Blind Hurdle Stick: Android Integrated Voice based Intimation Via GPS with Panic Alert System

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***Abstract*— Blind Stick is a break-through technology in navigational and reconstructive aids for the blind and visually impaired. It is developed to communicate using voice-based guide for users in order to have easy mobilization. Ordinarily available systems in the out-door environment are expensive and its designing is time consuming. Blind people haveextensive drawbacks as they cannot detect the obstacles and dangers. Theyhave little information about data such as landmarks and self-velocity information. This blind Stickprovides easier route to blind persons, by designing a cost-effective and more flexible navigation system. This helpsthem to move independently without any manual help or guidance. There are a few latest technologies which are now available in market to cater the needs yet they have their own particular drawbacks. Hence, one of the competent solutions is to use embedded system. Blind Stickwill be a powerful tool and it is very helpful for visually impaired, in achieving fully independent navigation for those with vision loss and blindness to move freely, safely, andindependently.**

Keywords*— *Object Location, Visually Impaired, Flexible Navigation System, Voice-Based Assistant, Cost-Effective.

I. INTRODUCTION

A. Background

We should first understand what blindness means to a person. Severity ofblindness varies from one person to anotherasfew people are born blindandfew of them lose their vision due to some diseases at a later stage. A person who is blind from birth can see nothing not even black because they do not know what black is. All they see is abyss because they have not seen anything ever to have a knowledge of what anything is. Approximately there are about 38 million of people around the world in developing countries who are blind, among them over 15 million are Indians. Blind people feel they are an outcast from the rest of the society, Because of this inferior feeling blind people are taken back from societal activities and their participation in sports academics is also very limited. As a result, the percentageofblind people who are unemployed is around two thirds of working-age visually impaired folks according to 2006 statistics. In March 2008 article,of Forbes magazine had cited discrimination as one of the biggest obstacles to employment for blind. This in a way can affect the country's economic growth as well. Problems faced by visually impaired peopleare many, among them many have trouble in maintaining a proper circadian rhythm due to lack of visual input to their brain, critical forreading, writing, navigation and identifying objects. Reading and writing can be accomplished to a great extent through development of Braille language. Physical movement is one of the biggest challenges for visually impaired, travelling or walking down a crowed street may posedifficulty.

B. Problem Statement

Outdoor navigation is a harder task for blind and visually impaired people in thecomplex urban world. Technologiesaccessiblefor navigation of the blind is not sufficient. Wedevelopedan android application which can be activated and deactivated through a button provided on the cane. The application guides the user through voice commands from his respective source to his particular destination. The ultrasonic sensor embedded in white cane is used to detect the obstacles along the path and passes the same information to the android application through USB.

The application alerts the user and guides him/her to a safer path. We also develop an app that contains all the information about the user whereabouts, the respective parent/guardian can have access to this information by logging into the app through his respective account.

II. LITERATURE SURVEY

The basic requisite for any system to be developed is to understand the available and existing systems in the respective fields. There is a need to understand the gap between what the user expects and what the system provides. Therefore, a detailed study of various available systems has been done in this section.TraditionalSystems

Traditionally the assistive systems available for visually impaired were long cane, white cane, short cane, kiddie cane, guide cane, identification cane and support cane. None of these provided information about the obstacle until the user encountered themphysically.

A. Assistive TechnologySystems

3D Ultrasonic Stick for Blind[1] This paper goes for developing a stick embedded with three ultrasonic sensors to detect obstacles in three different directions. Disadvantage of this system is that delay to detect the obstacles is more it is between 2- 4 seconds also, delay for GPS is about 30 seconds-1 minutes.

Using Ultrasonic Sensor for Blind and Deaf persons Combines Voice Alert and Vibration Properties [2] The system is designed forboth blind and deaf people to navigate. It involves a vibrator to generate vibrations for deaf and voice-based guidance for visually impaired. Disadvantage of this is it consumes more battery power forvibrations.

Use of Ultra-sonic sensors, GPS and GSM technology to implement alert and tracking system for Blind Man [3]. This intended work was successful in providing a low-cost equipment for navigation but it involves too many modules to be integrated.

A Multidimensional Walking Aid for Visually Impaired Using Ultrasonic Network with Voice Guidance [4]. This paper goes for developing a stick embedded with many ultrasonic sensors combined to form a network of sensors to detect obstacles in different directions. Disadvantage of this system is that delay to detect the obstacles is more. It cannot determine the distance of the obstacle to the multidimensional.

Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator [5] This method involves finding location of the user and obstacles in user's path. The main disadvantage is they developed a new model that was too heavy to hold and inconvenient to carry around. Electronic Guide Cane with Ultrasonic eyes for Visually Impaired [6]. This technology goes for developing a system that can detect obstacles through sensors embedded in cane along with acamera fixed to take images of the path in front of the user each and every second. Disadvantage is more memory space and complexity in processing theimages.

An Outdoor Navigation with Voice Recognition Security Application for Visually Impaired [7]. This application detects obstacles and guides the user through voice but the main disadvantage is that the application is initiated by comparing the user's voice with the sample user's voice collected at the beginning. The voice sample could not be matched against different tones of theuser.

Voice Operated Outdoor Navigation System for Visually Impaired Persons [8]This equipment involves detecting obstacles and providing guidance through voice but the disadvantage is use of complex NMEA protocol

Ultrasonic Stick for Blind [9]It involves detecting obstacles using sensors as well as camera and it uses vibrator to give the feedback of obstacles so the disadvantage is consumption of more battery power and memory space.

Voice Based Navigation System for Blind People Using Ultrasonic Sensor [10]This model involves detecting obstacles and providing guidance through voice but the disadvantage is use of complex text to speech and speech to text conversion through E-speak, Google API, Pocket sphinx, Raspberry pi.

III. PROPOSED SYSTEM

Here we design a system that overcomes the drawbacks of all the aforementioned systems. Precisely our system is designed to do the following action sequences, which includes creating the shortest path by taking destination from the user, guiding the user to specified destination, detect the obstacles along his/her way. A Blind guide should be installed on android mobile, which support GPS. To activate the application, user should just press a button on the stick. The destination spoken by the blind is recorded by mobile and sent to the centralized server along with the source where the blind is at present. GPS in android, locate your current position that is taken as source for blind navigation. After getting the source and destination information GPS forms the path, and application starts speaking out to the blind. Guidance for directions to be taken is given through voice output. The server directs the blind until he reaches the destination. When the blind requests for any instruction, each time a new shortest path is created from the current location to the desired destination so that blind people reach destination even if he diverts from the instructed path. An ultra-sonic sensor is used to find the obstacles anywhere in the path. If any puddle of water is there it will detect and alert the user and also fire sensor will detect fire in the proximityandalert the user. If any obstacle is found, then the sensor will report to the server, and then the server will report to the blind immediately and changes his/her path. Application is always in contact with the server and blind's path. Concerned person(s) of the visually impaired can login to centralized server to track his/herpath.

The main features that act as strong points for our system are:

a) Easy touse.
b) Input or output voice communication for the convenience of theuser.
c) Warns them if any obstacles found in the path and re-directs them to a safer path (alternatepath).
d) Detects fire and alerts theuser
e) Detects water and alerts theuser

f) SOS button foremergency
g) Costeffective.

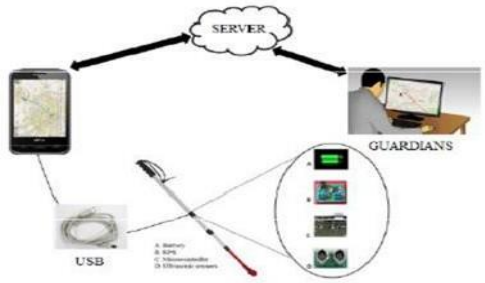


Fig. 1 Overview of Proposed System

IV. SYSTEM DESIGN

System design consists of both hardware and software requirements.

A. SoftwareRequirements

We use android as a platform and java language for coding. Here we develop two applications, one is to guide the user about his path and another one is for his guardians to track his path. Android Mobile Application: An Android Mobile Application blind guide should be installed on android mobile which support GPS, when blind takes his android mobile, the application starts recording his destination which he speaks out. To activate the application, we use proximity sensor of the mobile. The destination spoken by the blind is recorded through mobile and sent to the centralized server along with the source where the blind is at present.

GPS in stick locate your current position that is taken as source for blind navigation, using source and destination position centralized server forms the path through a customer care executive. After getting the source and destination information from the server, the application starts speakingoutto the blind. Guide is given as voice output. Blind's current direction will be found out using sensor and spoken out to the blind. Through voice output, the server tells direction to blind until he reaches the destination. Blind is provided an option to repeat the given instruction as well as to get the next instruction. When the blind requests for the next instruction, each time a new shortest path is created from the currentlocationto the desired destination so that blind people can reach destination even if he diverts from the instructed path. If any obstacles found in path, then the application warns blind and changes path.

