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Audio Guidance System for Visually Impaired

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Abstract - This paper describes the method for sustaining a visual impaired people. This helps to detect identifies and avoids objects in the field of vision of the surroundings. This paper specifically runs with ultrasonic sensor. The ultrasonic sensor is used to spot and measure the object distances and distance is measured in the form of feet. An audio representation is recognized as output unit. Then the corresponding audio will be pass on to the blind people via earpiece and guided by describing the objects and object distance to the person in the field of vision.

Finally this device embedded with the fault tolerance system such as GPS and GSM. Global Positioning System which gives the current location of the impaired people. Navigation information sends by means of text message. Global System for Mobile Communication it send message to service man and to family member when the system get fault.

Power distributed to the device by 2 way power supply .one by means of battery and other by solar. This is done to achieve robustness.

I.INTRODUCTION

There are many traditional and advanced navigational aids are available for visually impaired and blind people. Usage of all these travel aids for detecting obstacles for smooth navigation requires a good training. Presently several electronic travel aids (ETA) are available for visually impaired and blind people.

Ultrasonic sensors present one of the cost-effective digital distance measurement systems available for mobile applications. This sensor understands obstacles around the subject up to 500 cm in front, left and right direction using a network. It effectively calculates distance of the detected object from the subject (visually impaired and blind people) and prepares navigation path accordingly avoiding obstacles. Our work with sensors included signal filtering and triangulation to improve performance characteristics of ultrasonic-based measurements. Additionally, we describe the use of computer modeling to aid in the design of ultrasonic sensor systems. In our system use Global Positioning System (GPS) integration with the main system. GPS receiver is useful for understanding the current location of the subject and nearby landmarks and the APR sound system is use for audio instruction.

This system uses AT89S52 microcontroller based embedded system to process real time data collected using ultrasonic sensor network. Based on direction and distance of detected obstacle, current location and landmark, relevant pre-recorded speech message stored in APR9600 flash memory is invoked. Such speech messages are conveyed to the subject using earpiece.

II.RELATED WORKS

An audio guidance system that is equipped with sensors for similar purposes was proposed in [1]. The system uses differential GPS location information to allow the user to navigate to a general area. The usage of GPS technologies is becoming more widespread with blind individuals. This technology looks like a miniature computer and be worn easily on the individual. Like the previous technologies, GPS Solution was also introduced. The GPS Solution allows the user to create a route in order to get from one location to another. The system is based on an ultrasonic sensor in which it detects obstacles, distance and location. Other system that uses the ultrasonic sensor aimed to inform the user of the distance to the detected objects by means of speech. The volume of the speaker is inversely proportional to the distance between the ultrasonic sensor and the obstacle. Since the above invention is aimed to detect and avoid obstacles or objects located in front of the user, a fuzzy controller is required to determine the instructions that will be executed, for example to turn right, left or stop[2].

Using ultrasonic sensor the time interval between sending the signal and receiving the echo is calculated to determine the distance to an object. As these sensors use sound waves rather than light for object detection, so can be comfortably used in ambient outdoor application[3].

APR9600 is a low-cost high performance sound record/replay IC incorporating flash analogue storage technique. Recorded sound is retained even after power supply is removed from the module. The replayed sound exhibits high quality with a low noise level[4].

III.PROPOSED ULTRASONIC SENSOR

Triangulation is the application of geometric relationships to scalar measurements to calculate the position vector of an object. In general, triangulation requires at least the same number of sensors as the number of dimensions within which to fix the position of an object – two sensors can identify location in a 2D plane, while three sensors can fix location in 3-D space.

Figure 1 shows objects at any point on the arc (e.g. point A or B) yield the same reading when measured by a sensor at S1. Without additional information the system cannot tell the user how to avoid an object, only that an object is present in the field.

Figure 2 demonstrates how the addition of a second sensor fixes object location in two dimensions. While readings from the left sensor (blue arrows) are the same as in Figure 1, readings from the right sensor (red arrows) have different lengths (as evidenced by the red arcs passing through each point) – creating distinction between point A and point B.

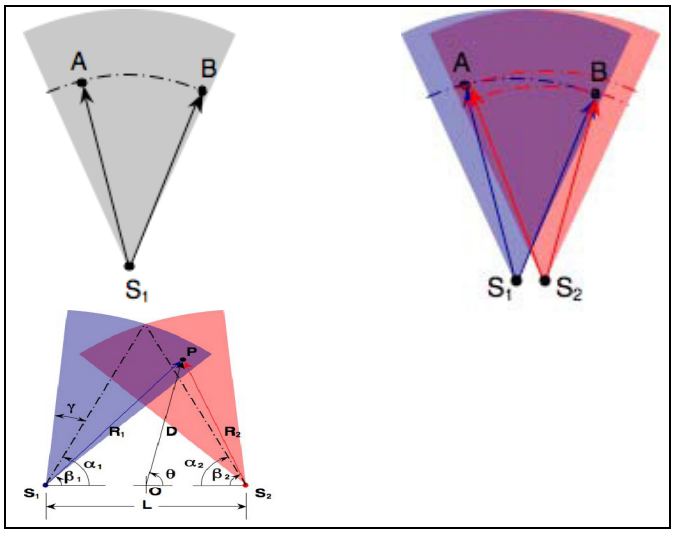

Fig. 1 Point A and B have the same scalar distance from a single ultrasonic sensor at S_1 and cannot be distinguished.

