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Alive Human Detection System for Rescue Operations in Hazardous Areas

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ABSTRACT: In this project, a new approach for detecting alive humans in destructed environments using a mobile robot is proposed. Human detection in an unmanned area can be done only by an automated system. Alive human body detection system proposed a monitoring system using PIR sensor and camera to record, transmit and analyze conditions of human body. In order to detect a human body, a robot must be equipped with a specific set of sensors that provide information about the presence of a person in the environment around. This work describes a robot for rescue operations. The proposed system uses an PIR sensor in order to detect the existence of living humans and a low cost camera in order to acquire a video of the scene. Additional, other sensors include temperature and gas detector to analyse the surrounding condition. This approach requires a relatively small number of data to be acquired and processed during the rescue operation. This way, the real-time cost of processing and data transmission is considerably reduced. This system has the potential to achieve high performance in detecting alive humans in devastated environments relatively quickly and cost effectively.

KEYWORDS: Sensor, human detection.

I. INTRODUCTION

Disasters can disrupt economic and social balance of the society. Natural disasters occur frequently now a days. Many human beings are victims of such occurrences. Because of high rise buildings and other manmade structures urban and industrial areas can be considered to be more susceptible to disasters. These disasters can be categorized into natural and human induced disasters. Natural disasters include floods, storms, cyclones, bushfires and earthquakes where as besides natural disasters, the urban environment is prone to human induced disasters such as transportation accidents, industrial accidents and major fires. During such calamities, especially disasters, in order to prevent loss of life and property various essential services (like fire brigades, medical and paramedical personnel, police) are deployed. Some lose their lives because of not being treated at time. According to the field of Urban Search and Rescue (USAR), the probability of saving a victim is high within the first 48 hours of the rescue operation, after that, the probability becomes nearly zero. Generally, Rescue People cannot enter into some parts / places of the war field or in the earth quake affected areas. All of these tasks are performed mostly by human and trained dogs, often in very dangerous and risky situations. To avoid such losses, a robotic system can perform well for providing alert (detection) of human being. The main purpose of the robot is to detect alive human beings after the occurrence of natural calamities with the help of PIR sensor. The robot based system will sense the radiation of human being and condition the sensed signal to communicate to the control section of this robot. Based on the responded commands the robot will react upon. The rescuer may become a victim who needs to be rescued. The proposed system uses an PIR sensor in order to detect the existence of living humans and a low-cost camera in order to capture video of the scene as needed.

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II. RELATED WORK

Steve Burion et.al[1] presented a project that aims to provide a sensor suite for human detection for the USAR robots. This study evaluated several types of sensors for detecting humans such as pyroelectric sensor, USB camera, microphone, and IR camera. The pyroelectric sensor was used to detect the human body radiation, but its limitation was its binary output. The USB camera was used for motion detection, but its limitation was its sensitivity to changes in light intensity. The microphone was used for long duration and high amplitude sound detection, but it was severely aected by noise. Lastly, the IR camera was used to detect humans by their heat image, but it was aected by other nearby hot objects. The main idea was to detect a change in the image scene by checking the values of the pixels. Several images for the scene were acquired and subtracted from each other to discover if a motion has occurred. The used technique was fairly ecient in detecting the victims. However, the robot was not fully autonomous and was dependent on the operator.

Yogesh V. Bangalkarl[2] described a paper in which a rescue robot is developed which is extensively used for military applications.PIR sensor is used to detect human. A Passive Infra Red sensor (PIR sensor) is an electronic device which measures infrared light radiating from objects in its eld of interpretation. Seeming motion is detected when an infrared source with one temperature, such as a human, passes in noticeable of an infrared source with another temperature, it detects. It acts as a motion nder. This robot uses RF technology controlled by RF remote controller. This can be enthused forward and reverse direction using geared motors of 60RPM. Also this robot can gross high-pitched turns towards left and right directions. This project uses ARM7 MCU as its controller. Also a wireless camera with voice is rim to the kit. GPS module used as an exact location tracker of robot when human body is detected is exhausted.

