

## Live Human Detection System for Earthquake Rescue Operation

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### ABSTRACT

Natural calamities do occur and they are unstoppable. But humans are becoming increasingly aware in the concept of intelligent rescue operations in such calamities so that precious life and material can be saved. Earlier techniques were aimed at sending mini robots consisting of PIR (Passive Infrared Rays) sensors built in them to detect the presence of human buried under Earth. The drawback of this system is that, there are chances for the robot to get struck during the calamity. Here is a proposal for a system which replaces the robots by a source of IR (Infrared Rays). This technique detects the alive human and rescues in a short duration.

**Keywords:** PIR sensor, Microcontroller unit, intelligence rescue.

### INTRODUCTION

A major earthquake occurred in Nepal on 12 May 2015 at 12:50 pm local time (07:05 UTC) with a moment magnitude of 7.3, 18 km (11 mi) southeast of Kodari. The epicenter was on the border of Dolakha and Sindhupalchowk, two districts of Nepal. In Nepal, at least 153 people were killed by the earthquake and more than 3,200 people were injured, primarily in mountain regions of the northeast.

TABLE I: Total Number of Death and Injuries in 2015 Earthquakes

Country	Deaths	Injuries
Nepal	153	3,275
India	62	~200
Bangladesh	2	~150
China	1	3
Total	218	3,500+

This huge loss of man power could have been minimized of, if an effective method was used inspite of normal way of identifying the buried humans. The use of PIR detecting system would be greatly useful in achieving this. A unique Passive Infrared sensor is used in the project which emits infrared rays to detect humans. As live human body emits thermal radiation it is received and manipulated by the PIR sensor to detect humans. Once the people are located it immediately gives audio alert to the authorities so that help can reach the live person so fast. This PIR sensor is placed on a detector which is capable of transmitting and receiving the PIR rays. PIR rays are used because their effect on human beings are very less in comparison with those caused by active Infrared rays. Here the principle of thermal sensing is used.

### EXISTING SYSTEM

In the current system the PIR sensor is placed on a moving all direction robot that can maneuver in the earthquake prone areas. The robot is driven on a geared dc motor for increased torque and low speed and stepper motor for increased turning accuracy hence the precise control of position is monitored. The robot consists of a three wheel geared drive with DC motors attached to perform forward and reverse movement and this serves the purpose of detecting the buried people through transmitting and receiving the PIR rays. The main drawback of the system is that it is more prone to get struck under the deformed structures and also it is not cost efficiency [1].

### PROPOSED SYSTEM

In order to overcome the above said drawbacks here is a proposal for a system which replaces the DC driven robot by a detector. The detector acts as a platform for the PIR sensor. Through this method those buried under impediment can be recognised and can be rescued as soon as possible.

### HARDWARE COMPONENTS

Embedded Microcontroller PIC

PIR sensor

Detector

Zigbee Transmitter and Receivers

Alarm

PC Interfacing

### SOFTWARE TOOLS

MPLAB IDE - for Controller programming

Visual Studio for pc interface programming

### DESCRIPTION

The detector which is enabled with the PIR sensor detects the body temperature of the human buried under the earth. Fig. 1, shows that once the living body temperature of human body is detected the PIR sends signal to the microprocessor. The microprocessor digitalizes the signal and sends it to the interfacing unit through zigbee, which is followed by sounding of alarm and visual image to alert the officials in charge.

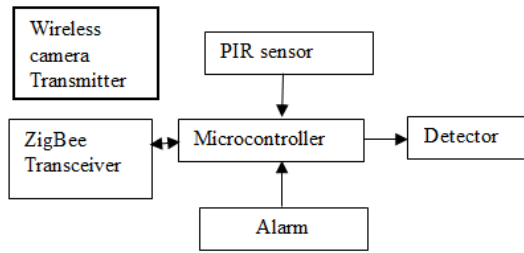


Fig 1: Block diagram for proposed system

The data collected in the spot is spontaneously sent to the district headquarters through zigbee for pursuing further help. As shown in fig. 2, In the head office they collect the data from zigbee to the PC via voltage conversion circuit and PC interfacing unit.

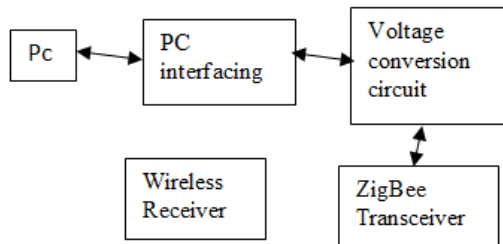


Fig 2: Control Room Module

### MICROCONTROLLER

PIC16F877A is the microcontroller used in the proposed method. Signals from PIR sensors are given to the microcontroller and this microcontroller will digitize the signal and send it to the Zigbee. The controller has peripheral features like inbuilt ADC (Analog to Digital Converter), required to get the signals from the various sensors. Beside this the microcontroller that is used in this method has some additional advantages. It has Maximum clock frequency of 20MHz and hence faster than 8051. It is based on RISC and Harvard architecture and hence even more faster. Embedded C is used for programming the microcontroller. This microcontroller instruction execution speed of 200ns, it is an CMOS FLASH based 8-bit microcontroller. It has Microchip's powerful PIC architecture. It has 14K

Flash program memory and 368 Bytes of RAM (Random Access Memory). It is based on only 35 instructions and has inbuilt high speed high resolution ADC and also features like USART, SPI, I<sup>2</sup>C communication capabilities are present [2].

