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OBSTACLE DETECTION AND NAVIGATION SYSTEM FOR IMPAIRED PEOPLE

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Abstract--In today's world about 15% of the population is suffering from different kinds of disabilities such as physical, visual or hearing impairments. It is difficult for blind persons to reach destination safely without others help when travelling from one place to another place. They reach the destination by taking others help but it is not possible for all times because everyone is busy with their own work. To overcome this problem, an obstacle detection and point-to-point navigation system is proposed.

This system uses a modular sensor box interfaced with a mobile application for intelligent navigation. The sensor box includes different sensors such as Ultrasound for detecting the obstacles and MEMS for identifying the position. It includes a GPS receiver for locating the place. Whenever an obstacle is detected it sends a signal to the mobile application by using Bluetooth technology. The mobile application receives the signal and intimates the position of the obstacle to person by the voice. The person can understand the position of the obstacle and can reach destination safely.

Keywords—Impairedpeople, obstacles, Navigation,Ultrasound,MEMS, GPS, Mobile application

I. INTRODUCTION

The World Health Organization states that 15% of the population is suffering from different kind of disabilities such as physical, visual, hearing in the 2011 report and are facing so many problems in present world [1]. Due to the Impairment so many accidents are happened on the roads in every day. They need others help for travelling on the road. But it is not possible to help them for all times because of every one busy with their own work. So, it is necessary to improve the quality of life to make possible change from isolation to integration of people. It is difficult for them to make interaction with the external world. The possible scenario is to use advanced communication and information technologies. Herewe usean Ultrasonic sensor for detecting the obstacles on the road.The mobile (android) application will act as interface between the sensors and impaired people. It receives a signal from the sensor box through the BC417 Bluetooth module. The application will give a direction to the person by the voice. So, the blind persons can analyze the position of obstacles easily by the voice. The MEMS accelerometers will identifies the position of person. The GPS receiver provides a continuous navigation.

II. EXISTING METHOD

In present days blind peoples are walking on the road with the help of walking sticks. With this either navigation or obstacle detection is possible.It is not possible to get both functions at the same time. Due to this it is difficult to reach the destination safely.

III. PROPOSED METHOD

Here the proposed framework integrates a specialized, adhoc route planner for impaired people with a sensor box embedded in a white cane. Initially we set a path from source to destination in map navigation [2], [3]. Our main objective is identifying the obstacles in the path. The sensor box supports the user during the execution of a given route by analyzing the environment. Whenever the sensor box real time processing detecting an obstacle, it sends a signal to the mobile application.The mobile application receives the signal through Bluetooth and intimates to the user through the voice [4]. The user can easily understand the position of the obstacle.The main aim of the sensor box is to sense the surrounding area by extracting all possible threats for the navigation.

IV.SYSTEM ARCHITECTURE

The architecture mainly consists of two blocks. They are

i) Sensor box
ii) Mobile application

The architecture of sensor box and mobile application is shown below

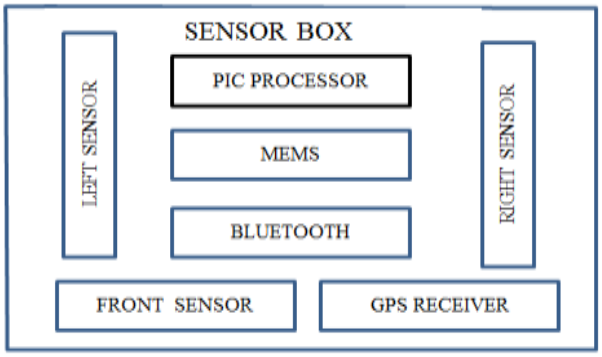

Fig. 1.Architecture of Sensor box

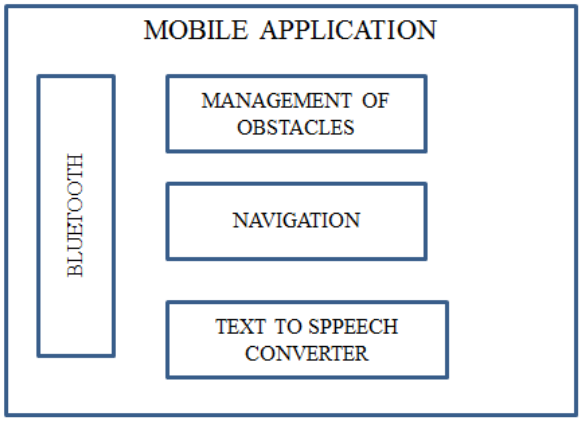

Fig. 2. Architecture of Mobile Application

The sensor box [5] detects the obstacles or threats and send signal to the mobile application. It mainly includes

