level, notifies others about visual disability of its user.

Disadvantages: does not protect from obstacles at torso and face level

2) Guidance of dog: A specially trained dog assisting the blind in obstacle avoidance, but usually not aiding in way finding (unless travelling a familiar path), e.g. the dog is trained to stop before obstacles, reacts to commands on walking directions. In spite of their great usefulness, guide dogs are a rarely used aid - only about 1% of the visually impaired use it. Most guide dog owners do not simultaneously use the dog and the white cane.
Advantages: good in following familiar paths, good overall obstacle avoidance, trained for selective disobedience when sensing danger to his owner.
Disadvantages: very costly (training cost approx. $40k in the USA), guide dog service period is on average 6 years, regular dog up-keeping costs and lifestyle changes.

3) HUMAN GUIDE: A blind person walks hand in hand with a sighted guide.
Advantages/disadvantages: The most obvious, but in practice not a permanent solution for aiding the blind in mobility and navigation. A blind person lacks privacy and can have a feeling of being a burden to his or her guide.

III. BLOCK DIAGRAM
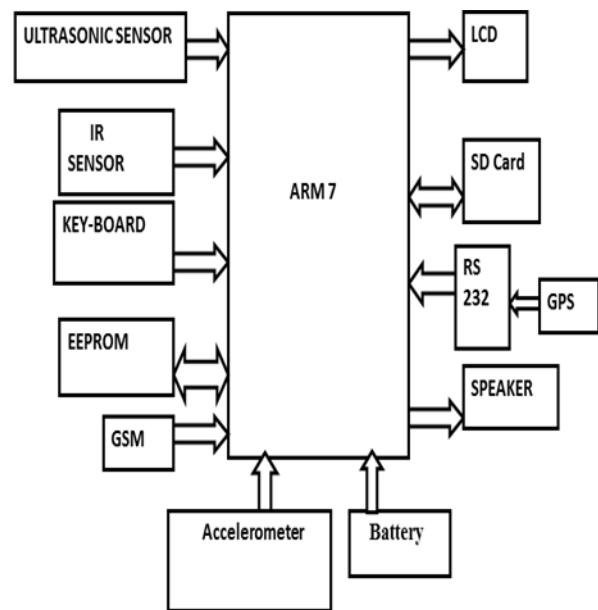
IV. SYSTEM DESCRIPTION

The Fig 2 shows the block diagram of the walking stick unit that is present in the walking stick of the blind people. In this paper, the main objective is GPS and GSM section, obstacle unit (IR SENSOR AND ULTRASONIC SENSOR). The blind person will reach his destination place using voice recognition. He will speak his starting and destination place. All this detail will be displayed on LCD. When he wishes to go to any new location he will enter the position using keyboard. His location will be trace using GPS. The co-ordinates given by GPS are stored in EEPROM. And it is given to micro-controller. It will match the co-ordinates and then it will display on LCD and announcement will be done on

speaker. Accelerometer is fitted on the stick, thus blind person turn to any direction such as left, right, forward and backward. So he will come to know the location of that place he is facing too. RFID will be placed at every corner. So as to know the position of the blind person standing. Ultrasonic sensor and IR sensor is used to detect the obstacle. Obstacle such as vehicles, any person etc. As soon as obstacle is detected the blind person is warned with the help of speaker. Thus avoiding any kind of mishap.

V. SYSTEM ANALYSIS

A. .arm 7

This generation introduced the Thumb 16-bit instruction set providing improved code density compared to previous designs. The most widely used ARM7 designs implement the ARMv4T architecture, but some implement ARMv3 or ARMv5TEJ. All these designs use a Von Neumann architecture, thus the few versions comprising a cache do not separate data and instruction caches. Some ARM7 cores are obsolete. One historically significant model, the ARM7DI is notable for having introduced JTAG based on-chip debugging; the preceding ARM6 cores did not support it. The "D" represented a JTAG TAP for debugging; the "I" denoted an Icebreaker debug module supporting hardware breakpoints and watch points, and letting the system be stalled for debugging. Subsequent cores included and enhanced this support. It is a versatile processor designed for mobile devices and other low power electronics. This processor architecture is capable of up to 130 MIPS on a typical 0.13 μm process. The ARM7TDMI processor core implements ARM architecture v4T. The processor supports both 32-bit and 16-bit instructions via the ARM and Thumb instruction sets. The ARM7TDMI (ARM7+Thumb tag Debug fast Multiplier enhanced ICE) processor is a 32-bit RISC CPU designed by ARM, and licensed for manufacture by an array of semiconductor companies. In 2009 it remains one of the most widely used ARM cores, and is found in numerous deeply embedded system designs. The ARM7TDMI-S variant is the synthesizable core.