1) Server Module: The Server Module is executed on a desktop PC running Windows. The blind is completely tracked by the server and later their concerned people can see his tracks. An ultrasonic sensor will report to the server, and then the sensor will report to blind as soon. Server checks each time for the ultrasonic sensor reports. So those blinds will be safe. Application is always in contact with the server and blinds path and given instructions are trackedeverywhere. Concerned persons of blind can login to centralized server to watch blind activities and they can track theblinds.

B. Hardware Requirements

User is provided by a stick which consist the following components.

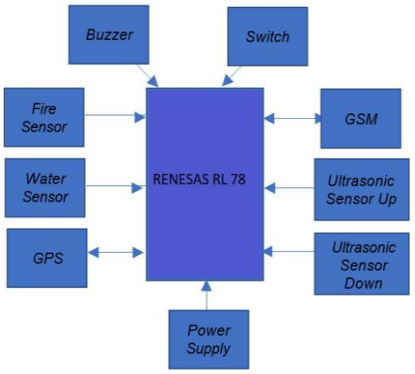


Fig. 2 Block diagram of hardware unit

C. Renesas Microcontroller

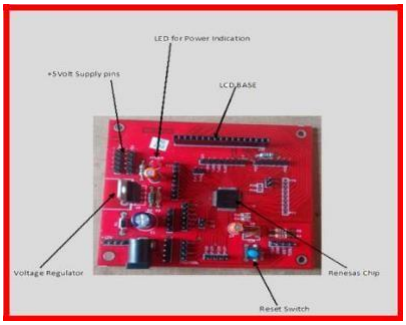


Fig 3: Renesas RL 78

It is a general-purpose register which is 8*32 bits register. It has a rom of 512KB and ram of 32KB it has a chip single power supply, flash memory with a prohibition of block, arrays or writing function the data flash memory is of 8KB, it has a on chip debug function and watch box timer and has 8 or 10 bit resolution ADconvertor.

D. ALCD [ALPHANUMERIC LCD 16X2 BIT RESOLUTION]:

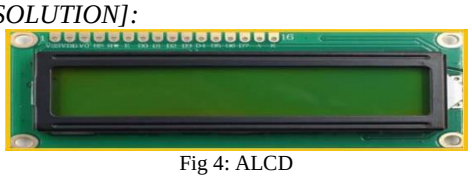


Fig 4: ALCD

ALCD is an electronic display module these modules are preferred over 7 segments and other multi-segment LED's these LED's are economical, easy to program, less limitation of displaying special and even custom character. It has command register which storescommand instructionsgiven tothe LCD to do pre-defined task like initialize it, clear its stream, sets its cursor position and control the display.

E. Ultrasonic sensor:

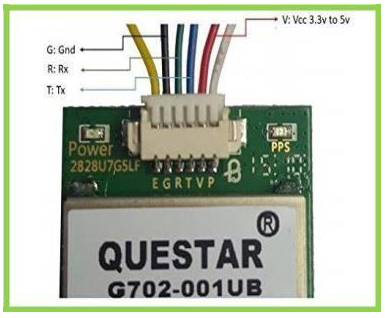
Fig 5. Ultrasonic Sensor (HC-SR04)

An Ultrasonic-sensor uses the soundwavesto measure the distance to an object. Measurement of distance is done by sending out a sound wave at a specific frequency and waiting for that sound wave to bounce back. By recording the elapsed time between the sound wave generated and the sound wave bouncing back, the distance is calculated between sensor and the object.

F. Global system for mobile [gsm]:

Fig 6: SIM800C GSM Module

The GSM Module used here is SIM800C.It is a Quad-band GSM/GPRS Module which can be embedded easily by customer. The SIM800 delivers GSM/GPRS 850/900/1800/1900MHz performance for SMS, data,voice with low powerconsumption.



G. Gobal positioning system[gps]:

Fig 7. GPS module

The GPS QUESTER TTL is a compact all-in-one GPS module solution used for Original Equipment Manufacturer (OEM) products.Each and every time the receiver tracks all satellites in view and provides accurate satellite positioning data.

