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Temperature Compensated Ultrasonic Ranging For Blind Person with Redundancy System

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Abstract: This paper is often well acceptable self moving robots, physically disabled to navigate. It's vital that, the article of obstacle or disturbance for navigation analysis for any advanced system to manage and to make the precise path for navigation. A rigid and fool proof sensing system is needed, that till not be affected from any physical worrying system like temperature and lightweight. The projected style work involves an inaudible sensing element in addition to a PIC microcontroller in conjunction with necessary signal acquisition circuit. The IR emitter and detector are additionally in addition to PIC microcontroller analog input for the redundancy of inaudible sensors. each inaudible and temperature sensors square measure in addition to analog input of embedded microcontroller and a mixture rule are going to be meted out to search out real distance full of temperature and delivers it to the pc exploitation serial input/output port and offers tuned in to the visually handicapped person exploitation voice processor with earpiece. The most theme of this project is to realize minimum struggle less quality for the visually handicapped person during this earth.

Keywords: inaudible go with Redundancy Temperature compensation, PIC Microcontroller and voice processor.

1. INTRODUCTION

The distance of obstacle activity is through with numerous strategies. Like laser, ultrasonic, Infrared, international Positioning (GPS) and frequency Identification (RFID), etc., the unhearable is best fitted to the setting temperature analysis. Applications square measure within the field of remote sensing, quality aid for visually handicapped person, in artificial intelligence and self -propelling vehicles. Self propellant vehicles square measure automatic tools that square measure helpful in industries that square measure wholly addicted to automatic machines. The unhearable devices supported the output wave whose pulse dimension varies with trip delay time of sonic pulse or distance measured & Temperature sensor with process unit. Within the second half the paper can describe a way to build associate unhearable distance activity system mistreatment temperature compensation. In associate unhearable methodology with temperature compensation to scale back the error in distance activity mistreatment sensors [1, 8, 9]. In an exceedingly survey was done of assorted ETAs supported options and performance parameters [2]. In [3] RFID based mostly walking stick was projected that assist visually handicapped person throughout walking on a passer. The employment of un hearable device in ETAs was analyzed [4]. The device contains a measuring instrument module associated an IR device with microcontroller design and five semiconductor diode based mostly attention system was developed [5, 14]. In [7] the author developed a way for position estimation of surfaces with IR sensors. The influence of temperature, pressure and wetness on unhearable rate [8, 12, 14].

A simple and low-cost proposal of obstacle measures is shown in fig. 1. The Peripheral Interface Controller (PIC) Microcontroller is employed for the information method systems and management systems. it\'s associate forty pin twin package IC factory-made by chip with serial I/O to the pc compatibility. The PIC microcontroller receives the unhearable device signaling with pulse dimension modulation. And additionally its initiate the temperature device for the redundancy, means that of at the low worth distance measured obstacle or the ETA problems. The voice recorder associated reproduce device is employed to administer alerts to the visually handicapped person through an speaker. the easy language visual basic is employed to implement this proposal for the serial knowledge affiliation between the PIC and also the laptop. MAX 232 is employed to covert this serial knowledge from microcontroller to computer.

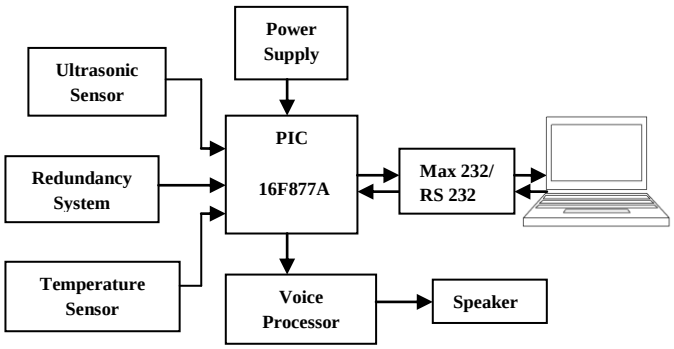

Fig 1: Block diagram for proposed method

2. PROPOSED METHOD

2.1. Ultrasonic Sensor

Ultrasonic sensors work on a principle just like measuring system or measuring instrument that evaluates attributes of a target by decoding the echoes from radio or sound waves severally. Inaudible devices generate high frequency sound waves and valuate the echo that is received back by the sensor. Sensors calculate the quantity between causation the signal associated receiving the echo to see the gap to an object.

