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AUTOMATIC AND MANUAL CONTROLLED ALIVE HUMAN DETECTION ROBOT DURING DISASTER MANAGEMENT

Shwetha R[1], Dr. Chethan H K[2]
[1]M.Tech Student, [2]Associate Professor
Dept. of Computer Science & Engineering
Maharaja Institute of Technology, Mysore

Abstract: Disasters like earthquakes, tsunami, bomb explosion and floods often cause loss of precious human lives. During such emergency situations, and especially in urban disasters, in order to prevent loss of life and property, various essential services like policemen, fire fighters and medical assistance etc, are deployed. Rescue operations are performed mostly by human and trained dogs, often in very dangerous and risky conditions. Hence, to make the rescue operation more safe and effective, mobile robots have been proposed which detect alive human beings and wirelessly communicate with the rescue team. This work aims to develop an economical robot, which works using AVR MCU, PIR sensor etc. It can be used in areas where rescue is needed. The robot senses the human body temperature using PIR sensor and alarm/indicator indicates the signal when it detects alive body and the message is sent through sms using GSM technology to enable rescue operation.
Keywords: PIR sensor, obstacle IR sensor, rescue robot, AVR microcontroller using GSM technology

I. INTRODUCTION

Alive human detector uses PIR sensor to detect alive humans. 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 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. Obstacle sensors detect the obstacle and send the analog signals to AVR Microcontroller. AVR is programmed to guide the robot automatically depending on obstacle detected. Alive human sensor detects the human who is alive and signal is given to AVR Microcontroller. AVR is programmed to send the alive human information to remote control place through the GSM Modem. Serial communication device provides the communication between the AVR Microcontroller and GSM Modem.

II. PROPOSED SYSTEM

The rescue operation by the workers in the earthquake affected areas is very difficult because it involves large area and hence it is time consuming. This project proposes an autonomous robotic vehicle that moves in the earthquake affected area and helps in identifying the live people and carry out the rescue operation.

III. HARDWARE COMPONENTS

1. AVR Microcontroller (ATMEGA8L)
2. PIR Sensor
3. RF Pair
4. Robotic Motor Driver board and motor
5. GSM Modem

IV. SOFTWARE TOOLS

1. ARDUINO Software
2. Embedded C

BLOCK DIAGRAM FOR PROPOSED SYSTEM

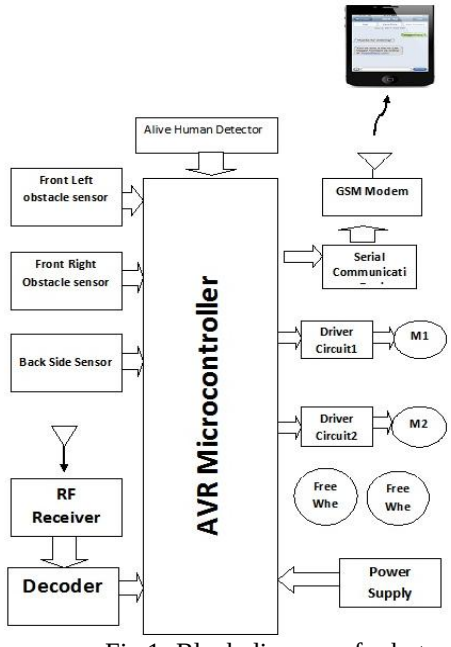

Fig 1- Block diagram of robot

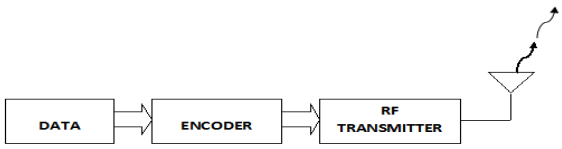

Fig 2- Remote control unit

V. MICROCONTROLLER

AVR ATMEGA8L microprocessor is used in this propject. AVR is Advanced Virtual Risc Microcontroller. It is a high speed and low power CMOS 8bit AVR Microcontroller. The device is manufactured using ATMEL non-volatile memory technology. It belongs to the family of Reduced Instruction Set Computer (**RISC**). In RISC architecture the instruction set of the computer are not only fewer in number but also simpler and faster in operation. The other type of categorization is CISC (Complex Instruction Set Computers).

AVR microcontrollers are available in three categories:
1. TinyAVR – Less memory, small size, suitable only for simpler applications
2. MegaAVR – These are the smost popular ones having good amount of memory (upto 256 KB), higher number of inbuilt peripherals and suitable for moderate to complex applications.
3. XmegaAVR – Used commercially for complex applications which require large program memory and high speed.

A. Special about AVR

They are fast: AVR microcontroller executes most of the instructions in single execution cycle. AVRs are about 4 times faster than PICs & 10 times faster than 8051. They consume less power and can be operated in different power saving modes.

