International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

A Reliable Monitoring System Based On PIR and Ultra Sonic Sensing

K. Ajay[1], D. Ravi Kiran Babu[2]

[1]Student, Jyothishmathi Institute Technology & Science, Karimnagar, A.P, India

[2]Associate Professor, Jyothishmathi Institute Technology & Science, Karimnagar, A.P, India

Abstract: ***In the present trends of technology the embedded technical environment plays a major role in sensing and automation. We design and implement an embedded surveillance system by use of ultrasonic signal coding of ultrasonic sensors with multiple pyro-electric infrared sensors (PIR) to detect an intruder in a home or a storehouse. The PIR sensors are placed on the ceiling, and the ultrasonic sensor module consists of a transmitter and a receiver which are placed in a line direction; however, ultrasonic sensors with the same frequency are subject to interference by crosstalk with each other and have a high miss rate. We design and implement an embedded surveillance system by use of ultrasonic signal coding of ultrasonic sensors with multiple pyro-electric infrared sensors (PIR) to detect an intruder in a home or a storehouse. The status will be sent to monitoring unit through ZIGBEE wireless communication.***

Keywords: Embedded Surveillance System; Majority Voting Mechanism; PIR Sensor; Ultrasonic Sensor

1. Introduction

Technology is the word coined for the practical application of scientific knowledge in the industry. The advancement in technology cannot be justified unless it is used for leveraging the user's purpose. Technology, is today, imbibed for accomplishment of several tasks of varied complexity, in almost all walks of life. The society as a whole is exquisitely dependent on science and technology. Technology has played a very significant role in improving the quality of life. One way through which this is done is by automating several tasks using complex logic to simplify the work.

Recently surveillance systems have become more important for everyone's security. The embedded surveillance system, frequently used in a home, an office or a factory [1-3], uses a sensor triggered to turn on a camera [4-5]. Some designs use different types of sensors to achieve reliability by means of the different features of each sensor [6-7]. In this paper we extend our previous design not only by using both multiple PIR sensors and ultrasonic sensors as a sensor group, but also by using the MVM. Ultrasonic receivers and transmitters are located at opposite ends [8-9]. However, to reduce the interference from other frequencies in ultrasonic signals, we use a coding signal to enhance the ability to distinguish the random interference [10]. To enhance system reliability in the experiment, we focus on how to improve the shortcomings of the ultrasonic sensor. Some research explores the influence of attenuation in air and crosstalk of ultrasonic signals by using a coding signal [11-12], while some provides improvement of the ultrasonic signal by using different coding signal types [13-14]. Other research uses the application of a coding signal to increase resolution and contrast of images [15]. Yet another approach build a 3D image with an ultrasonic sensor in the PN code that solves the problem with time delay [16]. To enhance the reliability of the ultrasonic sensors group, we propose adding to the number of bits with coding to reduce the probability of code breaking.

2. System Design Model

In the modules of the ultrasonic sensor groups the transmitter and the receiver are separated. The transmitter circuit generates a multi-frequency square waveform, and the receiver circuit amplifies the received signals and filters out any noise. When a transmitter transmits an ultrasonic coding signal, the ultrasonic receiver determines whether there is an intruder passing through the sensing area. If there is no intruder, the MCU (Micro Controller Unit) will use the predefined ultrasonic signal pattern to decode the received signal. Use of relay stations and frequency conversion extends the sensing range.

A. Hardware Section

Recently surveillance systems have become more important for everyone's security. The embedded surveillance system, frequently used in a home, an office or a factory, uses a sensor triggered to turn on a camera. Some designs use different types of sensors to achieve reliability by means of the different features of each sensor. The PIR sensors are placed on the ceiling, and the ultrasonic sensor module consists of a transmitter and a receiver which are placed in a line direction; however, ultrasonic sensors with the same frequency are subject to interference by crosstalk with each other and have a high miss rate. To overcome these disadvantages of the ultrasonic sensor, our design reduces the miss rate from the environmental interference by using an ultrasonic coding signal. Both ultrasonic sensors and PIR sensors are managed by the majority voting mechanism (MVM).When the system detects any intruder presence in house it will send an alert to the monitoring section through ZIGBEE wireless communication.

