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Design and Implementation of Ultra Sonic Path Finder for the Blind

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***Abstract*-Visually impaired and fully blind people find navigation difficult as they often lack much needed information for bypassing obstacles and hazards in their path. In order to help blind people navigate safely and quickly a navigation aid based on efficient PIC16F877A microcontroller with synthetic speech output has been considered. The suggested system can sense the surrounding environment via sonar sensors and sending vibro-tactile feedback to the user of the position of closest obstacle in the range. GSM module is incorporated in the system for the assistance of blind people in case of emergency help. The proposed system is able to collect the position of blind by using GPS module and give information to the blind about walking routes. This system is able to provide information about overhanging obstacles within 4m ahead of the user.**

Keywords-GPS, GSM, Microcontroller , MPLAB IDE

I. INTRODUCTION

Blindness is one of the most severe types of disabilities a person must endure and, despite numerous advancements in technology; it remains a serious problem to this day. Several research works are being performed by many institutions throughout the world to offer the best navigation system in terms of cost effectiveness. A person with little or no vision will face two lifelong challenges: accessing the world of information; and navigating through space. Of the two limitations, the loss of one's ability to independently move through the world is the more serious and has the greatest negative impact on human development.

The problem of information access is common to both sighted and blind persons; the problem of mobility is not. Independent mobility is a key component in maintaining the physical and psychosocial health of an individual. Further, for people with disabilities, independent mobility increases vocational and educational opportunities, reduces dependence on caregivers and family members, and promotes feelings of self-reliance. Psychologically, a decrease in mobility can lead to feelings of emotional loss, anxiety, depression, reduced self-esteem, social isolation, stress, and fear of abandonment.

To enable independent living, blind people want exact information about appropriate paths, dangers, distances and critical situations. Regardless of the tool used, the factor that most determines a person's mobility is the use of essential personal skills. The ability to determine one's current location is one of the most important, yet challenging, skill to acquire. These short comings drive the need for research on developing innovative navigational system for the blind people.

The blind and visually impaired users encounter serious health problems, especially if their visual impairment is a result of diabetes. In addition to blindness, diabetes has many health issues associated with it such as bone infections, nerve damage, and kidney failure. Such health related problems require them to frequently use hospitals and public health services.

Very few health care settings seem to pay attention to the access needs of blind people when designing the physical environment. Modern hospitals are increasingly large and complex organizations, in which little attention appears to be paid to way finding for blind people in these complex environments, and most would beimpossible to negotiate independently.

II.OVERVIEW OF THEPROPOSED SYSTEM

The proposed system is a self-contained portable electronic unit which can supply the blind person with assistance about walking routes by using spoken words to point out what decision to make. The two modes of operations of the system are recording mode and playback mode. To overcome the imperfections of existing electronic travel aids, the suggested method of finding the position of blind in recording mode is to use GPS. The obstacle detection system consists of ultrasonic sensors and vibrators have been considered in this aid. This system detects nearest obstacle via stereoscopic sonar system and sends back vibro-tactile feedback to inform the blind about its localization.

An ultrasonic cane [1] is considered to detect any obstacle which may be on the ground. The system has an environment recognition and clear path indicator functions.We should understand the needs and requirements of blind and visually impaired community before attempting to create a device for them.The block diagram [2] of the proposed system is shown in fig1:

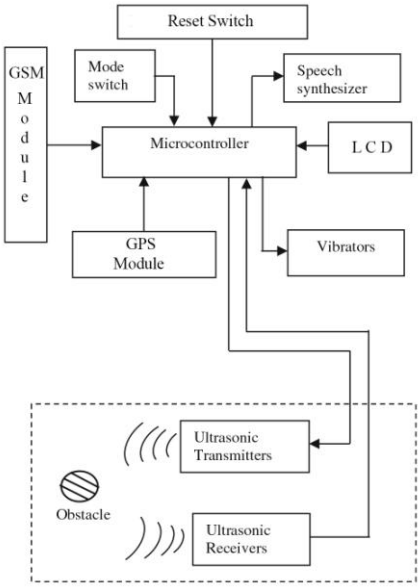

Fig 1 : Block Diagram

III. HARDWARE DESCRIPTION

The objective is to design and develop a prototype that can help blind people to travel with increased independence, safety, efficiency and confidence.To achieve this goal the designed system that should have the following functional components:

- PIC microcontroller
- A module for obstacle detection
- vibrators
- Keypad
- GPS
- GSM

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology. PICs are popular with both industrial developers and hobbyists alike due to their low cost,wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming capability.PIC architecture is RISC type.

The "ECHO" [3] Ultrasonic Distance Sensor from Rhydolabz provides very short (2CM) to long-range (4M) detection and ranging. The sensor provides precise, stable noncontact distance measurements from 2cm to 4 meters with very high accuracy. Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping.

Fig 2:ECHO-Ultrasonic Sensor

The board can easily be interfaced to microcontrollers where the triggering and measurement can be done using one I/O pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated.

