Voice Based Electronic Navigation Assistance to The Blind and Visually Impaired

Arivazhagan.R[1] Uma Mageswari.A[2]
[1]P.G. Student [2]H.O.D
[1,2]Department of Computer Science and Engineering
[1,2]DMI College of Engineering, Chennai, Tamilnadu, India

Abstract— Blind guide is a technology in navigation systems for visually impaired people. It is designed to provide dynamic interaction and the ability to change to fit changed circumstances guided with the use of audio instructions. To make the blind people active and independent it brings up the confidence and participation as possible. The system is used to assist blind by providing him information about the approaching obstacle using an ultrasonic sensor which works on the property of sonar. The current location information where the user is moving on will be provided by the use of global positioning system in the android mobile phone which is which is connected to the microcontroller by means of Bluetooth. A Bluetooth pairing device is used for the communication between microcontroller and android mobile. By the use of internet 3G,4G or wifi network data services are provided

Key words: Global Positioning System, Ultrasonic Sensor, Blind Tracking Application, location tracker

I. INTRODUCTION

Blindness is a condition that affects many people around the world. The recent statistics in 2011 by the World Health Organization (WHO) estimates that there are 285 billion people in world with visual impairment, 39 billion people of which are blind and 246 with low vision. The traditional and oldest mobility aids for persons with visual impairments are the walking cane and guide dogs. With the rapid advances in modern technology, both in hardware and software front brought potential to provide intelligent navigation capabilities. The aim of this project is to provide the current location information where the user is moving on and updating it time to time as per the GPS information range obtained through location tracker application present in our android mobile. Here, we are going to develop an intelligent system that works on unfamiliar environments. The current navigation system focuses on designing a device for visually impaired people to travel independently with outside environment. The blind tracking application we have created works well comfortably with ease of use and the voice alert to avoid obstacles based on ultrasonic sensor. The main objective of this project is to provide voice based electronic navigation assistance to the blind by means of blind tracker and location tracker application installed in our android mobile. Embedded systems are often required to provide Real-Time response. A Real-Time system is defined as a system whose correctness depends on the timeliness of its response. Examples of such systems are flight control systems of an aircraft, sensor systems in nuclear reactors and power plants. For these systems, delay in response is a fatal error. A more relaxed version of Real-Time Systems is the one where timely response with small delays is acceptable. Example of such a system would be the Scheduling Display System on the railway platforms. Embedded systems are playing important roles in our lives every day, even though they might not necessarily be visible. Some of the embedded systems we use every day control the menu system on television, the timer in a microwave oven, a cell phone, an MP3 player or any other device with some amount of intelligence built-in.

In fact, recent poll data shows that embedded computer systems currently outnumber humans in the USA. Embedded systems is a rapidly growing industry where growth opportunities are numerous. It is nice to have functional example code in some real language. Also, it is useful to point out some features of popular programming languages that are especially important for embedded systems.

II. EXISTING METHODOLOGIES

The count of visually impaired people rises every year. Currently the number is estimated to be around 285 million. Of this number, 39 million are blind while 246 are said to be suffering from low vision problems. Everyday life of visually impaired people is very difficult especially when it comes to move around in traffic resulting from ever growing population and vehicles. In everyday life they undergo problem of navigation to reach from one place to another safely and timely .In past, number of devices are made to assist them in travelling so that they can reach their destination timely and safely. Most of those devices operate on the conventional blind stick. But in order to make them not even feel the burden of carrying long and heavy stick, a design of a wearable assistive smart and intelligent system is presented, which could be the replacement of the blind stick, making the overall system smart and unique in its capabilities helping the blind travel with more convenient means of life. Other devices used earlier for the navigation purposes were walking cane, guide dog, and sighted guide. All these devices work well as long as blind people are within familiar operating environment and they also affect the independence of blind people. As electronic technologies have improved, a research about Electrical Aided: EA for blind people has started. With a current product, Human Tech of Japan developed Navigation for blind people, using GPS and cell phone. The oldest and traditional mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The drawbacks of these aids are range of motion and very little Information conveyed. With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities.