- Ultrasonic sensors in 3 directions
- Bluetooth
- Accelerometer(MEMS)
- Processing unit
- GPS Receiver

A. SENSOR BOX

The ultrasonic sensors will detect the obstacles or threats in 3 directions such as Front, left side, right side in the path or road. Similarly the position of the person can be identified by the Accelerometer (MEMS).These sensors will be controlled by a processor. The processor receives the signal from the sensors and transfers it to the mobile application through a Bluetooth module. The GPS receiver is used to get the location of the user.

B. MOBILE APPLICATION

The mobile application [6] receives the signal from the sensor box through Bluetooth. The mobile application performs the following functions.

- Management of obstacles
- Navigation

- Speech generation

The mobile app identifies the received signal coming from the sensor box. According to the received signal from sensor box it intimates the position of the obstacles by voice to the user. So, the blind person can easily get the position of obstacles with the help of voice signal. Navigation is also done by the mobile application. There is no need of separate Bluetooth at mobile application side for receiving signal from sensor box, because the mobile phone itself has a Bluetooth module [7].

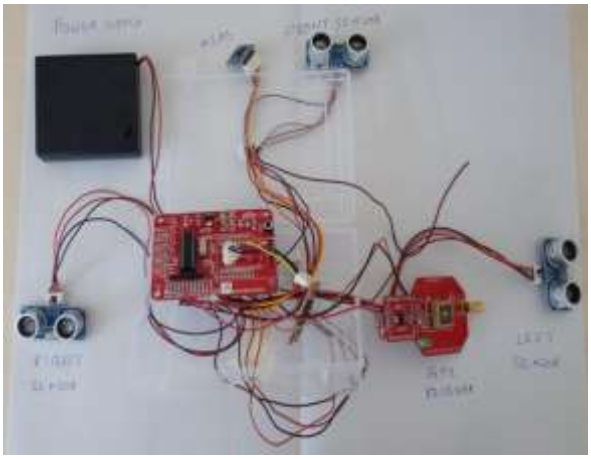

Fig. 3. Embedded development kit hardware

V.SYSTEM HARDWARE

Hardware components include PIC16F88 processor, Ultrasonic sensors, GPS receiver, Accelerometer, Bluetooth, Power supply [8].

A. PIC16F88

PIC stands for Programmable Interface Controller. PIC16F88 is 18/20/28 pin microcontroller.PIC is family of modified Harvard architecture microcontrollers made by Microchip Technology. Here, we use the 18pin Microcontroller chip for reducing the size on developing board.

The main features of the PIC controller are given below:

- Program Flash -- 4K ×14
- Data Memory— 368 ×8
- Data EEPROM – 256 ×8
- Data bus –8/16/32 bit
- Address bus –12/14/16/24 bit

B. HC-SR04

HC-SR04 is a Ultrasonic sensor used for detecting the obstacles or threats.

Fig. 4. HC-SR04 ultrasonic sensor

The transmitter emits 8 burst of a directional 40 KHz Ultrasonic wave when triggered and starts timer. Ultrasonic pulses travel outward until they encounter an object;the object causes the wave to be reflected back towards the unit. The Ultrasonic receiver detects the reflected wave and stops the timer.

1) FEATURES

- Stable Performance
- Accurate distance measurement
- High density SMD board
- Close Range(2cm)

2) USES

- Robotics barrier
- Object distance measurement
- Level Detection
- Security Systems
- Vehicle Detection / Avoidance

C. L80

L80 is an Ultra slim GPS POT (Patch On Top) module with an embedded 15*15*4 mm patch antenna. This saving space design makes L80 become the perfect module for the miniature devices. L80 has exceptional performancein both acquisition and tracking.

Fig. 5.L80 GPS module

L80 supports automatic antenna switching function. The switching between the internal patch antenna and external active antenna can be achieved. Moreover, it keeps positioning during the switching process.