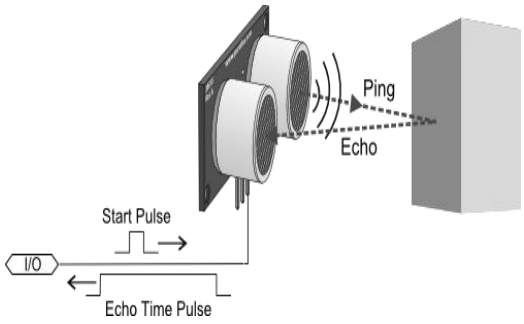

Fig 2: Ultrasonic Sensor with obstacle measures

There are many ways in which for inaudible go, like part detection technique, amplitude detection technique and round-trip time detection technique. Part detection technique has high exactitude; however the scope of testing is limited: acoustic amplitude detection is vulnerable for the mirrored wave. So, during this system, the round-trip time detection technique is adopted. Its regulation is as follows: the inaudible generator transmits the signal at a given moment, once the ultrasound wave meets the measured object; it'll be mirrored back and received by the inaudible receivers. As long as we tend to reason the echo time from inaudible transmission to receiving and recognize the propagation speed within the medium. Then, the gaps from measured object are often calculated. The formula is as follows:

$$d = s / 2 = (v \times t) / 2, \quad (1)$$

Where d is that the distance from the device to object, s is that the trip of inaudible wave, v is that the unfold speed within the medium, t is that the time from inaudible transmission to receiving. In general, the time t is often measured accurately by count the heart beat. If we tend to convert the time t to pulse variety N, then

$$d = Nc / 2f, \quad (2)$$

There is a substantial attenuation within the course of inaudible propagation, and also the attenuation is proportional to the degree of frequency. Supported comprehensive thought of the particular activity, we tend to choose 40 kHz because the operating frequency. So, if the inaudible propagation rate and time are determined, then the gaps are measured. The fundamental principle pulse period transmission and receiving is shown in below Fig 3.

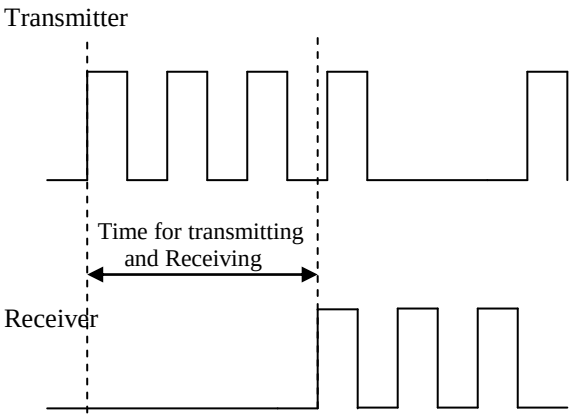

Fig 3: Ultrasonic Ranging

2.2. Redundancy System (Infrared (IR) Technology)

By victimization straightforward Infrared (IR) electrode and Detector (5mm LED/Phototransistor) redundancy are often administered for the projected system. Within the case of frequency and temperature affected atmosphere or the failure case of inaudible go sensors, the redundancies are activated during this system. The infrared is no particulate radiation of a wavelength longer than that of actinic ray, however shorter than that of microwaves. The name means that "below red" (from the Latin below, "below"), red being the color of actinic ray with the longest wavelength. Infrared has wavelengths between concerning 750 nm and one metric linear unit, spanning 5 orders of magnitude. Humans at traditional blood heat will radiate at a wavelength of 10 microns.

CIE division theme The International Commission on Illumination (CIE) counseled the division of infrared into the subsequent 3 bands:

- IR-A: 700 nm – 1400 nm (0.7 µm – 1.4 µm, 215 THz – 430 THz)
- IR-B: 1400 nm – 3000 nm (1.4 µm – 3 µm, 100 THz – 215 THz)
- IR-C: 3000 nm – 1 mm (3 µm – 1000 µm, 300 GHz – 100 THz)

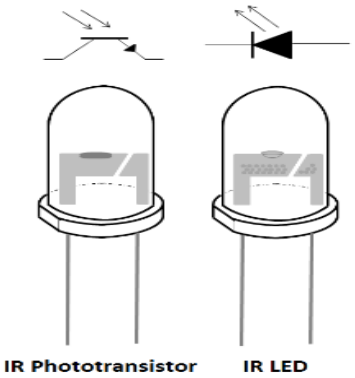

Fig 4: 5mm IR Emitter and Detector

2.2.1. IR EMITTER:

Early emitters, each visible and infrared, suffered from low power output deterioration (degradation) compared to gift day devices. Electrode chip materials, usually named as III-V compounds, square measure mixtures of parts. The contact is created by either spreading or epitaxial growing the junction. Typical materials used for emitters embrace atomic number 31 compounds and atomic number 31 metal compounds, among others. Once a forward bias current flow through the emitter's PN-Junction, Photons square measure emitted. Motorola's line of emitters operates at wavelengths of either 660,850 or 940 nanometers. This encompasses the red and also the close to I.R. parts of the magnetic force frequency spectrum. Emitters of varied wavelengths square measure made for the aim of optimizing system with a spread of applications and environments.

