Review Paper on Search and Rescue Robot for Victims of Earthquake and Natural Calamities

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Abstract- A rescue robot is a robot that has been designed for the purpose of aiding in most rescue workforces. In most of common circumstances that skill rescue robots are mining fortunes, urban ruins, imprisoned situations, and blasts. Rescue robots were used in the search for victims and survivors after the September 11 occurrences in New York city. The reimbursement of rescue robots to these operations include reduced personnel rations, reduced fatigue, and access to otherwise unapproachable areas.The Robotic search and rescue is valuable since robots may be deployed in dangerous environments without putting human responders at peril conditions. This project is a prototypical 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 field 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 finder. 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. We are exhausting the GPS module for exact location tracker of robot when human body is detected.

Keyword- DC motor, GPS, PIR sensor, Wireless Camera, GSM, ARM7 MCU, Buzzer, USAR(Urban Search and Rescue Robot).

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I. INTRODUCTION

Disasters can disturb economic and social equilibrium of the civilization. Because of high upsurge constructions and other manmade structures urban and industrial areas are considered to be more susceptible to disasters. These disasters can be characterized into natural and human induced disasters. Natural disasters contain floods, storms, tornadoes, bush fire, earthquakes etc whereas human induced disasters include transportation accidents, industrial accidents, major fires etc[1]. In most of the disasters and natural calamities the rescue teams faced many problems in searching peoples which were in concern .Although, it was a very problematic task for them in searching the victims .so the rescue robots were invented it helped the rescue teams during 11th September 2001. It was first developed & used for searching victim and survivals after the terrorist attack on 11 sept 2001 in NEW YORK[2]. The beneficial of the project is to reduce fatigue and to access unreachable areas. Robotics application is used for the search and rescue since robot can be deployed in dangerous environment without putting human at risk. In this project we are making the use of PIR sensor (as a human detector) Wireless communication(as a wireless camera, RF module, GPS, GSM)[3], Microcontroller (LPC-2148). Robot is controlled by using RF technology. We are making the use of wireless camera with voice transmission. RF module of Transmitter and Receiver both operate at same frequency of 433 MHZ[4].

II. LITERATURE REVIEW

Looking over the robotics literature for the past 30 years, USAR has always been talked about as a good application for robotics. Prof Shigeo Hirose in the Tokyo Technical Institute was probably the first person to build robots specifically for USAR. Robin Murphy in the University of South Florida appears to be the first to have a sustained focus on artificial intelligence for USAR robotics. (Mills, C, 1995) Fortunately, many researchers are getting involved these days, both because of the terrible earthquakes in Turkey and Taiwan and because of the challenge. Prof Satoshi Tadokoro in Kobe University became involved when one of his graduates was trapped for several days during the Kobe earthquake. (Mills, C, 1995) A competition called RoboCup Rescue is dedicated to encouraging researchers to develop intelligent robots for USAR [5].

In the US, as a new rising research field, USAR robot research is fiinded by some large research organizations, such as FEMA (the Federal Emergency Management Agency), NSF (National Science Foundation), DARPA (Defence Advanced

Research Projects Agency), etc. Industry is another fianding source because if a robot can be used for USAR, it also can be used to access a possible biological, chemical, or nuclear spill, or help gather data in a hostile situation[5]. Following are the some design approaches these are Remote Operated and Controlled Hexapod (ROACH): ROACH is a design that provides significant advantages in mobility over wheeled and tracked designs. It is equipped with cameras which transmit live audio and videos of the disaster site, as well as information about locations of objects with respect to the robot's position to the interface on the laptop [6].

Kohga: University of Tokyo - The most complicated task for most of the USAR robots has been working on a rough landscape. Specialized robots have been designed for these types of environments such as KOHGA the snake like robot. The robot is constructed by connecting multiple crawler vehicles serially, resulting in a long and thin structure so that it can enter narrow space. System for disasters made up of four parts sensor, mobile rescue robot, transmission network, monitoring center. When victims are trapped inside debris, it will be difficult to search and rescue them quickly. At this situation Mobile robots are use that can go inside the building and detect if any victim is present and then signal the crewmembers for recovery. [6].

Quality work has been done in the field of robotics. They came into existence in the early 21st century but since then enormous improvements have been made in its concept, design based on purpose of use. Various rescue robots have been developed and some of these are – CRASAR (Centre for Robot-Assisted Search and Rescue) in University of South Florida.This robot was used for first time in real conditions on 11th September 2001 in the World Trade Centre disaster. Different sensors like millimeter wave radar for measuring distance, a color CCD camera for vision and a forward-looking infrared camera for the human heat detection were used in it [7].

Burion presented a project that provided a sensor suitable for human detection for the USAR robots. It evaluated several types of sensors for detecting humans such as pyro electric sensor, USB camera, microphone, and IR camera. The pyro electric sensor was used to detect the human body radiation. The USB camera was used for motion detection. A microphone was used for long duration and high amplitude sound detection. The IR camera was used to detect humans by their heat image. 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 efficient in detecting the victims. But still, the robot was not fully autonomous and was dependent on the operator[8].