B. LCD

LCD is used in a project to visualize the output of the application. We have used 16x2 LCD which indicates 16 columns and 2 rows. So, we can write 16 characters in each line. So, total 32 characters we can display on 16x2 LCD. LCD can also used in a project to check the output of different modules interfaced with the microcontroller. Thus LCD plays a vital role in a project to see the output and to debug the system module wise in case of system failure in order to rectify the problem.

C. KEYPAD

        Keypad is basically used to provide the input to the microcontroller. The keypad consists of micro switches which are connected to the microcontroller pins in a matrix format. Each key is assigned with the special character or symbol or digit. When user press the key the respective assigned ASCII value of that key is provided to the microcontroller via software. The keypad is also standard 4x4 which has 8 pin connector. The 4x4 keypad has the layout like the table shown

below. BK is backspace while entering the password. EN is enter and is used do enable/disable menu item or enable the system

1	2	3	^
4	5	6	˅
7	8	9	BK
	0		EN

Keyboards are the most widely used input device of the 8051, and the basic understanding of them is essential. At the lowest level, keyboards are arranged in matrix form of rows and columns. The CPU accesses both rows and columns through ports: therefore, with two 8-bit ports, an 8 X 8 matrix of keys can be connected to microcontroller. When a key is pressed, a row and a column make a contact: otherwise, there is no connection between them.

D. SCANNING AND IDENTIFYING THE KEYS

The rows are connected to an output port and the columns are connected to an input port. If no key has been pressed, reading the input port will yield 1s for all columns since they are all connected to high (VCC). If all the rows are grounded and a key is pressed, one of the columns will have 0 since the key pressed provides a path to ground. It is the function of the microcontroller to scan the keyboard continuously detects and identifies the key pressed.

To detect pressed key, the microcontroller grounds all rows by providing 0 to the output latch, then it reads the column. If the data read from the columns D3 to D0 =1111, no key has been pressed and the process continues until a key press is detected. However, if one of the column bits has a 0, this means that a key press has occurred. For e.g. If D3 to D0 = 1101, this means that a key in the D1 column has been pressed. After a key press is detected, the microcontroller will go through a process of identifying the key, starting with the top row, the microcontroller grounds it by providing a low to D0 only: then it reads the columns. The data read is all 1s , no key in that row is activated and the process is moved to the next row. It grounds the next row, reads the columns, and checks for any 0. This process continues until row is identified. After the identification of the row in which the key has been pressed, the next task is to find out which column the pressed key belongs to.

E. GPS MODEM

The GPS smart receiver features the 16 channels .Ultra low power GPS architecture. This complete enabled GPS receiver provides high position, velocity and time accuracy performances as well as high sensitivity and tracking capabilities.
The ultra low power CMOS technology, the GPS receiver is ideal for many portable applications such as PDA, Tablet PC, smart phone etc.

Benefits-
1. Ultra low power consumption
2. Easy and fast to install
3. Superior urban canyon performance
4. Low cost with high performance

Fig 2: GPS Component

F. ANNOUNCEMENT SYSTEM

Announcement system is nothing but a speaker system which is connected at the output of the system for announcement purpose. As per the system application, according to the visual based guide, the respective saved audio file is played using a speaker system.

G. SD card

SD card is basically is used as an storage device which will required to store the required data. The system database can be used to store in SD card in the form of .wav file and can be accessed from that whenever it is required. SD card is interfaced with the system using a protocol called SPI protocol.