Hardeep Pal Sharma et.al[3] proposed an autonomous robotic vehicle that moves in the earthquake prone area and helps in identifying the live people and rescue operations. Hence precious life can be saved by timely detection in natural calamities even without the help of large number of rescue operators.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. The main disadvantage of this project was the initial cost was high and the battery back up for camera was weak.

III. PROPOSED METHODOLOGY

Now days, there are a number of techniques which are purposefully used and are being build up for well management of garbage or solid waste.

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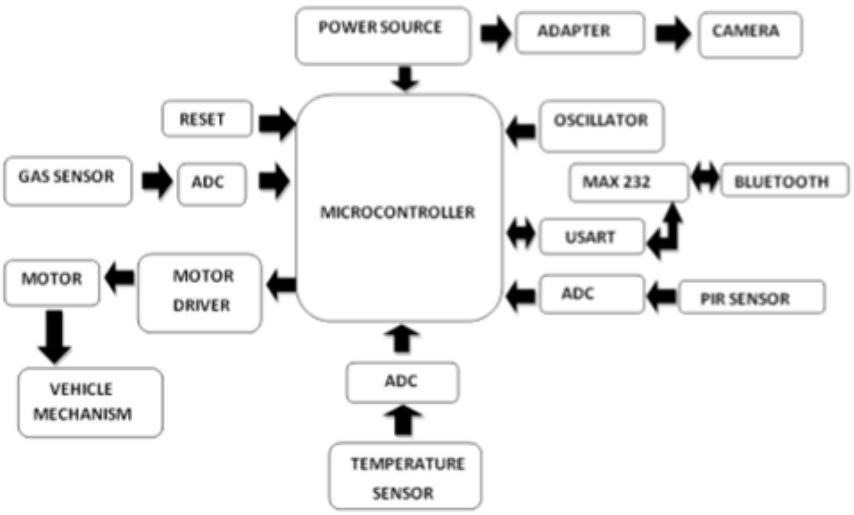

Fig 3.1 Block Diagram of Proposed System

MICROCONTROLLER

The major heart of this project is microcontroller; a microcontroller (sometimes abbreviated C or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals etc. However, compare to others, microcontroller is fast and very easy to program.

Crystal Oscillator - A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time, to provide a stable clock signal for microcontrollers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators.

Reset Function - Reset is used for putting the microcontroller into a known condition. That practically means that microcontroller can behave rather inaccurately under certain undesirable conditions. In order to continue its proper functioning it has to be reset, meaning all registers would be placed in a starting position. Reset is not only used when microcontroller doesnt behave the way we want it to, but can also be used when trying out a device as an interrupt in program execution, or to get a microcontroller ready when loading a program.

DC MOTOR AND MOTOR DRIVER

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic elds. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current ow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

Motor driver: This part is used to control the gate as per the situation. It is controlled by the microcontroller.

COMMUNICATION ELEMENTS

USART - A Universal Synchronous/Asynchronous Receiver/Transmitter (USART) is a type of a serial interface device that can be programmed to communicate asynchronously or synchronously.

Bluetooth module - A BlueTooth module is usually a hardware component that provides. a wireless product to work with the computer; or in some cases, the. Bluetooth may be an accessory or peripheral, or a wireless headphone or other product.

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MAX232 - The MAX232 is an integrated circuit rst created in 1987 by Maxim Integrated Products that converts signals from a TIA-232 (RS-232) serial port to signals suitable for use in TTL-compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide TIA-232 voltage level outputs (about 7.5 volts) from a single 5-volt supply by on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages. The receivers reduce TIA-232 inputs, which may be as high as 25 volts, to standard 5-volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts.

ADC AND SENSORS

ADC - In electronics, an analog-to-digital converter (ADC, A/D, AD, or A-to-D) is a system that converts an signal into a digital signal. A digital-to-analog converter (DAC) performs the reverse function. An ADC may also provide an isolated measurement such as an electronic device that converts an input analog voltage or current to a digital number proportional to the magnitude of the voltage or current. Typically the digital output will be twos binary number that is proportional to the input, but there are other possibilities. There are several ADC architectures. Due to the complexity and the need for precisely matched components, all but the most specialized ADCs are implemented as integrated circuits (ICs). Sensors are used to detect the various conditions required

POWER SUPPLY

A power supply is a device that supplies electric power to an electrical load. The term is most commonly applied to electric power converters that convert one form of electrical energy to another, though it may also refer to devices that convert another form of energy (mechanical, chemical, solar) to electrical energy. A regulated power supply is one that controls the output voltage or current to a specic value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supplys energy source.