The Global Positioning System (GPS)is a worldwide resource from which the user's exact location can be derived. Until now, adding GPS capability to a product has almost always required treating GPS as a standalone function. That is, adding a GPS module that provides the entire function from tracking the GPS satellites to computing the finished position, velocity, and time (PVT) solutions, which then are communicated to the host computer for use in the overall application.

GTPA006 is a high gain GPS Receiver (5V Serial) with 4-pins. Receiver is made with third generation POT (Patch Antenna On Top) GPS module. The built in 3V to 5V level convertor enable us to interface with normal 5V Microcontrollers. Its low pin count (4-Pin)

Fig 3 : GPS Module

will make it easy to interface and it is bread board friendly (2.54 mm connector). The 4 Pins are 5V, TX, RX, GND. When it is plugged in to the power (5V), the data is ready at TX pin. This is a standalone 5V GPS Module and requires no external components. It has internal RTC Back up battery. It can be directly connected to Microcontroller's USART.

The Global System for Mobile Communications (GSM) is the most popular standard for mobile phones in the world. GSM service is used by over 1.5 billion people across more than 210 countries and territories. The ubiquity of the GSM standard makes international roaming very common between mobile phone operators, enabling subscribers to use their phones in many parts of the world. GSM differs significantly from its predecessors in that both signalling

and speech channels are digital, which means that it is considered a second generation (2G) mobile phone system.

Fig 4 :GSM Module

GSM/GPRS Modem-TTL (5V) from rhydoLABZ is built with Tri-band GSM/GPRS engine, works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. It is very compact in size and easy to use as plug in module. The Modem is coming with5V TTL interface, which allows you to connect directly to 5V microcontroller/ Arduino. The baud rate is configurable from 9600- 115200 through AT command. The GSM/GPRS TTL Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.

IV. SOFTWARE DESCRIPTION

Embedded C is used as software platform. The programming is done with the help of MPLAB IDE 8.36. PCB layout is generated using PROTEL 99 SE.

The MPLAB IDE software brings an ease of software development previously unseen in the 8-bit microcontroller market.The ability to use MPLAB IDE with multiple debugging tools allows users to easily switch from the cost effective simulator to a full-featured emulator with minimal retraining.

Electronic Design Applications (EDA) exist to both create schematics of a circuit and transfer them to a working PCB layout.The resulting PCB design from PROTEL99SE can then be sent to a company for a professional board with silkscreens, multiple layers, etc.

V. RESULT AND DISCUSSIONS

The cane type system notifies whether any obstacle is in the middle of the walking direction. Since the cane is always contacted with ground, the user can recognize the condition of ground such as depression, cavity, and the stairs with his hand's tactile sensation intuitively. This obstacle detection system use a 40 KHz ultrasonic signal to acquire information and can detect the presence of any obstacle within the specified measurement range ofapproximately 2 cm to 4 m. It operates by sending out a pulse of ultrasound. Eventually the pulse is reflected from a solid object in the path of the pulse. The time between the outgoing pulse being transmitted and its echo being received corresponds to the distance between the transmitter and the object or the obstacle. This information is then relayed to the blind in some vibro-tactile way and speech way for the cane.

GPS [4] is used to find the position of the blind person and there by calculating the distancetravelled by him. The speech synthesizer device is activated by pulses from the microcontroller. The output represents the different actions to be taken .The speech synthesizer chip with a small vocabulary tells then the blind person about present location and decisions to make. Information about the route is stored in the memory in the form of a digital map of the device to guide the user to his destination via the planned routes. Since hearing for blind people is very important, the headphones would dull this sense. For this system, it has been decided to consider headphones used for walkman. Spoken words from the speech synthesizer which represent thedifferent action to be taken will therefore be heard by the blind.

Fig 5 :Sonic Pathfinder

In order to input information a set of switches is used in this aid. It is placed on the side of the case. The switches enable the user to select routes and to enter decision. It is of course possible to label these keys with Braille symbols if it is thought necessary. The microcontroller estimates the position of blind and calculates the distance. The microcontroller estimates and calculates the errors. Afterwards corrections are made.

In the recording mode the path is recorded by an authorized person by saving five locations or decision words. In playback mode the blind will travel through the recorded path according to the speech information .The current location continuously compared with the saved locations, if the saved location arrive then the corresponding sound emerges. And after reaching the destination a message will be send to the authorized person through the GSM module about the safe arrival of the blind.And also by pressing the message switch at any time a message will be send to the authorized person about the unknown place.

VI.CONCLUSIONAND FUTURE SCOPE

A portable, self-contained product that will allow blind and visually impaired individuals
to travel through familiar and unfamiliar environments without the assistance of guides is the outcome of the system. As a future enhancement we can integrate a blind patient monitoring system and its database to the existing navigation system. The real time route information including video files can be

transmitted to the database by adding two way LEO satellite modem to the system. This will help the authorities at hospital to continuously track and monitor the condition of the blind.

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