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Implementation of ultrasonic ranging and fire safety for blind person

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ABSTRACT

This paper shows a method to introduce a mobility aid for blind persons by giving alert to blind person using voice processor with ear phones. This system is also used in automatic robots, self propelling vehicles in automated production factories etc. This system contains a signal processing unit with LPC 2148 microcontroller. This receives data from serial input/output port and gives alert to blind people. This paper contains temperature compensation method to reduce the error in measurement of distance using ultrasonic sensors. Signal processing is done using lpc2148 micro controller which is used for interfacing between different sensors and pc. sensor then process it and delivers it to the computer using serial input/output port and gives alert to blind people. This paper contains temperature compensation method to reduce the error in measurement of distance using ultrasonic sensors. Signal processing is done using LPC 2148 micro controller which is used for interfacing between different sensors and pc. Further received data is verified using MATLAB.

INTRODUCTION

Ultrasonic sensors works on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an

This system presents a concept to provide a smart electronic aid for blind people. The system is intended to provide overall measures artificial vision and object detection, real time assistance via global positioning system . The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives sense of artificial vision about the environmental scenario of objects around them. In this system embedded system plays a major role. In this system we are using the Ultrasonic sensor, temperature sensor, humidity sensor, GPS receiver, Vibrator, Voice synthesizer, speaker or headphone, microcontroller and Battery.

There are various methods to measure the distance of obstacle. One of the methods is by means of ultrasonic. Applications are in the field of remote sensing, mobility aid for blind person, in robotics and self -propelling vehicles. Self propelling vehicles are automatic tools which are useful in industries which are totally dependent on automatic machines. The first part of the paper provides information about the ultrasonic sensors based on the output waveform whose pulse width varies with round trip delay time of sonic pulse or distance measured & Temperature sensor with processing unit. In the second part the paper will describe how to build an ultrasonic distance measurement system using temperature compensation.

A survey was done of various ETAs based on features and performance parameters. A author develops a navigational/orientation system that uses

RFID technology, GPS and computer vision. A new device was developed based on multisensory strategy and smart signal processing. A smart phone based ultrasonic wireless ranging and collision warning system was proposed. It uses Bluetooth technology and a smart phone along with Text to Speech Feature.

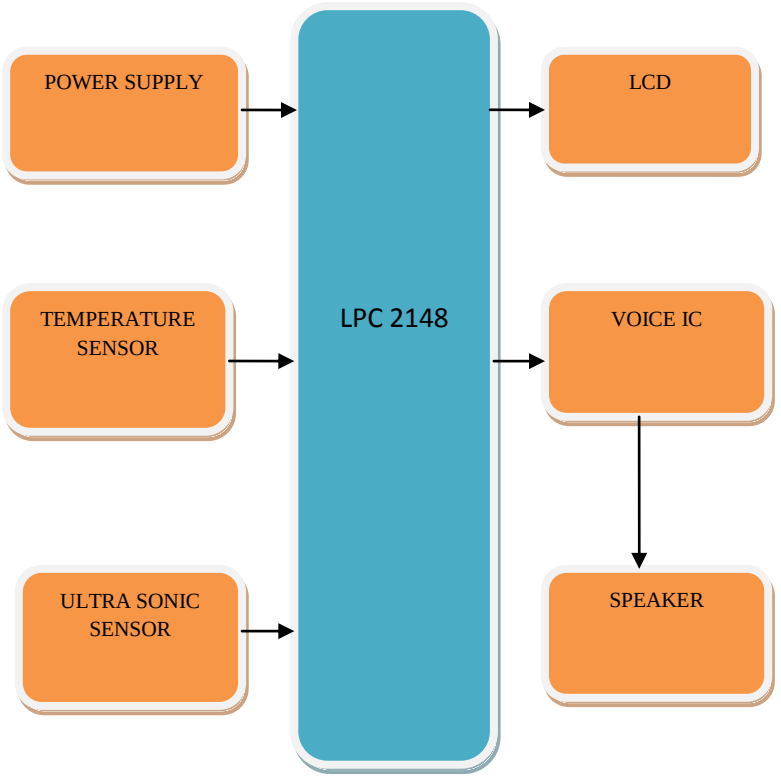
LITERATURE SURVEY

Mobility for the blind can be defined as the ability to move with ease, speed and safety through his environment independently. With the advances of modern technologies many different types of devices are available to support the mobility of blind which are generally known as electronic travel aid which aims at conveying information about the environment to visually impaired individuals, so that they can exploit part of the information that sighted people normally use to experience the world and navigate it.