VI. MOTOR AND MOTOR DRIVE

Motor denotes the robot which can move over earthquake prone areas. Motor drive is the interfacing circuit between microcontroller and robot. The project uses DC motor. DC motors have polarity and direction of rotation depends on direction of current. But a DC motor cannot be interfaced to the microcontroller directly because it requires much higher voltage and current. Motor drive is used for this. It is built using an npn transistor –BC547. It acts as an interfacing device to supply required power to the motor.

VII. RF TRANSMITTER AND RECEIVER

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

VIII. ENCODER AND DECODER

The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. The popular links is like this:MCU->Encoder->Transmitter----Receiver->Decoder->MCU,
Encoder and decoder are optional, their existence is to 1) avoid confusing when multiple RF links in range 2) isolate disturbance. We can integrate the encoding and decoding work to the MCUs on the both side.

IX. FRONT LEFT, RIGHT OBSTACLE SENSOR, BACK SIDE SENSOR

These sensors detect the obstacles at the respective positions viz, front left, front right and back side. If the obstacles are found in a particular position the respective sensor detects it and sends the signal to the MCU. And changes the direction of motion of the robot avoiding obstacle**.**

X. PIR SENSOR

Fig 3- PIR sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

A. WORKING OF A MOTION SENSOR OR PIR SENSOR

The PIR sensor itself has two slots in it, slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, when the sensor is idle , both slots detect the same amount of IR, the ambient amount radiated from the room or walls or when the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one whereby the sensor generates a negative differential change. These change pulses are what is detected

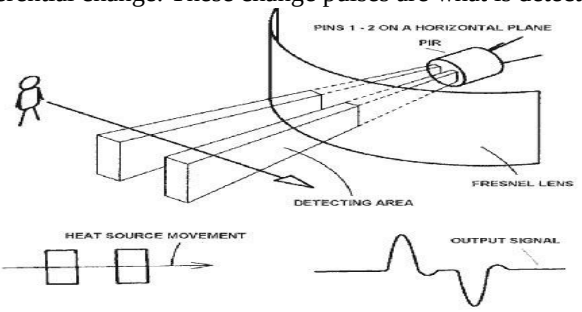

Fig 4- Working of PIR Sensor

XI. GSM (Global System for Mobile Communication)

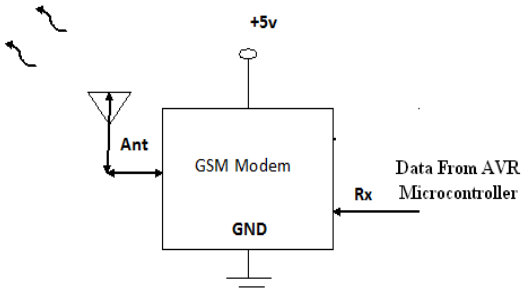

Fig 5- GSM MODEM

Circuit diagram of GSM board is shown in the figure.GSM Modem needs 5v DC supply. Receiver pin connected to AVR Microcontroller. It will receive the data from this Master controller to transmit data.

XII. ADVANTAGES

- It is a safe method for rescue operation to detect alive humans
- It uses GSM technology to send the message quickly
- It is fast and accurate
- It reduces the work load &
- Number of staff is not required more
- Maintenance cost is low

XIII. DISADVANTAGES

- Low battery backup
- Initial cost is high

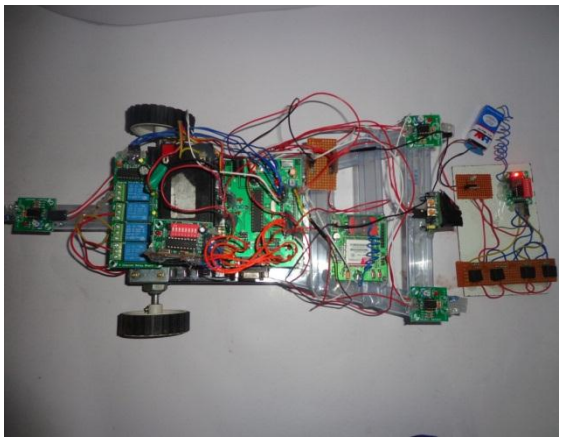

Fig 6- The Robot and the Control Unit

XIV. CONCLUSION

Automatic and manual controlled alive human detection robot has been designed and demonstrated. AVR Microcontroller is reprogrammable so that we can reprogram it when we need modify the features. RF frequency range is 434 MHz. Remote controlling is designed for limited distance, in future we can enhance the wireless remote control distance. Since battery backup is not sufficient, solar panel can be used to get uninterrupted power supply.GSM Technology can be more effectively used by adopting image processors. Also in feature if we can add wireless camera to monitor the alive human body.

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