III. PROPOSED SYSTEM

The exact position, orientation and coordinates of any place on the globe will be known to blind using GPS, thus they can discover unknown places to them. This GPS technology is

very reliable to use as satellite access or link is always present throughout the glove anytime and every time. Our blind tracking application present in the android mobile with the use of GPS will provide the current location information by continuously wherever the user is moving on and it gives the name of the place with exact address accurately which is much faster and reliable, but obstacles /hindrance present in the path can be found out using ultrasonic sensor which helps improve the resolution and proximity detection to avoid collision. The location tracker application gives the latitude and longitudinal values of the places instantly. Ultrasonic sensor uses ultrasound which is noise resistant. It can be used to find out range of the obstacle present in the path away from the blind people. Being cost effective, least affected by target materials, surfaces and color and small and compact compared to conventional sensors, it is very popular and useful.

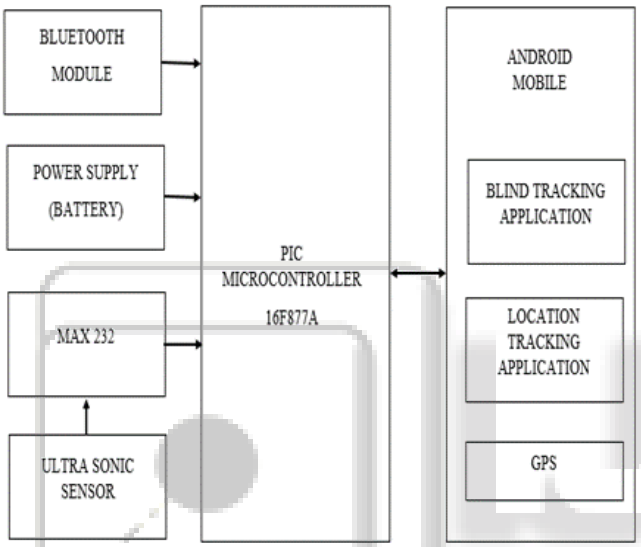

Fig. 1: System Architecture of our proposed system

Fig.1 gives the system architecture of our proposed system which works efficiently with the use of our blind tracking application and location tracking application. The latitude and longitudinal values are obtained by the location tracker application with the use of global positioning system the current place of the user is obtained and the address of the location is given to the user as voice output through the android mobile.

Modules

The proposed system includes the following modules

1) PIC microcontroller
2) Ultrasonic sensor
3) Bluetooth device
4) Android
5) Max 232

A. PIC Microcontroller:

PIC is a family of Harvard architecture microcontrollers madeby Microchip technology, derived from the PIC1640, originally developed by the Microelectronics division of General Instrument. The name PIC initially is referred to Peripheral Interface Controller. PICs are popular with developers due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost, free development tools and serial programming (and reprogramming with flash memory) capability. The microcontroller is from PIC series. PIC microcontroller is the first reduced instruction set computing based microcontroller fabricated in complementary metal oxide semiconductor, that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that, it has immunity to noise than other fabrication techniques.