There are various methods to measure the distance of obstacle. One of the methods is by means of ultrasonic. Audible electronic mobility aid and obstacle detector designed for use by individuals who are blind or have low vision, it is a small electronic device aids users who are blind or visually impaired with orientation and mobility. By listening to sounds produced by the device, users can determine the distance and location of objects and some of the object's features.

The device attaches to the golf grip handle of a long cane or onto gloves which is worn by the blind person. A headphone provides audio feedback. The device comes with headphones and an instructional audiotape with sample sounds and a vibrator which vibrates when obstacle is detected. The device also incorporates a fire sensor to alert the blind person if fire is detected. Ultrasonic sensors are based on the output waveform whose pulse width varies with round trip delay time of ultrasonic pulse or distance measured.

SYSTEM ARCHITECTURE



Different types of ultrasonic sensor and fire sensors are available in the market. Ultrasonic sensor measures the round trip delay which is directly proportional to output pulse width of the distance measured. The block diagram of proposed hardware is shown in Fig.1.The microcontroller triggers the ultrasonic sensor and receives echo when it detects any obstacle. The microcontroller collects information from ultrasonic sensor (and fire sensor if any fire is detected) and computes the distance.

The microcontroller works on the 3.3v which receives data signal from Ultrasonic sensor and fire sensor then processes it and gives alert to the blind person using voice processor with earphone/speaker, this project also detects fire and gives alert.

Signal processing unit contains LPC 2148 microcontroller which is used for interfacing between

different sensors. Here as output device audio sound generator are used, the audio tones gives information about the travelling path and can hear through head phone/ speaker. The audio messages given through the headphone/speaker are like STOP when the distance measured is less than 0.3m, DANGER when the distance measured is less than 0.6m, WALK when the distance measured is greater than 0.6m and FIRE when fire is detected.

HARDWARE DESCRIPTION

LPC2148 ARM PROCESSOR

ARM is known as Advanced RISC Machine. Most of the embedded systems are designed by using ARM processor as a core. ARM has wide range of applications in every day Portable consumer devices. ARM1 prototype is introduced in the year 1985, in which one billion ARM processors are launched in worldwide by the end of 2001. ARM7 has high code density and low power consumption.

ARM creates a flexible embedded processor by adopting RISC Architecture. RISC Architecture provides or delivers simple but powerful instructions which executes within a single cycle along with high clock speed. By using ARM processor in embedded systems we can provide greater flexibility in software rather than hard ware. The designs rules we use in RISC Architecture are instructions, Pipelines, Registers, load store Architecture. ARM design philosophy includes extend battery operation, high code density, price sensitive, high volume application with low cost memory devices.

ULTRASONIC SENSORS

Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. Active ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal, and report it to a computer.

TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ˚ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4˚C at room temperature and ±3⁄4˚C over a full −55 to +150˚C temperature range. Low cost is assured by trimming and calibration at the wafer level.

VOICE MODULE

The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-select- able, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify sys- tem design. the device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. APLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology in an advanced Flash non-volatile memory process, where each memory cell can store 256 volt- age levels.

Algorithm for the proposed system is divided in two parts as

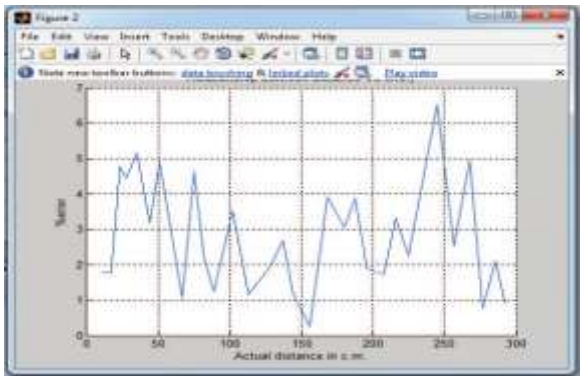
Algorithm for system consists sensors, ARM7:

1. Initialize SPI (Serial Peripheral Interface.
2. Initialize all sensors.
3. Display sensors current status.
4. Voice module is activated.
5. If any sensor status changes then message audible from voice module.
6. Same information is sent to computer.