2.2.2. IR DETECTOR

IR Detector has reverse characteristics of the IR electrode. That's we have a tendency to cannot consume additional current from it on account of positive sensitivity. For the on top of grounds we've used 100K from the availability Voltage. Therefore the sink current are going to be as per the Ohm's Law I=V/R. so 5/100K are going to be but a microampere which can improve the detecting characteristics. IR Detector can conduct as long because the rays fall thereon. Therefore the level are going to be low which can goes to whenever there are not any rays. Standing is going to be high. From the on top of we have a tendency to square measure clearly understand that if there's no entry signal are going to be low, if there's entry signal are going to be high.

2.3. Temperature Sensor

The semiconductor unit (THERMAL RESISTOR) is employed during this style for temperature compensation that comes underneath passive electrical device classification. Semiconductor unit finds wide applications and benefits.

Here we mention some of it.

1. Fast response.
2. Smaller in size.
3. Rugged. (Not affected by shock and vibration)
4. Good sensitivity.
5. Low cost.

A semiconductor unit may be a ceramic semiconductor that exhibits an outsized amendment in resistance with an amendment in its blood heat. The word semiconductor unit is really a contraction of the words "THERMAL RESISTOR". though there square measure each positive constant (PTC) and negative coefficient(NTC) square measure offered, for our application we have a tendency to use negative coefficient(NTC) kind semiconductor unit. These NTC thermistors square measure composing of oxides like the oxides of the metal, NICKEL, COBALT, COPPER, IRON and Ti. The thermistors have higher far better} sensitivity than RTD's and square measure thus better suited to exactness temperature measurements. The supply of high resistance values permits the thermistors to be used with long extension leads, since the lead resistance or contact resistance effects may be greatly diminished. The non-linearity of the semiconductor unit resistance-temperature characteristics outs a sensible limit on the temperature span over that a thermistor may be operated in activity or feedback loop. RTD's have lower sensitivity and square measure additional linear and might thus be utilized in applications, wherever the temperature spans square measure terribly wide.

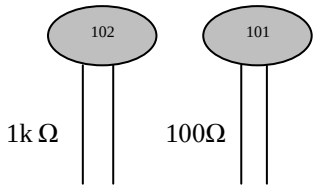

Fig 5: Thermistors

For temperature sensing we follow the same circuit what we have used for flame sensing except the value of resistors. Here we have used potential divider, where a fixed resistor of 4.7Kilo ohms acts as R1 and thermistor being R2. According to potential divider formula, drop across R2

Vd = {V/(R1+R2)}*R2

Apart from this we have a specification chart of the thermistors.

For room temperature R = 800 ohms
For 50^0 C temp. R = 650 ohms
For 100^0 C temp. R = 500 ohms
For 150^0 C temp. R = 350 ohms
For 200^0 C temp. R = 200 ohms
For 225^0 C temp. R = 125 ohms

We use this thermal resistor to live electrical device temperature that ne'er crosses quite 1500 C. we are able to all right use this thermal resistor for our application. As per the formula, on the market thermal resistor knowledge and by implementing the formula we'll get the subsequent results. The electrical device is in space worker.

Vd = {5/(4.7+0.8)}*0.8 =0.7407.....C(i)
For 100^0 C R = 500 ohms.....C(ii)

Vd = {5/(4.7+0.5)}*0.5 =0.456

As per Case (i) we tend to get output voltage of 0.7407V. As per Case (ii) we tend to get output voltage of 0.456V. By viewing the on top of knowledge we tend to are clearly known that case (i) output will drive the following NPN semiconductor device (because the voltage is on top of 0.7V). If the semiconductor device in conductivity the resistance between electrode and collector is comparatively lower. So the collector are low that's fed to the inverting SCHMITT TRIGGER are in high state. This cannot raise

fault data to pc, as a result of we've got designed the total system for low logic in failure conditions.

2.4 Voice processor

Data Storage Devices' ISD2500 Chip-Corder ® Series provides high-quality, single-chip Record/Playback solutions for 32- to 120-second electronic communication applications. The CMOS devices embody associate on-chip generator, mike pre-amplifier, automatic gain management, technique filter, smoothing filter, speaker electronic equipment, and high density multi-level storage array. Additionally, the ISD2500 is microcontroller compatible, permitting complicated electronic communication and addressing to be achieved. Recordings are hold on in on-chip nonvolatilisable memory cells, providing zero-power message storage. This distinctive, single-chip answer is created doable through ISD's proprietary structure storage technology. Voice and audio signals are hold on directly into memory in their natural type, providing high-quality, solid-state voice copy.

