DETECTION OF HUMAN BEINGS UNDER BUILDING RUBBLE

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ABSTRACT

"Thousands of people killed as an effect of building disaster". The above words are not the headlines of the newspaper but such news come after the disaster destroyed the field. It was said if survivors has been found and rescue earlier the numbers of victims have been lower. Existing systems to detect the human being are the dogs, optical devices and acoustical life detectors and the rescue robot. Acoustical detectors such as geophones require quite working environments, a condition difficult to reach especially in critical situations the other methods such as, rescue robot can navigate deep into rubble to search for victim by the use of temperature sensor but they are unable to trap once they go out of range. The microwave life detection system is developed for the search and rescue of victims trapped under the rubble of collapsed building during the earthquake or other disasters. Comparing with the existing systems, the proposed life detection system has an advanced microwave beam the reflected wave from the human will be modulated by human being movements, which includes breathing and heartbeat. Hence the efficiency is increased and reduces the time taken for the rescue process which leads to reduction in death rate.

Keywords: Microwave sensor, PIC Microcontroller, ZigBee, MPLAB, RS 232

I. INTRODUCTION

In this global criterion natural calamities are unaccounted and are not easily solvable crate. Those unusual happenings result in human lives being left forever. Taking this portion of saving those suffered under this bondage, a new revolutionary microwave life detection system which is used to locate human beings buried or trapped under earthquake rubble has been designed. This system operating at particular frequency can remotely detect the breathing and heart beat signals of human beings buried under this rubble. By proper processing of these signals, the status of the human being under trap can be easily obtained. The entire process takes place within a few seconds as the system is controlled by a PIC Microcontroller unit.

Information about the location of buried person would be of great value for the rescue personnel, since it would help to reduce the time of operation and thus, help to save more lives. There is a need to construct a life detection system which can detect buried victims under earthquake or building debris most efficiently and as possible in short time. Such kinds of problems have been efficiently solved considering continuous waves which offer good localization and spatial accuracy.

In rescue mission and also in some surveillance operations there is not only the need of detect life signals but also the identification of people in a given area, to help rescue side operations in case of emergencies. This job can be complied with through wall surveillance techniques.

II. LITERATURE SURVEY

[1] Human detection in an unmanned area can be done only by an automated system. The system uses ultrasonic sensors and camera to trace, convey and analyze conditions of human body. In order to detect a human body, an independent robot must be equipped with a specific set of sensors that provide information about the presence of a person in the environment around. This effort describes an independent robot for rescue operations. Ultrasonic sensor is used in order to detect the existence of living humans and a low-cost camera in order to acquire a video of the scene as needed. Having detected a hint of a living human, the ultrasonic sensor activates the camera to show live picture. The video is then exhibited on the screen. This approach requires a fairly small number of data to be acquired and processed during the rescue operation. The detection depending on a number of factors such as the body position and the light intensity of the scene.

[7] Doppler Effect based methods for detection of live human beings, however, they are not able working effectively under realistic conditions, for example, when attenuation of sounding signals is so large that the signal reflected from the wall exceeds significantly (by factor of many orders) the signal scattered by a target behind the wall. Besides, the need of weak signal detection under presence of strong signal reflected by the wall and other objects brings also considerable difficulties. For the above and some other reasons the known systems are useless for solving the problem of Through Wall Detection and Recognition.

III. PROPOSED METHOD

This section includes detail description of block diagram of Detection of human beings under building rubble. Also with this there is explanation of various parts of microwave system.

3.1 Principle of Working

The principle of detection is firstly, microwave is sent through rubble to detect vital signs of life. Microwave would reflect back from some objects. These objects include humans. When the beam hits the body, the signal reflected with an additional modulation created by movement of heart and lungs. So, the reception of modulated signals shows the presence of alive human inside the rubble. With the modulated signal there are some signals, which are reflected from the immobile object such as rubble or debris. Thus in order to maintain a high sensitivity for this application, the wave reflected from the rubble or the surface of the ground has to be cancelled as thoroughly as possible. A microwave life detection system operated on the radio frequency was proposed in the 1985. This system detects the body oscillations occur due the breathing and heartbeat fluctuations. The system includes the additional subsystem to cancel the unwanted signals receive from the motionless objects such as rubble.

