Robot Assisted Emergency Search and Rescue System with Wireless Sensors

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***Abstract*-The number of natural and human-induced disasters has increased enormously in the past decade. There is a necessity for more effective equipment to enhance emergency search and rescue operations. Search and rescue technology to date still rely on old technologies such as search dogs, camera mounted probes. Hence, intelligent robots equipped with advanced sensors are attracting more and more attentions from researchers and rescuers. The goal of the project is to develop mobile robot tracking prototype system which can explore during floods. The proposed system uses the specific set of sensors such as PIR sensor which is used to detect the motion of the human body, Temperature sensor which is used to measure human body temperature and Heart beat sensor which is used to give digital output of heartbeat when a finger is placed on it. All these sensors give information about the presence of an alive human body. Having detected the sign of living humans the system sounds buzzer and the sensors trigger camera mounted on it. The camera captures the video scene of the environment and gives information about the status and the location of trapped human lives.**

***Keywords:* Tele-operated robotic search, PIR sensor, Heartbeat sensor, Temperature sensor, Heart beat sensor.**

I. INTRODUCTION

Tele-operated robotic search and rescue systems consist of tethered mobile robots that can navigate deep into broken fragments to search for victims and to transfer critical on-site data. Distributed wireless sensor network is suitable for tracking the location of search and rescue robots in large search fields. The goal of the project is to develop and demonstrate the mobile robot tracking prototype system which can explore during floods. The proposed system is used to detect alive human beings and send the information regarding the situation of the spot to rescue team for proceeding further rescue operation. The system is mounted with set of sensors and camera, which triggers when the alive human being is detected.

Fig1.1: Flood scenario

II. RELATED WORK

In [1] to elaborate how robotic rescue team makes use of its designed systems and utilized detection methods to help people and help rescuers to accurately detect victims when natural disaster such as flood and earthquakes occurs. Here ground rescue robot functions as the main commander, an aerial rescue robot is used for more accurate identification and air support, and an automatic control ground robot is used for speeding up the operations. The three robots each have their unique function and are linked together through a ground control center. The team identifies and rescues the victims of disaster where humans can't enter for any reason, and the robot used is a remote controlled rescue robot. In [2] to elaborate how the robot can be used to reduce risk of losing life due to natural and man-made disasters. PIR sensor based semi-autonomous mobile rescue robot is developed which can detect live human being from an unreachable point of the disaster area. Joystick and RF technology is used to control the semiautonomous robot and to communicate with control point. Ultrasonic sensor is used for obstacle detection in navigation path of robot. IP camera is also integrated to observe and analyze conditions that will facilitate human detection in reliable manner. In [3] it deals how Arduino microcontroller and Android smart phone can be used by the robot to rescue people. The robot connects to the smart phone via Bluetooth which is accomplished by the Bluetooth module and to the via Wi-fi module. The robot is provided with a battery to power Arduino, sensors and the smart phone. It has also been provided with facility to charge battery with solar power when required. Bhatia [4] proposed a new approach for detecting alive humans in destructed environments using a autonomous robot. Alive human body detection system proposed a monitoring system using ultrasonic sensors and camera to record, transmit and analyze conditions of human body. The task of identify human being in rescue operations is difficult for the robotic agent but it is simple for the human agent. In order to detect a human body, an autonomous 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 autonomous robot for rescue operations. The system uses an ultrasonic sensor in order to detect the existence of living humans and a low cost camera in order to acquire a video of the scene as needed. Additional, other sensors include temperature, fire and metal detector which help in rescue operations. FahedAwad[5] a new approach for detecting surviving humans in destructed

environments using a simulated autonomous robot. The system uses a passive infrared sensor (PIR) in order to detect the existence of living humans and a low cost camera in order to acquire a snapshot of the scene as needed. Having detected a sign of a living human, the PIR sensor triggers the camera to acquire an image of the scene. The image is fed into a feed-forward neural network, trained to detect the existence of a human body or part of it within an obstructed environment. Yogesh [6] elaborates how robot 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. PIR sensor is used to detect human. A Passive Infrared 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.

In [7] elaborates how Tele-operated rescue robots search that can navigate deep to search for victims and to transfer critical field data back to the control room has gained much interest among emergency response institutions. In response to this need, a low-cost robot equipped with PIR sensor, accelerometer, camera and -n communication module is developed. The robot can navigate autonomously between damaged areas to look for living body +heat and can send back audio and video information to allow the operator to determine if the found object is a living human. In [8] author elaborates how mobile robot based on Wireless Sensor Network (WSN) which is designed for human existence & detection in an unmanned area can be done only by an automated system. This system proposed a monitoring system using sensors unit and camera module to recording, analyze conditions of human body and transmit data [3]. Mobile robots perform cooperative Simultaneous human body localization function and communicate over the WSN. The main objective of this Paper is to rescue more & more number of people from the adverse condition. In [3,4] author elaborates how a vision based technique that can be employed in case of hazardous condition where human beings cannot be employed. The main aim is to operate the robot which can work automatically on an object with a mechanical linkage. It identifies the intruders by using facial recognition technique. First using the technique of artificial intelligence the changes in the environment like fire, pit, obstacles, bomb and human live body are recognized. The robot is controlled from a remote location in addition to remote monitoring. The development of this application uses an 8051 microcontroller which is developed to control the peripheral devices using the sensors such as passive infrared sensor, light dependent resistor and thermostat. The robot is expected to perform various works like moving forward, reverse, left and right with super intelligence technology like detecting the obstacle, bomb, metal, fire and also for detecting pits. The microcontroller gets all the input from the sensors and controls the robot according to it. The Zigbee technology is used to communicate with the robot in remote location. The paper elaborates how Autonomous robots can be used in urban search and rescue (USAR) to fulfill several tasks at the same time: localization, mapping, exploration, object recognition, etc. In [8]author describes the whole system and the underlying research of the NuBot rescue robot for participating RoboCup Rescue competition, especially in exploring the rescue environment autonomously. A novel path following strategy and a multi-sensor based controller are designed to control the robot for traversing the unstructured terrain.