H. accelerometer

An accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic - caused by moving or vibrating the accelerometer. By measuring the amount of static acceleration due to gravity, you can find out the angle the device is tilted at with respect to the earth. By sensing the amount of dynamic acceleration, you can analyze the way the device is moving. Accelerometers use the piezoelectric effect - they contain microscopic crystal structures that get stressed by accelerative forces, which causes a voltage to be generated. Another way to do it is by sensing changes in capacitance. If you have two microstructures next to each other, they have a certain capacitance between them. If an accelerative force moves one of the structures, then the capacitance will change. Add some circuitry to convert from capacitance to voltage, and you will get an accelerometer. The three axis accelerometer are basically used to identify the movements across the three axis i.e. x-axis, y-axis, z-axis. Accelerometer is an electronic

device which is interfaced using I2C protocol and provides the reading after every 1msec. According to the requirement of the application, the microcontroller will take the reading from the accelerometer within a fixed interval of time and do the necessary operation according to the requirement of the application.

I. GSM MODEM

GSM (Global System for Mobile communication) is a digital mobile telephony system. With the help of GSM module interfaced, we can send short text messages to the required authorities as per the application. GSM module is provided by SIM uses the mobile service provider and send SMS to the respective authorities as per programmed. This technology enables the system a wireless system with no specified range limits. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

J. RFID reader

RFID reader is interfaced with the microcontroller. RFID reader works on Weygand protocol and transmits the wireless signal at 125 kHz. RFID readers have two data line i.e. DATA0 and DATA1. Both the lines are active low and are connected at the external interrupt pins (INT0, INT1) of the microcontroller. Logic 1 is transmitted on DATA1 line and logic 0 is transmitted on DATA0 line.

Interfaced RFID reader continuously transmits the electromagnetic field across it. The range is max of 10cm. when the RFID tag/card comes within this range, the RFID card gets powered up and provide their 26 bit ID data to the RFID reader.

K. IR OBSTACLE SENSOR

Here we are connecting an IR based obstacle sensor. The 50 ohm resister is used for current limiting. The current through the LED is 5v / 50 ohm = 100 mump, which is high for an LED. But to increase the range of the obstacle sensor we are using a lower range resistor (50 ohm).On the receiver side we have connected the IR receiver in reverse bias. So as soon as the light falls in the IR receiver, the anode voltage increases and when the anode voltage is more than the cathode voltage then the LED is in forward bias mode and start conducting.

L. ultrasonic sensor

Ultrasonic sensors are basically used to measure the distances between the obstacle / object and the sensor. The ultrasonic sensor works on Doppler Effect. It consists of a ultrasonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So the total time taken by the signal to get transmitted and to received back will be used to calculate the distance between the ultrasonic sensor and the obstacle.
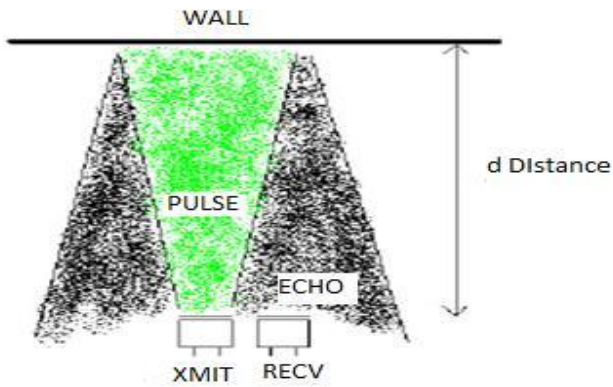
Fig 3: Working of Ultrasonic Sensor

VI. CONCLUSION

An attempt has been made to make a compact and portable device which is exclusively designed for visually impaired people. It will allow the visually impaired person to travel through an unfamiliar environment with ease. It can be said that the project provides Silicon Eye for visually impaired people. The design and architecture of a new concept of Smart Electronic Travel Aid Stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind persons worldwide. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure. This system is intended to provide overall measures object detection and real-time assistance via Global Positioning System (GPS).The system consist of ultrasonic sensor, sonar sensors, GPS Module, GSM Module and vibratory circuit (speakers or head phones). When the object is detected near to the blinds stick it alerts them with the help of vibratory circuit (speakers or head phones). The location of the blind is found using Global System for Mobile communications (GSM) and Global Position System.

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