Speech/Sound Quality: The ISD25120 offers 4.0 kHz sampling frequency, permitting the user a far better speech quality. Increasing the period among a product series decreases the frequency and information measure that affects sound quality. The speech samples are hold on directly into on-chip nonvolatilisable memory while not the digitization and compression related to different solutions. Direct analog storage provides a really true, natural sounding copy of voice, music, tones, and sound effects not on the market with most solid-state digital solutions.

Table 1: Operating Conditions

Sl. No.	Condition	Value
01	Commercial operating temperature range(1)	0° C to +70° C
02	Industrial operating temperature range(1)	–40° C to +85° C
03	Supply voltage (VCC)(2)	+4.5 V to +5.5 V
04	Ground voltage (VSS)(3)	0 V

Notes: **1.** Case temperature.
2. VCC = VCCA = VCCD.
3. VSS = VSSA = VSSD.

3. APPLICATIONS

- This system might scale back and useful for the blind man struggle less navigation for the blind man i.e. Navigation singly.
- This system may be utilized in automatic robots, self propellant vehicles in automatic production factories etc.
- The distance activity and obstacle detection system may be utilized in places wherever correct distance activity is needed.

4. CONCLUSION

Hence that a quality aid with completely different frequencies and temperature compensation is completed. With temperature compensation the error is reduced victimization Temperature compensation technique however wetness and pressure are different factors which may be enclosed and a lot of efforts may be done on these factors. The results defines that associate Redundancy system i.e. Infrared electrode and detector is additionally wont to live distance. And it'll be activated by the visual Basic that once at ETA problems or any case of supersonic failures. The voice processor is additionally used as voice recorder and playback device to alert blind man through phone with varied messages like STOP, WALK, and DANGER etc.

REFERENCES:

[1] Rahul Kumar Rastogi, Rajesh Mehra "Efficient Error Reduction in Ultrasonic Distance Measurement Using Temperature compensation".
[2] Amit Kumar, Rusha Patra, M. Manjunatha, J. Mukhopadhyay and A. K. Majumdar, IIT, Kharagpur "An Electronic Travel Aid for Navigation of Visually Impaired Persons" International Conference on Communication Systems and Networks (COMSNETS), PP-1-5, IEEE 2011.
[3] A. A. Tahat "A Wireless Ranging System for the Blind Long-Cane Utilizing a Smart-Phone" 10th International Conference on Telecommunications (ConTEL), PP-111-117, IEEE 2009.
[4] S. Innet , N. Ritnoom "An Application of Infrared Sensors for Electronic White Stick" International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS), PP-1-4, IEEE 2009.
[5] C. Gearhart, A. Herold, B. Self, C. Birdsong, L. Slivovsky, "Use of ultrasonic sensors in the development of an Electronic Travel Aid," Sensors Applications Symposium, (SAS), PP-275-280, IEEE 2009.
[6] Physics Research International Volume 2011 (2011), Article ID 156396, 10 pages http://dx.doi.org/10.1155/2011/156396
[7] B. Ando, "Sensors that provide security for people with depressed receptors," Instrumentation and Measurement Magazine, Vol. 9, no. 2, PP-58–63, IEEE 2006.
[8] C.E. Woon, L.D. Mitchell, "Temperature-induced variations in structural dynamic characteristics. Part II: Analytical", Proc. SPIE Vol. 2868, p. 58-70, Second International Conference on Vibration Measurements by Laser Techniques: Advances and Applications, 1996
[9] SONG J. G.,LI Y. Z., XU Y. H.. Application of PIC16F877 in Ultrasonic Measuring System[J]. Mechanical Engineering &Automatic, 2007,(4): 118-120.
[10] WU W., DAI Y. W.. The Design of Ultrasonic Ranging System Based on AT89S52 MCU[J]. Journal of Zhongyuan University of technology, 2008,19(5):65-68.
[11] LIU Y. M., ZHANG Q. Z.. Design of Distance Measurement System Based on Ultrasonic Sensor[J]. Instrument Technique and Sensor, 2009,(2):109-110.
[12] ZHANG C. G.. Design of Ultrasonic Distance Measurement System Based on Microprocessor[J]. Machine Tool & Hydraulics, 2008, 36(7):208-211.
[13] Wang W. C.. Intelligent Ultrasonic distance Measurement Based on ARM[J]. Instrument Rechnique and Sensor, 2010, (7):34-36.
[14] XIAO J., NIU W., MO Y. M., et al. Design of ultrasonic distance measuring system with transmitting-receipting sensor[J]. Journal of Transducer Technology, 2003, (8):32-34.