3.2 Frequency Bands

The microwave life detection system can works on different range of frequencies from L-band (2GHz) to X-band (10GHz). But X- band microwave is unable to penetrate deep into the building rubble. It can penetrate

building rubble up to 1.5 ft in the thickness (5 layers of bricks). while L- band can enter the rubble of about 3 ft in thickness (10 layers of bricks).

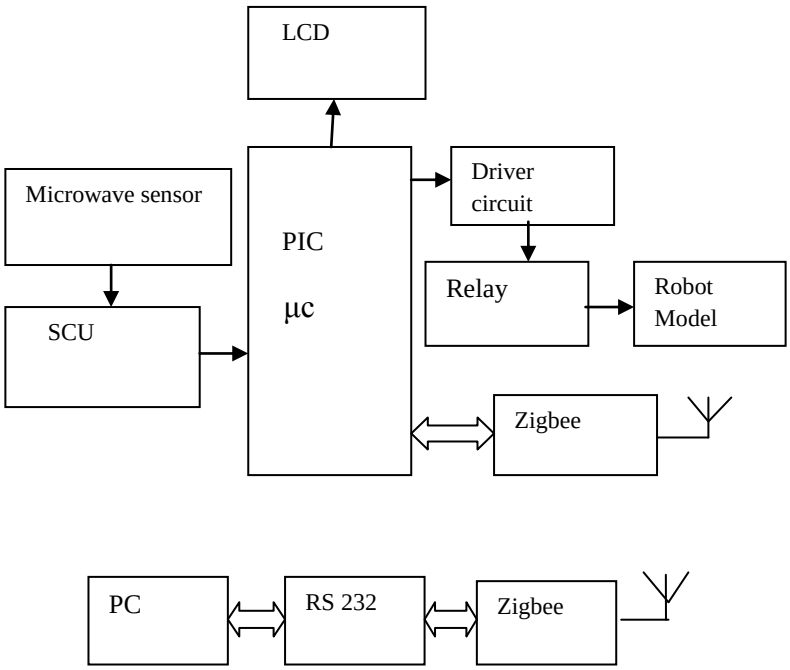

Fig 1. Transmitter and receiver side block diagram

Due to the fact that lower frequency will be more capable of detecting vital signs through very solid rubble, so frequency of an electromagnetic wave needs to be in the L-band or S-band range, For this cause, the microwave life detection system which operates on the L-band frequency. This system is supposed to quite efficient to trap the breathing and heartbeat signals of victims who are completely trapped and too weak to respond.

3.3 Driver Circuit

A driver circuit has its own 12V power supply making it self contained but the power supply portion can be left out if an external supply will be used. The output from the power supply shown by the circuit, can be used to power other devices but it should be noted that the supply is unregulated and not particulary powerful with the parts declared. The 12V DC output is appropriate for powering a few LEDs or low voltage lights but should not be used to power other electronic boards or motors.

3.4 Signal Conditioning Unit (SCU)

The signal conditioning unit accepts input signals from the analog sensors and gives a conditioned output of 0-5V DC corresponding to the entire range of each parameter. This part also accepts the digital sensor inputs and gives outputs in 10 bit binary with a positive logic level of +5V. The calibration voltages* (0, 2.5 and 5V) and the health bits are also generated in this part. Microcontrollers are widely used for control in power electronics. They offer real time control by processing analog signals obtained from the system. An appropriate isolation interface needs to be designed for interaction between the control circuit and high voltage hardware. It provides necessary interface between a high power grid inverter and a low voltage controller unit.

3.5 Zigbee

The specification is a combination of Home RF Lite and the 802.15.4 specification. The specification runs in the 2.4GHz (ISM) radio band - the similar band as 802.11b normal, Bluetooth, microwaves and some other devices. It is skilled in connecting 255 devices per network. The design supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZigBee's tools is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices.

WPAN Low Rate or ZigBee provides specifications for devices that have low data rates, low power consumption and are thus characterized by long battery life. ZigBee creates possible complete network homes where all devices are able to communicate and be controlled by a single unit. ZigBee designed to enable two-way interactions, not only will the consumer be able to monitor and keep track of domestic utilities usage, but also supply it to a computer system for data analysis.