H. Fire sensor

Flame Sensors, Smoke Sensors, Fire Alarms form part of a safety equipment that is useto keep our homes and offices safe from fire accidents. Almost all modern houses, malls, apartments, cinema halls, theatres, shops and office buildingsare equipped with such safety equipment and it is mandatory in some regions to install fire safety devices. This particular flame sensor is based on YG1006 NPN Photo Transistor. At the front of the module there is a black objectcalled photo transistor.

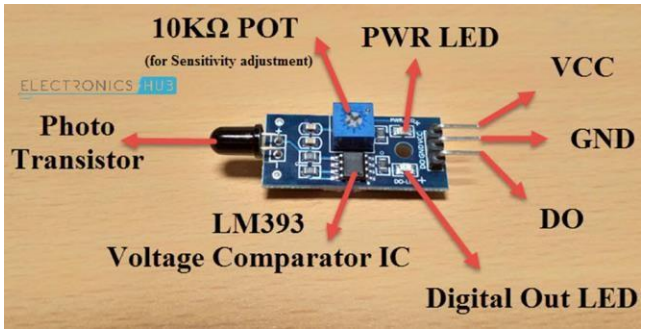


Fig 8: Fire Sensor

I. Water Level Sensor:

This sensor has a series of ten exposed copper traces- five sense tracesand five power traces.The purpose of these traces isinterlaced so that there is one sense trace between every two power traces.These traces are not connected but are bridged by water whensubmerged.

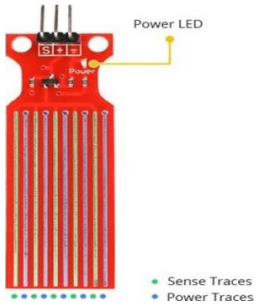


Fig 9: Water Sensor

J. Battery:

Fig. 10. Battery

A lithium-ion battery or Li-ion battery (abbreviated as LIB) is a rechargeable battery consisting of lithium ions movingfrom negative electrode to positive electrode during discharging and back when re-charging. These batteries use

an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery. The electrolyte allows for ionic movement and two electrodes constitute the components of a lithium-ion batterycell.

V. IMPLEMENTATION

The software is implemented using java language on android platform. The stick with ultrasonic sensor which is controlled by microcontroller, detects the obstacles. The working process of the above system is shown in flow chart.

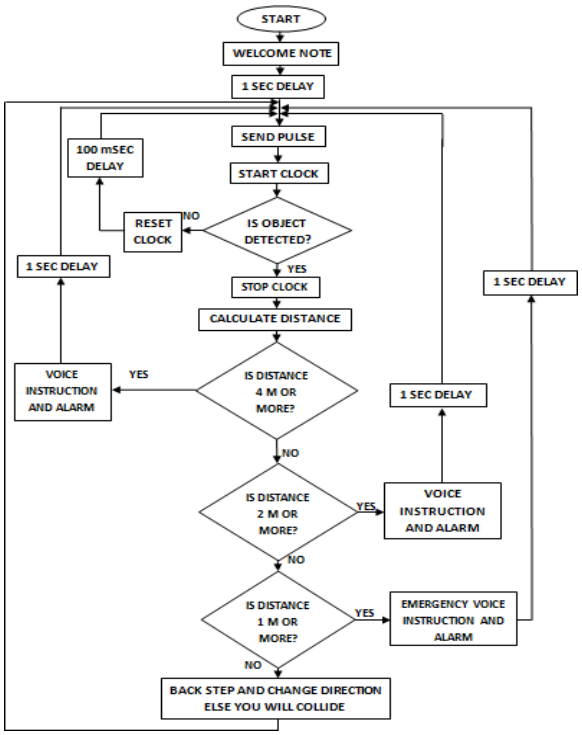


Fig. 11. Flow chart of the proposed work

VI. CONCLUSION & FUTURE ENHANCEMENT

The proposed system helps the visually impaired to move independently and safely. On board sensors like water and fire detects other hazards. SOS Button helps in case of emergency. It can be used in any public places. As it is a voice-based system, the user can provide the destination easily. This system is designed in less time with low cost and low power consumption. The application requires less space and it is dynamic. Compared to other existing system, this system is more efficient. In future this project aims to improve another device that can be either necklace or goggles embedded with ultrasonic sensors that can detect obstacles above the abdomen level so that user can navigate more effectively. Computer vision can be implemented for better object identification.

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