### PIR SENSOR

As live human body emits thermal radiation it is received and manipulated by the PIR sensor to detect humans. PIR sensors are passive infrared sensors. They detect change in the heat and this can be used to detect movement of people. It has digital output and can be directly given to Integrated Intelligent Research (IIR) the digital pins and no ADC is needed. It operates at 5V DC. The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared (heat) levels emitted by surrounding objects. This motion can be detected by checking for a sudden change in the surrounding IR patterns. When motion is detected the PIR sensor outputs a high signal on its output pin. This logic signal

can be read by a microcontroller or used to drive a transistor to switch a higher current load. Detection range up to 20 feet away [3]. Some additional advantages of using PIR sensor are

- Single bit output
- Jumper selects single or continuous trigger output
- Mode, 3-pin SIP header ready for breadboard or through whole Project,
- Small size makes it easy to conceal.

### ZIGBEE TRANSCEIVER

It is used to send and receive data between robot and the control unit. Zigbee is a digital wireless communication protocol. It is a very low power communication technology. Zigbee is a very versatile communication technology that can be used for many applications like

- Industrial Automation
- Home Automation
- Sensor Networks
- AD Hoc Networks
- Wireless control

XBee and XBee-PRO Modules were engineered to meet Zigbee/IEEE 802.15.4 standards and support the unique needs of lowcost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of critical data between devices. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other [4], [5]. As shown in fig. 3 and fig. 4 the zigbee works and process the signal.

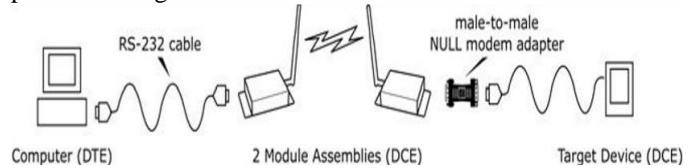


Fig 3: Working of Zigbee

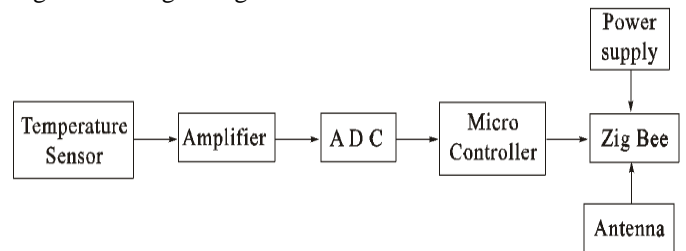


Fig 4: Processing of the signal

### VOLTAGE CONVERSION CIRCUIT

The operating voltage of Zigbee transceiver and PC are different hence we need a voltage conversion circuit. As shown in fig.5, PC Interface circuit is needed whenever an external hardware component is to be connected to a computer. This circuit is required to connect to the serial port of a computer. The serial port of the computer is also called the RS232 port, because it is based on the RS232 standard RS232 is a serial communication standard that uses voltages (+12V/-12V) different from conventional digital circuits (0V/5V) [6].

### ADVANTAGES

- ❖ This System is an effective and a safe system to ensure that there are no humans left behind in a rescue operation.
- ❖ The system uses Zigbee and this makes the system

both accurate and reliable.

- ❖ The use of detector in the place of robots ensure that no problem occurs in transmission of the signals and also overcomes drawback of having got struck under the rubbles.

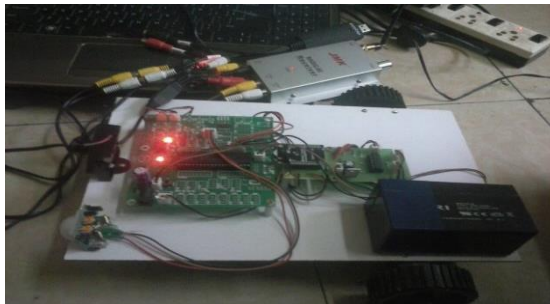


Fig 5: PC interfacing

### CONCLUSION

Using PIR detecting system life can saved with minimum expenditure. It is also time conserving which helps in detecting the affected within a short time and rescuing them as soon as possible. This proposal greatly helps in reducing the death rate.

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