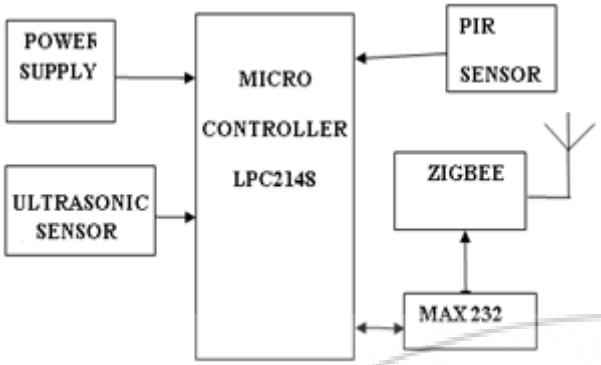

Figure 1: Block Diagram of Transmitter Section

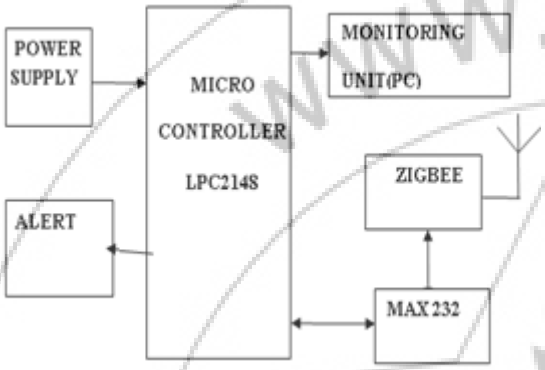

Figure 2: Block diagram of monitor section

We use two groups of the external hardware circuits, the PIR and the ultrasonic sensor group, which are shown in fig: 1 and 2. As the PIR sensor produces a weak voltage, we input the sensed signal to a two-stage OP amplifier to amplify the weak voltage by about1000 times. Since the amplified signal changes between positive and negative voltage, we input this signal to the absolute value circuit, and then we input it to the adjustable comparator to compare the sensing voltage and the reference voltage which are set according to the environment temperature.

B. Software Section

This is an Operating System (OS) on which all the software applications required for our design are going to be run. This OS is flexible to any user to operate and easy to understood. Accessing the soft wares and using them is very convenient to user. The µVision development platform is easy-to-use and it helps you quickly create embedded programs that work. The µVision IDE (Integrated Development Environment) from Keil combines design management, source code editing, program debugging, and complete simulation in one powerful environment. Code written in 'EMBEDDED C'. The µVision3 IDE is a Windows-based software development platform that combines a robust editor, design manager, and makes facility. µVision3 integrates all tools including the C compiler, macro assembler, linker/locator, and HEX file generator.

3. Experimental Results

In the experiment results we found that an ultrasonic signal would be affected by environment sounds and the amplitude of the reference voltage. Those factors affect the transmission distance and the error rate of detecting. We therefore put the transmitter and the receiver on both ends of the sensing area and make sure the intruder passes through if the outside group has detected an individual.