Bahadori presents an analysis of techniques that have been studied in the recent years for human body detection (HBD) via visual information. The focus of this work is on developing image processing routines for autonomous robots operating fordetecting victims in rescue environments. The paper both discusses problems arising in human body detection from visual information and describes the methods that are more adequate to be applied in a rescue scenario. Finally, some preliminary experiments for such methods in recognizing rescue victims are reported.

The project proposes a mobile rescue robot that moves in the disaster, earthquake prone area and helps in identifying the live people, injured people, location and rescue system operations. Hence due to the on timely detection in natural calamities this can save precious life & great loss even without the help of large number of rescue operators. The proposed system consists of a mobile rescue robot, PC control Module.The mobile rescue robot consists of four units that are namely Sensor unit, Micro-controller, Camera unit, Motor driver unit, Transmission unit. The sensor unit must be directly interfaced to the micro-controller. The sensor devices monitor current readings and sends data to the Micro-controller. The controller circuit is responsible for transmitting this information. Controllers are designed at hardware level. The 2.4GHz RF module is interfaced with the microcontroller via the standard serial port. These data's are updated by the PC/SERVER So that rescue team can view the readings real time and camera is used to detect motion & live visualization of critical situation of the disaster.

III. BLOCK DIAGRAM

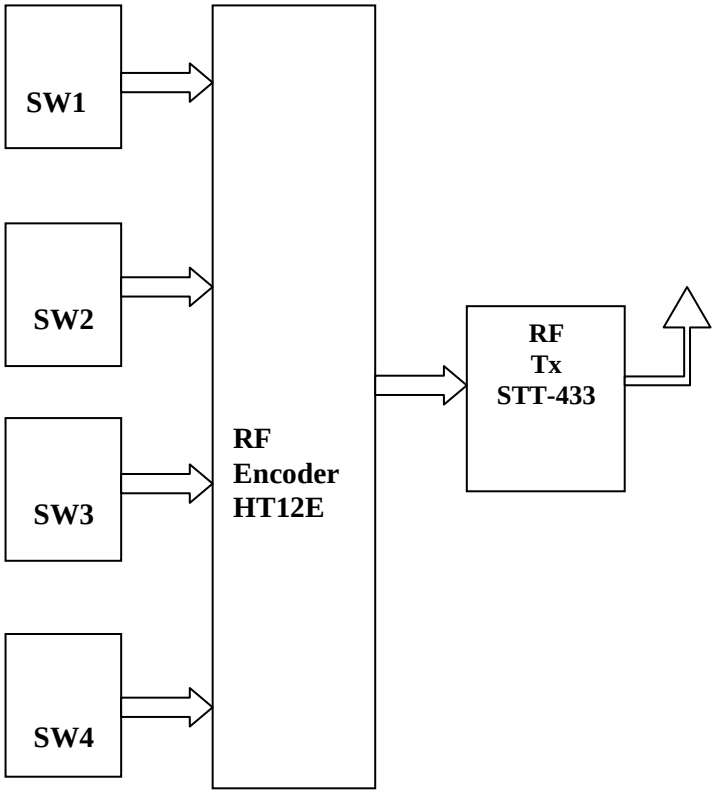

Fig1: Transmitter Module

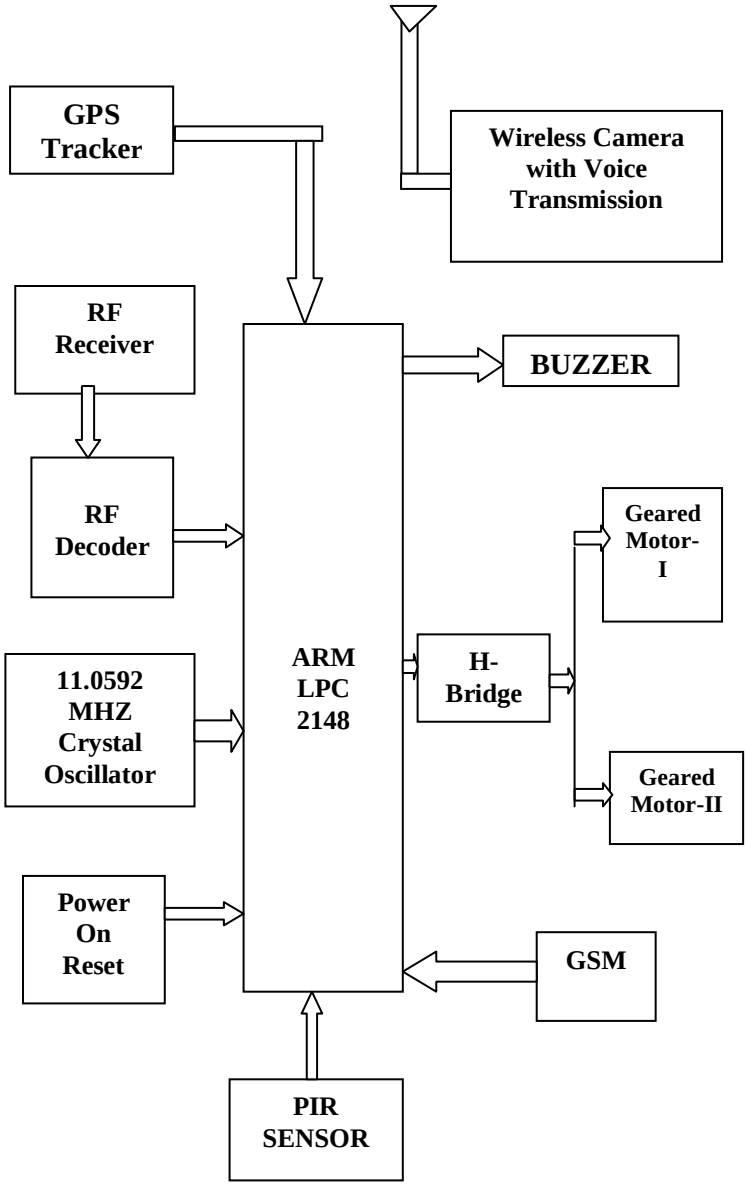

Fig2: Receiving Module

IV. WORKING OF THE SYSTEM

1. PIR SENSOR

The Passive Infra Red (PIR) sensor will, under typical conditions, detect a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m. As live human body emits thermal radiation it is received and manipulated by the PIR sensor to detect humans. PIR sensors are passive infra-red sensors. It operates at 5V DC. The PIR (Passive Infra-Red) Sensor is a pyro electric 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[9][10].

2. MICROCONTROLLER UNITE

The microcontroller that is been used is the ARM LPC 2148 controller. ARM's are popular with both industrial developers and hobbyists alike due to their cheap, easily available, large user base, easy to program according to application, free development & low cost tools availability, and serial programming (and re-programming with flash memory) capability. The microcontroller is used to gather the data from the sensor unit in real time and compare it with the set point (safer level of temp) and transfer the corresponding information data to the CPU of control room. It also receives commands from the CPU and transfers it to the robot unit for its movement. The microcontroller is the core of the surveillance robot.