3.6 Rs-232

It is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is frequently used in computer serial ports. Electrical signal characteristics such as voltage levels, timing and slew-rate of signals, short-circuit behavior and maximum stray capacitance. The general standard does not define elements such as character encoding (for example, ASCII, Baudot), or the enclosing of characters in the data stream (bits per character, start/stop bits, parity). The general standard does not define protocols for error detection or algorithms for data compression. The general standard does not define bit rates for transmission, although the general standard says it is intended for bit rates lower than 20,000 bits per second. Many recent devices can exceed this speed (38,400 and 57,600 bit/s being common, and 115,200 and 230,400 bit/s making special appearances) while using RS-232 compatible signal levels. Details of character format and broadcasting bit rate are controlled by the serial port hardware, frequently a single integrated circuit called a UART that converts data from parallel to serial form. A usual serial port includes focused driver and receiver integrated circuits to convert between internal logic levels and RS-232 compatible signal level.

3.7 Relay

It is an electrically operated switch. The flow of current through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The current from the coil can be on or off so relays have two switch positions and they are double throw switches. A relay normally allows one circuit to switch a second circuit which can be completely separate from the first. The relay coil passes a relatively large current, usually 30mA for a 12V relay, also it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the accepted 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

3.8 Pic 16f877

Various microcontrollers offer different kinds of memories. Among EEPROM, EPROM, FLASH etc. FLASH is the most recently developed. Methodology that is used in pic16F877 is flash technology, so that data is

maintained even when the power is switched off. Easy Programming and removing are other features of PIC 16F877.

3.9 Mplab Ide

MPLAB provides development engineers with the flexibility to develop and debug firmware for various Microchip devices. It is also a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and dsPIC digital signal controller (DSC) families.

MPLAB SIM is a discrete-event simulator for the PIC microcontroller (MCU) families. It is incorporated into MPLAB IDE. The MPLAB SIM correcting tool is designed to model operation of Microchip Technology's PIC microcontrollers to assist users in debugging software for these devices.

IV. CONCLUSION

A new sensitive life detection system using microwave radiation for locating human beings buried under hidden various barriers have been designed. This system operating either at L (or) S band (or) UHF band can detect the breathing and heart beat signals of human beings through earthquake rubble and this technique stands better rather than searching in depth to the core to obtain relevant information and diagnosing it. This analyzing method proves to be an efficient solution and can be implemented with an ease of build and doesn't require any skilled labour for its usage.

In future, depending upon the development of technology, we can enhance the system so that it will able to detect number of victims buried under the respective rubble. Then rescuer will desire area with more number of victims. Eventually, our system can save more lives.

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REFERENCES

[1]. Chen,K. M.,D. Misra,H. Wang,H. L. Chueng, et al ., 'Xband M/W life-detection system,' IEEE Trans. Biomedical Eng., Vol. BME-33,697–701,July 1986.

[2]. Aggelopoulos,E. G.,E. Karabetsos, Constantinouan N. Uzunoglu, et al 'Robot for detection of trapped human beings,' Measurement: Journal of the International Measurement Confederation, Vol. 18,No. 3,117–183,July 1996.

[3]. Arai, I. ; Univ. of Electro-Commun., Tokyo, Japan et al 'Human detection using Doppler radar,' Measurement: Microwave Conference, APMC,Asia-Pacific Vol. 2, 2001

[4]. Aspirant Lesya Anishchenko et al, 'Non-contact Remote Bio-Radiolocation' presented at Bauman MoscowState Technical University, January 2004.

[5]. S.I. Ivashov, V.V. Razevig, A.P. Sheyko, I.A. Vasilyev, et al, 'Detection of human breathing and heartbeat by remote radar', Progress in Electromagnetic Research Symposium, Pisa, Italy, March 28 – 31,2004.

[6]. Kun-Mu Chen ; Dept. of Electr. & Comput. Eng., Michigan State Univ., East Lansing, MI, USA ; Yong Huang ; Jianping Zhang ; Norman, A et al ' Microwave detection', Biomedical Engineering, Volume:47,Issue: 1 , April 2006.

[7]. Konstantin Lukin and Vladimyr Konovalov, et al, 'Through wall detection and recognition of human beings using noise radar sensors', National Academy of Sciences of Ukraine,june 2007.

[8]. Sevgi Zübeyde Gürbüz et al, 'Radar Detection And Identification Of Human Signatures Using Moving Platforms' presented at Georgia Institute of Technology, December 2009.