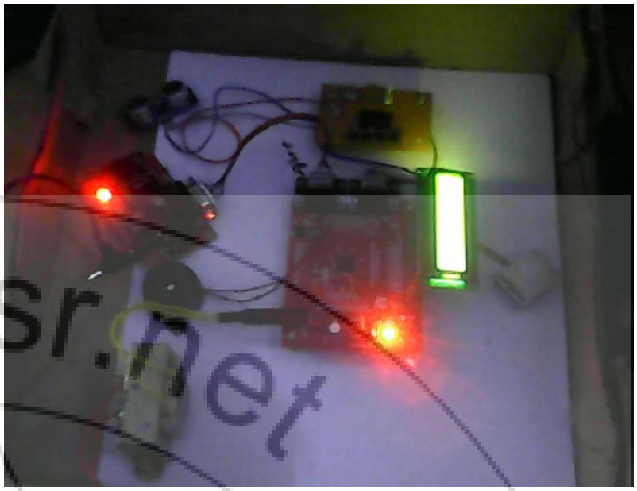

Figure 3: experimental Kit with Power Supply

In order to establish the serial communication between transmitter zigbee, receiver zigbee. Weneed to set the baud rate as 9600 bps in PC

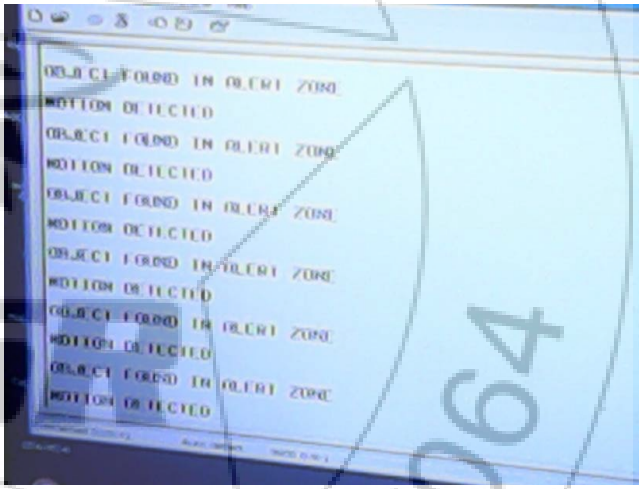

Figure 4: Motion Detected and analysis in PC.

4. Conclusion

Our experiment shows two different types of sensors which are enhancing the overall sensing probability by using theMVM to reduce the shortcomings of both the ultrasonic sensors and the PIR sensors. By adding an ultrasonic coding signal our design reduces the miss rate of the receiver with ultrasonic sensors by different patterns, improving the reliability of the overall system.

References

[1] Jun Hou, Chengdong Wu, Zhongjia Yuan, Jiyuan Tan, Qiaoqiao Wangand Yun Zhou, "Research of Intelligent Home Security Surveillance System Based on ZigBee," International Symposium on Intelligent Information Technology Application Workshops, Shanghai, 21-22 Dec.2008, pp. 554-57.