3. SENSOR UNIT

A sensor (also called detector) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.PIR sensors are used in the project. . 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 field of view. Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, it detects. It acts as a motion detector[6].

4. CAMERA MODULE

The camera module consists of a web camera and it is mounted on the robot and the video signal is transmitted to the receiver at control room. The camera module will transmit the video coverage of the paths and thus helping in easier mapping of the path to be taken by the rescue team. For real time applications, camera of high range is to be used to get good clarity and good coverage of area. The function of camera also help the robot from getting stuck in a pit as the obstacles lying in path is foreseen and required action can be taken, thus improving the life of robot in the disaster area. Due to which we can observe the robot & we can see live vision.
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5. ROBOT DRIVER UNIT

The robot driver unit is primarily concerned about the movement of the robot in x-axis and y-axis.The robot is of conveyor belt type as it helps to maneuver over debris and rugged terrain. Two DC motors of 200rpm will run the wheels of mobile rescue robot. When both the wheels are given with positive pulse edge, then robot will moves in forward

direction. when the supply is reversed mean both the wheels are given with negative pulse edge, then it goes in backward direction and similarly by varying the negative and positive edge, left and right turn can be achieve successfully. The selection of supply given to each motor, L293D IC is used. This will drive the robot to move in forward, reverse and turn left and right[6][11].

6. GSM (Global System For Mobile)

Circuit diagram of GSM board is shown in the figure. GSM Modem needs 5V DC supply. Receiver pin is connected to Microcontroller. It receive the Data from master controller to transmission data[4].

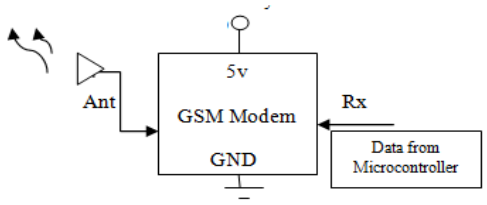

Figure 3: GSM Modem

V. PROPOSED OUTPUT

Hence many life's can be saved by using this autonomous vehicle during an earthquake disaster in a short duration which becomes time consuming and unaffected if done manually. This vehicle can be improved by using high range sensors and high capacity motors. Some more sensors like mobile phone detector, metal detector etc. can be implemented to make this vehicle more effective.

VI. FUTURE SCOPE

Since this robot is developed on small scale and is still cost and energy efficient, its future is bright and wide. Robot can further be equipped with speaker or recorder to interact with surviver and assure them of nearby help.

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