An Embedded Low-Cost Robot for Detecting Alive Human Presence and Assisting Rescue Operations

Sreedevi N Parameswaran, Vinu Vijayan, Salima M Beeras, Shareena E M
Dept. Of Electronics,
MES College Marampally

***Abstract* --The project proposes a new approach for detecting alive human beings in the devastated environments during natural calamities. The disaster may include earthquakes, flood, storms etc. This robotic system uses various set of sensors that includes Passive Infra-Red Sensor (PIR), Infrared Sensor (M395), Temperature sensor (LM35), Ultra-sonic sensor (HC-SR04), flame detector (LM393) etc. which gives the information about the devastating environment, unnamed obstacles and the presence of alive human body. There is a microcontroller ATmega328p holds all of these sensors which is attached with a movable robotic system. This robot can be controlled using a PC. When such natural or any other disasters are occurred, peoples may get stranded or got captured inside those buildings that are affected. To collect data from here manually going inside won't be that easy. At such times, these kinds of miniature robots will be very useful for collecting data. The components used for this robot is very cheap and easily available and that's how this system becomes different than any other existing system.**

Keywords: Arduino, Low-cost, Embedded robot, PIR, LM35, LM393, HC SR-04

I.INTRODUCTION:

This project proposes an approach for detecting human presence in devastated environments. Disasters can be human-induced and natural. The natural disasters include Earthquakes, Flood, Storms, etc. And an urban area is very susceptible to human-induced disasters. They include Industrial accidents, Transportation accidents etc. In all these kinds of situations, people are suffered and various rescue operations are carried out. To collect the data or to check if people are trapped inside, manually going inside won't be that easy for humans but rescue operations should be carried out immediately. During such situations, to help and make the rescue faster, miniature mobile robotic systems are used. This project proposes such robotic system which detects the presence of humans and collects data.

The robotic system uses a special live body sensor called PIR sensor to detect human presence. It senses the passive infrared rays emitted by the human body. In this project, we are using ZigBee for the wireless communication. The collected data is transmitted and received at remote PC using the ZigBee transceiver. It also includes other sensors like infra-red sensor (M395), temperature sensor (LM35), flame detector (LM393), ultrasonic sensor (HC-SR04) etc. There is also a microcontroller ATmega328p holds all of these sensors which is attached with the mobile robot. And it is controlled using the PC.

All the components in this proposed system are standard and easily available. This makes the robot cheaper and easy to build. And that's how the proposed system is different from the any other existing system

II. BLOCK DIAGRAM:

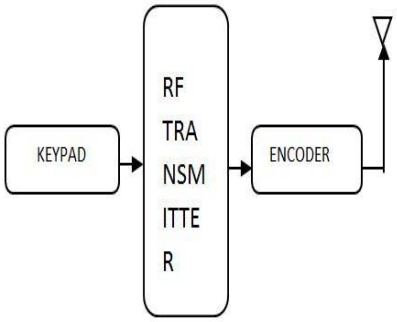

Fig 1: Transmitter section

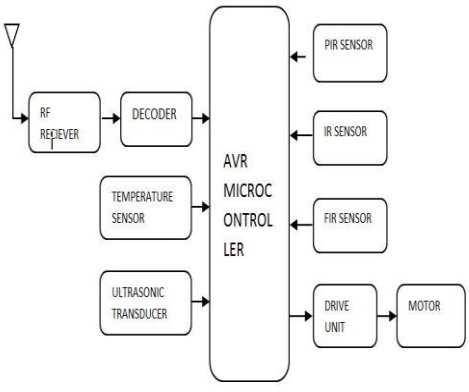

Fig 2: Receiver section

III. BLOCK DIAGRAM EXPLANATION:

1. AVR Microcontroller

The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of

almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on our 28 pin AVR Development Board

2. PIR Sensor

The passive infrared sensor detects the motion with the variation of infrared radiation. It is small, inexpensive, low power device consists of multiple facets with each part containing Fresnel lens. Fresnel lens can detect level of infrared radiation. It provides single bit digital output and is compatible with all microcontrollers. The motion of injured person can be detected with this sensor.

3. IR Sensor

Infrared sensor consists of two sections-transmitter and receiver. Transmitter continuously sends the IR signal and receiver receives the reflected light from the obstacle. So, it has been used as the obstacle detector in the proposed system. Whenever receiver receives reflected IR signal LED glows indicating obstacle is detected on its path.

4. Temperature Sensor

LM35 has been used as a temperature sensor in the system. It is a precision IC temperature sensor with its output proportional to the temperature (in 0C). With LM35, temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1 0C temperature rise in still air.

5.Ultrasonic Sensor

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. The sensor is act as a transducer, the sensor head transmit an ultrasonic wave and receives the wave reflected back from the target. Sensor head measure the distance to the target by measuring the time between the emission and reception.

6.Fire Sensor

Fire sensor also known as flame detector is a sensor is designed to detect and respond to the fire or flame. It conducts a small amount of current in micro amps. The feedback signal will give to the processor that there is a flame established.

7. Motor

Geared motor is a simple DC motor with gear box attached to the shaft of the motor which is mechanically commutated electric motor powered from direct current. 60RPM Centre Shaft DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring.

8. RF Tranciever

RF transceiver module is a small electronic device provided a transmitter and a receiver. It is often desirable communication with two devices in an embedded system wirelessly. The rf transceiver module is very simple and offers low current consumption.

IV. WORKING PRINCIPLE:

The robot is manually controlled by the keys provided in the transmitter section using RF technology. The robot is sent to the field and it is controlled from the base station. Base station consists of PC communicated with robot via high band RF communication. The robot consists five sensors. Based on the signals from the sensors the movement is controlled manually. An IR sensor basically detects the obstacle on the path of the robot. PIR sensor is used as motion detector in the proposed system based on the variation of infrared radiation. Temperature sensor is used for measuring temperature and fire detector is used to detect the presence of flame in the area. An ultrasonic sensor can be used for detecting the unnamed obstacles from outside. When the robot is deployed in such environments, the sensors start collecting data and transmit it through a wireless transceiver and received at the base station. This data will be helpful to the rescue operations and it also helps to detect the human presence in such an environment.

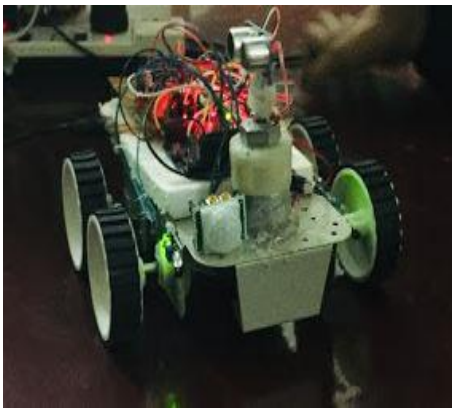

Figure3: Working Model

V. CONCLUSION:

This project proposes a low-cost PC controlled robot that can be deployed in the devastated condition for assisting in the rescue operations. This system is different from any other existing system because of the use of sensors that are cheaper and easily available. When the robot is deployed in such environments, it detects human presence using PIR sensor and continuously send messages regarding the current situation of the spot.

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