[2] Xiangjun Zhu, Shaodong Ying and Le Ling, "Multimedia sensornetworks design for smart home surveillance," Control and Decision Conference, 2008, Chinese, 2-4 July 2008, pp. 431-435.
[3] L. Lo Presti, M. La Cascia, "Real-Time Object Detection in EmbeddedVideo Surveillance Systems," Ninth International Workshop on Image Analysis for Multimedia Interactive Services, 7-9 May 2008, pp.151-154.
[4] Wen-Tsuen Chen, Po-Yu Chen, Wei-Shun Lee and Chi-Fu Huang,"Design and Implementation of a Real Time Video Surveillance System with Wireless Sensor Networks," VTC Spring 2008. IEEE VehicularTechnology Conference, 11-14 May 2008, pp. 218-222.
[5] MikkoNieminen, TomiRaty, and MikkoLindholm, "Multi-SensorLogical Decision Making in the Single Location Surveillance Point System," Fourth International Conference on Systems, France, 1-6March 2009, pp. 86-90.
[6] Ying-Wen Bai, Li-SihShen and Zong-Han Li, "Design andImplementation of an Embedded Surveillance System by Use ofMultiple Ultrasonic Sensors", The 28th IEEE International Conferenceon Consumer Electronics, Las Vegas, Nevada, USA, 11-13 Jan. 2010, 11.1-3, pp. 501-502.
[7] Yang Cao, Huijie Zhao, Na Li and Hong Wei "Land-CoverClassification by Airborne LIDAR Data Fused with Aerial Optical Images," International Workshop on Multi-Platform/Multi-SensorRemote Sensing and Mapping (M2RSM), Jan. 2011, pp. 1-6.
[8] Hai-Wen Zhao, Hong Yue, and He-GaoCai, "Design of a DistributedUltrasonic Detecting System Based on Multiprocessor for Autonomous Mobile Robot," Proceedings of tbe 2007 WSEAS Int. Conference onCircuits, Systems, Signal and Telecommunications, Gold Coast, Australia, January 17-19, 2007, pp. 59-64.
[9] Zi-LI Xie and Zong-Han Li, "Design and implementation of a homeembedded surveillance system with ultra-low alert power," IEEE Transactions on Consumer Electronics, Feb. 2011, pp. 153-159.
[10] Francesco Alonge, Marco Brancifortem and Francesco Motta, "A novelmethod of distance measurement based on pulse position modulationand synchronization of chaotic signals using ultrasonic radar systems,"IEEE Transactions on Instrumentation and Measurement, Feb.2009, pp.318-329.
[11] ShragaShoval and Johann Borenstein, "Using Coded Sognals to Benefitfrom Ultrasonic Sensor Crosstalk in Mobile Robot Obstacle Avoidance,"IEEE International Conference on Robotics and Automation, Seoul,Korea, 21-26 May, 2001, vol.3, pp. 2879-2884.
[12] Hannes Elmer, and Herbert Schweinzer, "High Resolution UltrasonicDistance Measurement in Air Using Coded Signals," The 19th IEEE Conference on Instrumentation and Measurement TechnologyConference, Anchorage, AK, USA, 21-23 May, 2002, vol.2, pp. 1565-1570.
[13] Rodrigo Pereira Barretto da Costa-Felix and Joao Carlos Machado,"P1G-9 Stepped Sine Versus Coded Pulse As Excitation Signals forUltrasonic Transducer Calibration in a Non-Linear Propagation Field,"IEEE Conference on Ultrasonics symposium, 2-6 Oct, 2006, pp.1398-1401.
[14] Fernando J. Alvarez, A. Jesus Urena, varoHermamdez, Ana Jimenez,Carlos de Marziano, M. Jose Villadangos, and M. Varmen Perez, "Detecting Ultrasonic Signals in a Turbulent Atmosphere Performanceof Different Codes," IEEE International Symposium on IntelligentSignal Processing, 3-5 Oct, 2007, pp. 1-6.
[15] Jose R. Sanchez, Marko Orescanin and Michael Oelze, "Improvingimage contrast using coded excitation for ultrasonic imaging", IEEE International Conference on Electro/Information Technology, 20-22May, 2010, pp.1-6.
[16] Hongbo Zhu, Hiroki Inubushi, Noriyuki Takahashi and Kenji Taniguchi,"An ultrasonic 3D image sensor employing PN code", The 5th IEEE conference on Sensors, Daegu, Korea, 22-25 Oct, 2006, pp. 319-322.

Author Profile

K. Ajay,Pursuing M. Tech Embedded Systems Dept. of ECE In Jyothishmathi Institute Technology & Science, Nustulapur, Karimnagar -District, A.P, INDIA.I Have Completed B.Tech From VITS college At Karimnagar.I Have Attended 2 National Workshops And I Have Given 1 Paper Presentation In Nation Level .

D. Ravi Kiran Babu, M.TECH, MISTE, Working As Associate PROFESSOR In Dept. Of ECE From Jyothishmathi Institute Technology & Science, Nustulapur, Karimnagar--District, A.P, He Has Completed M. Tech Digital Systems & Computer electronics From JNTUH Hyderabad And has completed B. Tech from Pullareddy engineering college at Kurnool Worked In Various Engineering Colleges And Have 17 Years Of Teaching Experience. He Has Presented 3 National &1 international Papers. He Has Published 2 Research Papers In National And International Journals