III. PROPOSED SYSTEM

The proposed system uses various sensors to detect alive human reliably. The sensors are placed in the robot moving in all the directions to convert the physical quantities like radiations from the body, temperature etc which are the basis for alive human detection into the signals that are easily read or interpreted by remote observer or rescue team. Different types of sensors like PIR sensor, Heart beat sensor and Temperature sensor are used in the proposed system. The benefits of Robots assisted emergency search and rescue systems with a wireless sensors are: Reduced personnel requirements, fatigue, helps rescuers identify the survivors quickly,

The reason for the design is to arrange the arrangement of the issue determined by the necessities report. This stage is the initial phase in moving from issue to the arrangement space. As such, beginning with what is obliged; outline takes us to work towards how to full fill those needs. The configuration of the framework is maybe the most basic component influencing the nature of the product and has a noteworthy effect on the later stages, especially testing and upkeep. Framework outline depicts all the significant information structure, document arrangement, yield and real modules in the framework and their Specification is chosen. The architectural configuration procedure is concerned with building up a fundamental basic system for a framework. It includes recognizing the real parts of the framework and interchanges between these segments. The beginning configuration procedure of recognizing these subsystems and building up a structure for subsystem control and correspondence is called construction modeling outline and the yield of this outline procedure is a portrayal of the product structural planning. The proposed architecture for this system is given below. It shows the way this system is designed and brief working of the system.

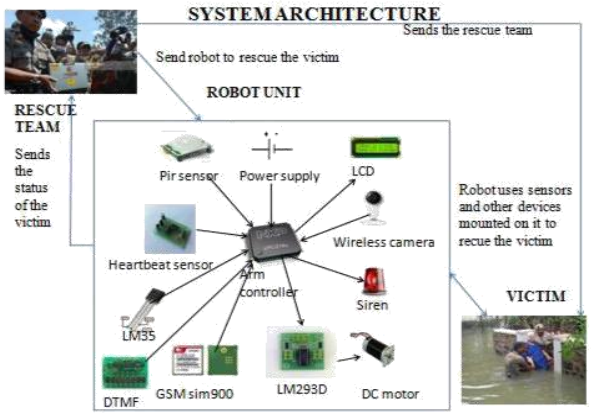

Fig 2.Architecture -Rescue Robot.

Location Track Module:

Firstly, the location of the victim is tracked with the help of the GPS in the form of longitude and latitude.

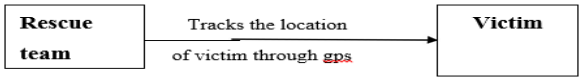

Fig 3: Location track module

Robot Module:

In this phase the robot is sent to the location of the victim. The robot is made to move in all the directions using DC motor which is driven by LM293D.

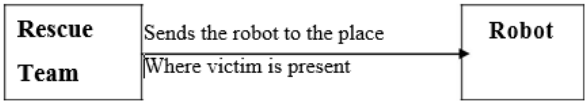

Fig 4: Robot module

Classification Module:

The victim is classified as dead or alive with the help of PIR, Heartbeat and Temperature sensors.

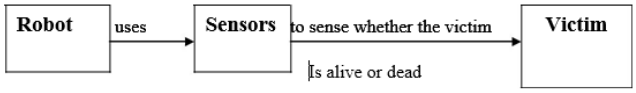

Fig 5: Classification module

Notification Module:

The rescue team is notified about the victim with the help of the GSM

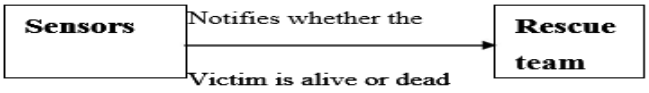

Fig 6: Notification module

Surveying Module:

The camera captures the video scene of the environment and gives information about the status and the location of trapped human lives, which helps the rescue team to survey the entire area.

Fig 7: surveying module

IV. PSEUDO CODE

Step 1: Firstly, all the components must be connected to the arm controller. Then the power supply must be given to the robot.

Step2: Call should be made to the mobile which is connected to robot from the mobile with the rescue team to establish a communication between the robot and rescue team. The robot is controlled using the mobile which is with the rescue team. Firstly the button 2 is pressed in the mobile and the reset button on the arm is pressed. Now the robot is ready to be sent to the flood environment.