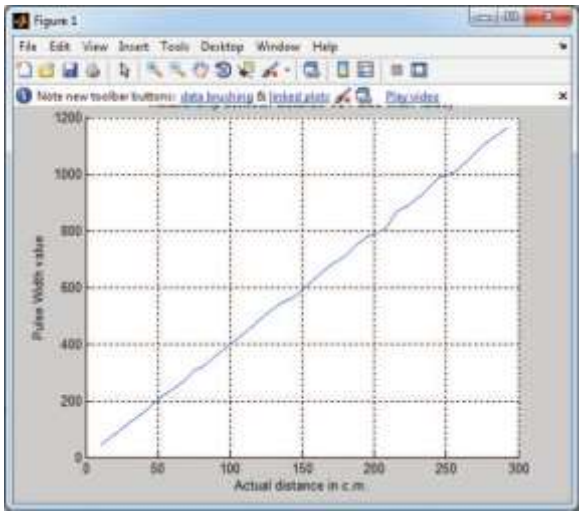
7. Then particular action will be taken by the blind person depending on status of sensors .

RESULTS

Experimaental setup



Grph: 1 Plot between percentage error versus distance



Grph: 2 Plot between width versus distance

RESULT VERIFICATION FOR MATLAB

Input serial data to matlab

SNO	DISTANCE TAKEN MANUALLY D(CM)	PULSE WIDTH W(MICRO SECS)	TEMPERATURE	DISTANCE WITH TC D1(CM)
1	11	0044	33.0	011.2
2	17	0067	23.0	017.3
3	23	0092	29.0	024.1
4	27	0110	42.0	028.2
5	35	0140	27.0	036.8
6	44	0174	25.0	045.4
7	51	0208	36.0	053.5
8	67	0263	21.0	067.7
9	75	0302	43.0	078.5
10	82	0320	19.0	083.8
11	89	0351	24.0	090.1
12	102	0405	35.0	105.6
13	113	0452	40.0	114.3
14	128	0518	33.0	130.5
15	137	0549	38.0	140.7
16	144	0563	17.0	145.7
17	156	0615	28.0	156.4
18	168	0672	37.0	174.6
19	180	0711	24.0	185.5

20	188	0750	29.0	195.3
21	196	0779	30.0	199.7
22	208	0805	23.0	211.6
23	216	0869	41.0	223.2
24	225	0894	34.0	230.1
25	234	0931	31.0	243.8
26	245	0987	44.0	261.0
27	257	1010	25.0	263.5
28	268	1062	34.0	281.3
29	277	1108	22.0	279.1
30	286	1139	42.0	292.0
31	293	1162	37.0	295.6

OUTPUT DATA FROM MATLAB

SNO	%Error between distance with T.C and distance taken manually E(%)
1	1.8182
2	1.7647
3	4.7826
4	4.4444
5	5.1429
6	3.1818
7	4.9020
8	1.0448
9	4.6667
10	2.1951
11	1.2360
12	3.5294
13	1.1504
14	1.9531
15	2.7007
16	1.1806
17	.02564
18	3.9286
19	3.0556
20	3.8830
21	1.8878
22	1.7308
23	3.3333
24	2.2667
25	4.1880
26	6.5306
27	2.5292
28	4.9627
29	0.7581
30	2.0979
31	0.8874

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.

The system has been used to receive the data from the sensing devices and command. We have integrated the ultrasonic sensor data in order to detect obstacles, and to obtain more detailed regarding the blind's environment. Evaluations of the system that we have developed have been conducted by attaching the prototype to the handle of the white cane. 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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