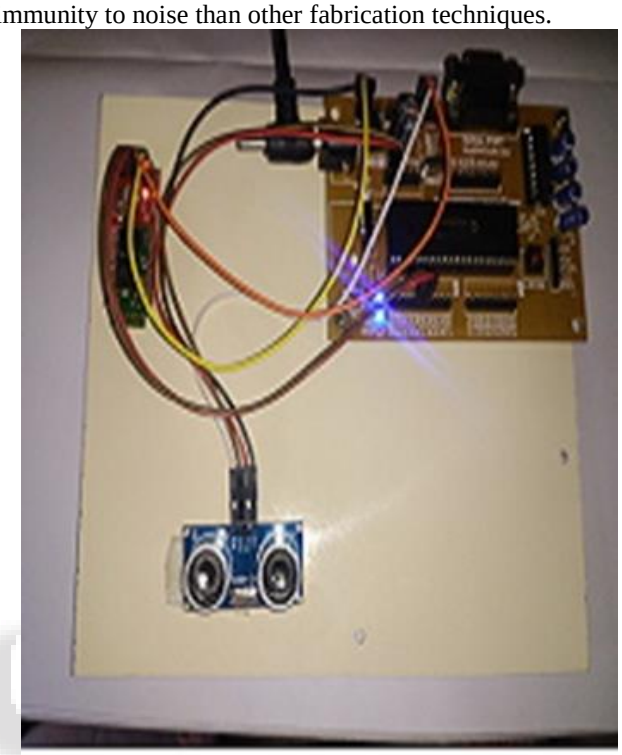

Fig. 2: Proposed system

B. Ultrasonic Sensor:

Ultrasonic sensors are devices that use electrical–mechanical energy transformation to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along the direction of wave propagation through the medium. Apart from distance measurement, they are also used in ultrasonic material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc. These sensors are categorized in two types according to their working phenomenon – piezoelectric sensors and electrostatic sensors. Here we are discussing the ultrasonic sensor using the piezoelectric principle. Piezoelectric ultrasonic sensors use a piezoelectric material to generate the ultrasonic waves. Ultrasonic transmitter uses a piezoceramic crystal attached with a conical metal sheet. When an electrical voltage is applied to the piezoceramic, it vibrates with continuous expansion and contraction.

C. Bluetooth Device:

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH

(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

D. Android:

Android is a software stack and mobile operating system that includes the operating system for portable devices, middleware,user interface,and a standard application ,multimedia message service (MMS). Android developers were able to write applications in the Java language, a runtime library that can run the compiled byte code. In addition, it provides the required application through the Android Software Development Kit (SDK) to develop a variety of tools and APIs. Android works on the Linux kernel and the Android system uses C / C + + libraries, etc. are included. Android, unlike existing Java virtual machines, uses an Java application made of Dalvik Virtual machine that runs on a separate process. In 2005, Google acquired Android Inc. and in November, 2007, Google announced to freely open Android platform to the public. After the announcement, 48 different hardware, software, and communication companies collaborated to design Open Handset Alliance, OHA and it has been developing an open-to-public standard. Google distributed all source code of Android as Apache v2 license so that companies or users can independently develop Android program. It is divided into a total of 5 class of application, application framework, library, Android runtime, and Linux kernel. Handset layout platform is adaptive to expand 3D graphic library based on OpenGL ES1.0, VGA, and 2D graphic library, and it uses SQLite database software for a purpose of data storage. Android supports connection technologies including GSM/EDGE, CDMA, EV-DO, UMTS, BlueTooth, and WiFi. It also supports a web browser based on an open source, Webkit application framework and it allows the usage of touch screen that is supported by additional hardware, GPS, acceleration sensor, compass sensor, and 3D graphic acceleration.

E. Max232:

MAX232 is an integrated circuit, first created by Maxim Integrated Products, that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

Fig. 3: GPS Location

IV. APPLICATION

Our proposed system is more helpful to the blind people to travel independently to both familiar and unfamiliar environments without the help of sighted person. It is much faster and more accurate in providing location of places continuously. It is portable and production cost is low. The user can reach the destination place much sooner as the travelling time is reduced by the use of this system.

V. CONCLUSION

The proposed project resulted in designing a system which is useful for visually impaired people to make them independent and also to lead their life lesser support from others. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind person worldwide. Therefore, future work lies in how to improve the user trust in terms of its accuracy of perceiving information as well as the user interface. The developed service utilized Smart Phone in order to search route between the current location of user to the destination and provide a voice-navigation. The test of the application functions were done by using Android 2.2. As the result, voice support on route was successfully proven to work without any troubles. Further researches have to be continued in order to provide the users about the information on the obstacles using sensors connected to Android mobile.

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