Step3: The robot is made to move in all directions by using motor driver (LM395D) and dc motor. The movement of the robot is controlled by the rescue team using mobile. The functionality of this robot is controlled through DTMF. When 2 is pressed the robot moves front, when 8 is pressed the robot moves back, when 4 is pressed the robot moves left and when 6 is pressed the robot moves right. 5 is pressed to stop the functioning of robot. All this instructions are displayed on the LCD as well.

Step4: 3 is pressed to get connected to the PIR sensor. PIR sensor is a passive infrared radiation sensor which senses the body movement of the human. When it detects the movement of human then the message "VICTIM IS DETECTED" is displayed on the LCD along with the latitude and the longitude of the trapped victim

Step5: 1 is pressed to get connected to the heart beat and temperature sensors. The threshold for temperature sensor are set be to be above 35. The threshold for heartbeat sensor is set to be above 10 degree Celsius. If the temperature and heartbeat is within the defined value then the victim is said to be alive and the message "VICTIM IS ALIVE" is displayed on LCD along with latitude and longitude. Otherwise the message "VICTIM IS DEAD" is displayed.

Step 6: The flood environment is monitored using the wireless camera mounted on the robot. The live video scene captured by the camera is displayed on projector in the base station. Based on this information the rescue team is sent to the flood environment to rescue the victim.

V. RESULTS

This area portrays the outcomes got after the execution of actualized re-enactment. The accompanying screenshots characterize the outcomes or yields that are got after orderly execution of all modules of the framework.

The purpose of the proposed system is to provide a cost effective robot for rescuing human beings during floods. The proposed system is superior to other existing robots due to the use of sensors that are cheaper and easily available. It is not feasible for rescue personnel to individually visit the site and check who is alive and who needs rescue. So, in such circumstances, the proposed system can be of great importance. It can be deployed to detect alive human beings and send the information regarding the situation of the spot to rescue team for proceeding further operation. Furthermore, the reliability of detection is enhanced by 2 level sensors. The first level sensor is PIR sensor which detects the motion of human. The second level sensors used are Heartbeat and Temperature sensors. They are used to detect whether the victim is alive or not. So if one sensor fails, other sensors can also provide sufficient information in conjunction with wireless camera mounted on it.

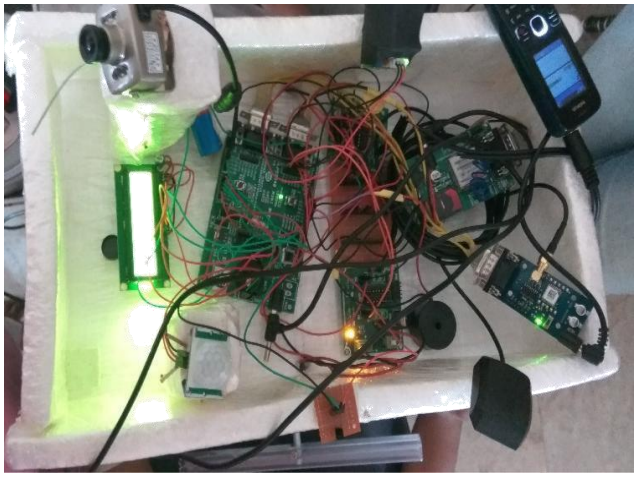

Fig 8: Screenshot of Rescue Robot

Fig 9: Screenshot of Initial Adjustments

Fig 10: Screenshots of Directions

Fig 11: Screenshot of Message Obtained

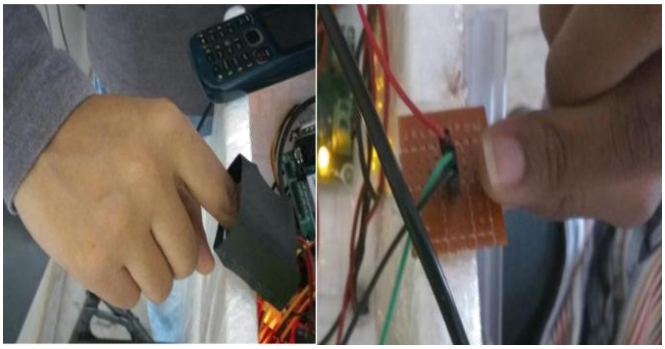

Fig 12: Heartbeat Sensor

Fig 13: Temperature Sensor

VI. CONCLUSION AND FUTURE WORK

The purpose of the proposed system is to provide a cost effective robot for rescuing human beings in catastrophic conditions. The proposed system is superior to other existing robots due to the use of sensors that are cheaper and easily available. It is not feasible for rescue personnel to individually visit the site and check who is alive and who needs rescue. So, in such circumstances, the proposed system can be of great importance. It can be deployed to detect alive human beings and send the information regarding the situation of the spot to rescue team for proceeding further rescue operation.

The areas of improvement are in the future the power supply can be made provided to robot through batteries instead of using direct current and Solar panels can also be mounted on the robot as a source of power supply.

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