IV. RESULTS AND DISCUSSION

This system consist of a robot control section and video coverage section. This system consists of a Robot control section and video coverage section. Furthermore Robot section consists of a movable unit, which has Bluetooth module,camera, PIR sensor ,gas sensor and temperature sensor mount on it and a microcontroller PCB-Meprobo board.

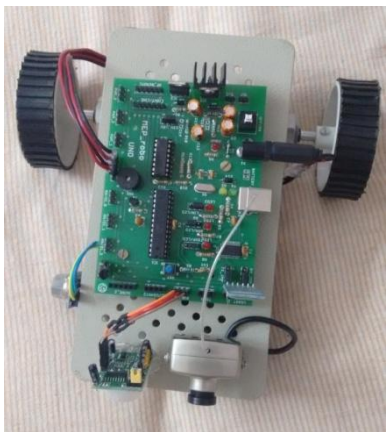

Figure 4 (a). Hardware Model

The robot can be manually controlled using PC, with the help of Visual Basics. The user interface has options to control the robot motion and also displays the sensor details Visual analysis of the affected area is made possible by a wireless camera placed on the robot which captures live video of the scene. The live video enables the operator to control the robotic movement by observing the scene and avoiding obstacles.

Once an alive human is identified, the details from other sensors is observed before manual rescue operation. This

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enables us to ensure safety of the rescue operators and hence take the required precautions before entering the scene.
This system consists of a Robot control section and video coverage section. Furthermore Robot section consists of a movable unit, which has Bluetooth module,camera, PIR sensor ,gas sensor and temperature sensor mount on it and a microcontroller PCB-Meprobo board.
The robot can be manually controlled using PC, with the help of Visual Basics. The user interface has options to control the robot motion and also displays the sensor details(figure 4.(b)).

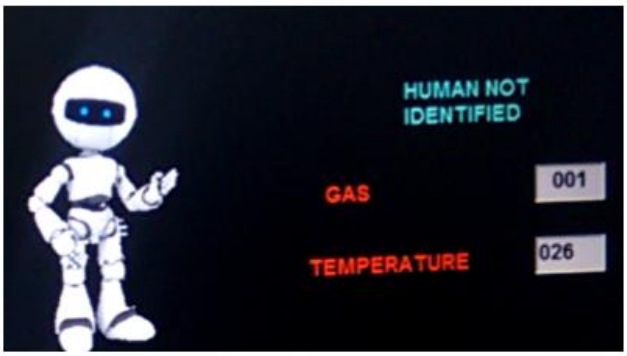

Fig 4(b): Sensor Values

Visual analysis of the affected area is made possible by a wireless camera placed on the robot which captures live video of the scene. The live video enables the operator to control the robotic movement by observing the scene and avoiding obstacles.
Once an alive human is identified, the details from other sensors is observed before manual rescue operation. This enables us to ensure safety of the rescue operators and hence take the required precautions before entering the scene.

V. CONCLUSION

The goal of this work was to provide a rescue robot for human detection in a disaster environment. Though, the existing Urban Search and Rescue Robots are equipped with various sensors, but the problem with them is the cost and complexity of circuit. The sensor used in the development of this project is easily available and cost effective. In this project, a new method for detecting surviving humans in destructed environments using simulated autonomous robot is made. The robot uses two sections for this operation and these two sections are inter-related to each other. The first section is the Robot section, which moves into the debris and searches for the alive humans. The second section is the Control section, which is with the Rescue team and used to control the movement of Robocar. Adding more number of DC motors to the Robocar can further enhance this, so that the torque can be still improved. A timer can be built-in and this complete system can be made automated.
Future developmental scopes of this project includes building an automatic system ulitising obstacle sensors. The size of this model can be considerably reduced so that its movement can be made much easier by using a compact robot chassis..

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