Fig. 2 Triangulation from S_1 and S_2 creates distinction between points A and B.

Fig.3 Diagram of geometric parameter naming convention used to derive triangulation equations.

Figure 3 shows our naming convention for geometric parameters used for triangulation. Based on the length separating the sensors, L, and readings R1 and R2, we triangulate the distance D and angle θ between points O and P. The angle αn is the angular orientation of sensor *n*. The angle γ is half of the angle from the detection beam centerline to the edge of the detection area, and is constant for a specific sensor. Finally, βn is the angle to a specific reading within the detection field relative to sensor *n* [5].

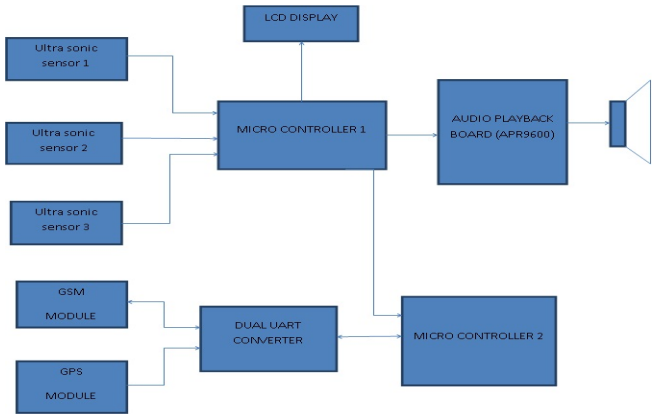

Fig. 4 Block diagram of Audio Guidance System for Visually Impaired

IV.GSM AND GPS MODULES

In addition to that, when the GSM modem receive a message it will be sent to the microcontroller which will get the location from the GPS modem and transmit the location to the GSM modem in response to the sender. In case of an emergency, the user will press the emergency button and the signal from the button will go to the microcontroller which will get the location from the GPS modem and transmit the location to the GSM modem which will send a SMS messages to the all saved numbers in the system.

Microcontroller

An embedded system integrating three ultrasonic sensor pairs, APR9600 audio recording and playback flash memory, speaker with AT89S52 microcontroller. Figure 4 shows the proposed system for visually impaired and blind navigation. In this wearable system, ultrasonic sensors are placed 500/12 cm apart facing towards front ,left and right direction.

Using this ultrasonic sensors, subject can detect obstacles from waist level height to head level height in the range of 500 cm in any direction. These ultrasonic sensors collect real time data after every 20 msec. and send it to AT89S52 microcontroller. After processing this data, microcontroller invokes relevant speech message stored in flash memory. APR9600 audio recording and playback flash memory is used for storing pre-recorded speech messages. Variable duration of speech messages up to 60 sec. duration can be stored in this memory [4].

Audio Play Back Board (APR9600)

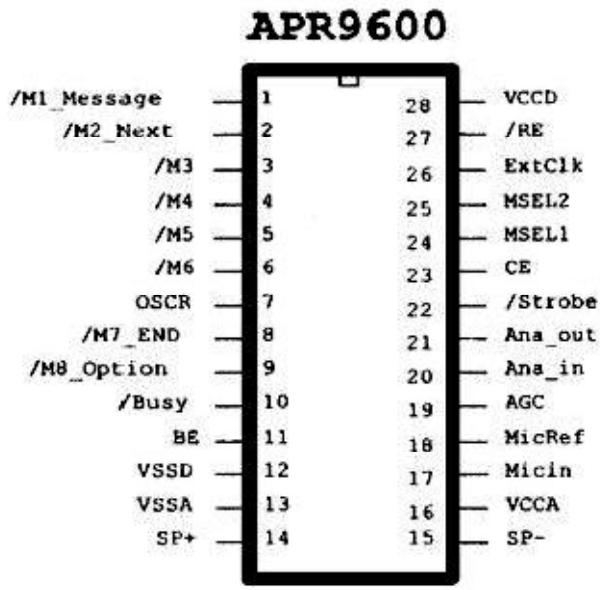

Fig. 5 Pin Diagram of APR9600

During sound recording, sound is picked up by the speaker. An AGC circuit is included in the pre- amplifier, the extent of which is controlled by an external capacitor and resistor. If the voltage level of a sound signal is around 100 mV peak-to-peak, the signal can be fed directly into the IC through ANA IN pin (pin 20). The sound signal passes through a filter and a sampling and hold circuit. The analogue voltage is then written into non-volatile flash analogue RAMs.

V.CONCLUSION

In this paper, we have presented new intelligent system for guiding individuals who are blind or partially sighted, and we have described how the system can be used to enable those people to move with the same ease and confidence as a sighted people. In order to incorporate the properties of the GSM_GPS module, we have developed another module that comprising different sensing devices and microcontroller. The system has been used to receive the data from the sensing devices and command the GSM module. We have integrated the ultrasonic sensor data in order to detect obstacles, and to obtain more detailed regarding the blind's environment. The experimental results have shown the usefulness of the system in allowing blind people to move independently, safely and quickly among obstacles and hazardous places.

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