D. ADXL 335

The ADXL335 is a minor, low power, complete 3-axis accelerometer through signal trained voltage outputs. The product processes acceleration with a minutest full-scale range of ±3 g. It can amount the static acceleration of gravity general tilt-sensing applications, as dynamic acceleration resultant as of motion, shock, or vibration. The sensor stands a polysilicon surface-micro machined structure built on highest of a silicon wafer. Polysilicon springs hang the structure ended the surface of the wafer and offer a resistance next to acceleration forces. Deflection of the structure is leisurely by a differential capacitor so as to consist of sovereign fixed plates and plates devoted towards the moving mass. The fixed plates are resolute by 180° out-of-phase square waves. Acceleration bounces the moving mass and interrupts the differential capacitor subsequent in a sensor output whose amplitude is comparative toward acceleration. Phase responsive demodulation techniques are used to conclude the magnitude and direction of the acceleration.

E. BC417143B

It is a single chip radio and base band IC for Bluetooth 2.4 GHz systems including enhanced data rates to 3Mbps.It Interfaces to 8Mbit of external Flash memory. It provides Bluetooth system to v2.0 of the specification for data and voice communications.

Features:

- Full speed Bluetooth operation with full piconetsupport.
- Scatternet support
- Low power 1.8V operation
- Minimum external components
- USB and Dual UART ports
- Support for 802.11 Co-Existence

Applications:

- Personal Computers
- Digital Cameras
- Personal Digital Assistants(PDAs)
- Access points.

VI. IMPLEMENTATION AND RESULT

The Embedded Board is designed by above mentioned hardware devices. The developed embedded program is burned into the PIC microcontroller by using the USB Programmer. This developed kit was fixed to a walking stick or wheel chair. The mobile application should be installed on the Mobile phone. The ultrasonic sensors detect the obstacles in all directions. The

mobile application intimates to the user about the position of obstacles by the voice.

The mobile application produces different voice signals for different positions of obstacles.

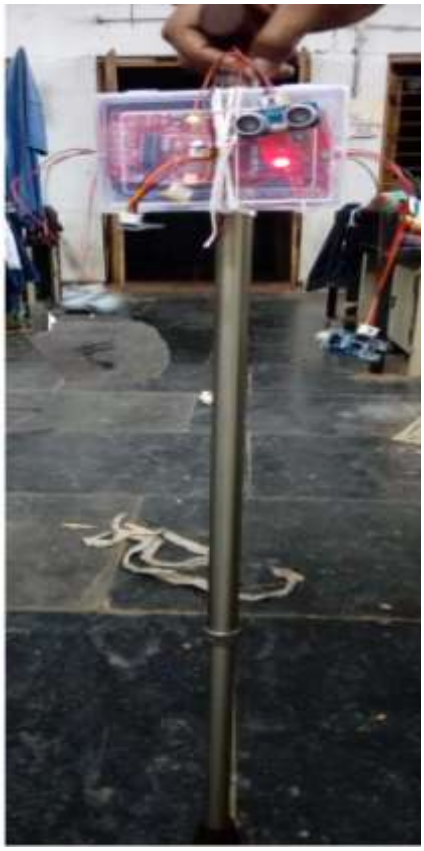

Fig. 6. Structure of blind navigator

POSITION OF OBSTACLE AND PRODUCED VOICE

a)If No obstacle is there ----- ”*go now*”

b)If obstacle at left side -----“*obstacle is left*”

c)If obstacle at right side -----“*Obstacle is right*”

d)If obstacle at ahead ------“*Obstacle is ahead*”

e)If obstacle at multiple sides-----“*Stop*”

The application displays the position of the user and position of obstacles. It can also display the movement of user.

The result on the mobile screen is shown below

Fig. 7. Displayed image on Mobile screen

If No obstacle is there mobile application displays ‘0’ on the screen in front of longitude and latitude values. Similarly if any obstacles at any direction it shows‘1to 5’according to the position of obstacles.

If the userfell down the accelerometer values are changed and the application shows ‘9’on the screen.

VII. CONCLUSION

The developed Blind Navigator system is useful for impaired peoplein detecting the obstacles and navigation. The used ultrasonic sensors have the capability to detect wide range

Obstacles. Due to this,the impaired people can detect the obstacles easily and can reach the destination safely and road Accidents can be reduced.

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