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ALIVE HUMAN DETECTION ROBOT

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Abstract: The main purpose of this project initiative is to design a remotely controllable Robot prototype that can detect live humans and transmit the location details wirelessly. It can also be used in war fields and places where disaster has occurred. Human detection is also required in hazardous sectors like boilers, reactors where only authorized person can enter. The live body detection is performed by a biomedical unit that comprises mainly of a temperature sensor combined with a pulse detector. Any alive body with a temperature above absolute temperature is measured tentatively. It senses these pulse variations in the given subject body with the help of a robotic arm with attached clipping mechanism for effective and reliable operation. Human identity is also carried using a wireless camera module. The remote-control unit is used to provide interconnectivity between the robot and human operator and the on-bot camera is used to detect the motion in any kind and will inform to micro controller and then via wireless transmission to an operator located at a remote place. In this project we propose to deploy wireless transmission of data using ZigBee based wireless system for the procurement of efficient communication. If the micro controller unit receives the detected signal, it will send a message through Zigbee signal transmitter to the remote-control unit. The GPS receiver receives the Longitudinal and latitudinal value when the robot continuously monitors to check for even the slightest movement of the human body it sends the location details to the remote-control unit at the earliest.

Keywords: Global Positioning System (GPS), PIR Sensor, Zigbee, Robotic Arm, Pulse Detector, Temperature Sensor

1. INTRODUCTION

Disaster sites may be complex and hazardous to be reached for rescue and there are great threat and risk linked to rescue workers and survivors trapped in such accidental sites. Even though, technology have been developed, still trained dogs and humans are used in this risky situation, which maybe time consuming and due to the vast area, that get affected it becomes more difficult. In order to curb this problem and to make the rescue operation safer and more effective "ALIVE HUMAN DETECTION ROBOT" is proposed which will work in disaster environments of man-made structures like collapsed buildings, war fields etc. It can be assisted for firemen, police, and disaster agencies with appropriate reconnaissance, site evaluation, human detection etc. Basically, the robot consists of a mechanical part and a biomedical part.

The mechanical part consists of wheeled platform, arm and the biomedical part consist of microcontroller, temperature sensor. Sensors are used to sense the environment and give practical feedback to the device. Apart from this, it includes a robotic arm that is equipped with the pulse detector to access the pulse of the victim and thermal sensor to form a combined data set and transmits this real time data to the remote-control unit that helps in triggering rescue operations. The robot is controlled using a wireless sophisticated joystick. It has a display, where all the information from the robot are visually illustrated. A camera is used to capture the status of the surrounding and one can perceive the current condition of the casualty with the help of this camera.

2. LITERATURE SURVEY

Ukey Etal [5], has given in the proposal of a microcontroller operated robot based on the integrated operation of PIR sensors, camera, RF module, motor and three wheeled gear drives. robot is equipped with a PIR sensor to detect live human, a robotic arm to remove any obstacles in its way, a camera to send images to control unit. Microcontroller SST89E516RD is used to control the robot and is the core of robot

S Bhatia Etal [2], had proposed a system using 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 works as bomb sensor to detect the presence of bomb in Warfield and in rescue operations

Aravind Sasikumar Etal[1], proposed an embedded design of a PC controlled Robot which can detect live humans and transmit the location details wirelessly. The PIR sensor is used to detect the motion in any kind and will inform to micro controller. GSM based wireless system is proposed for the efficient communication.

S Chowdhury Etal[3], had put forth the design initiative proposal for developing a rescue robot that consist of a PIR sensor, which will help to detect the alive human beings, it also contains an IR based human radiation sensor, which picks up signals from human body radiations and gives a signal output. The robot would be equipped with a wireless RF transmitter and sends the message to the remote location whenever it finds any alive human

Naeem Farooq Etal[4], Had proposed the concept of alive human detection integrated onto a rescue robot designed for the very purpose.To detect the presence of living human they had utilised OMRON D6T-44L IR thermal sensor that senses the thermal radiations emitting from the objects and then determines the object's temperature to identify whether the victim is alive or not. An MQ-6 Gas sensor is also deployed on the robot to monitor different gases in the operational environment. Apart from these the team went for a Wireless IP camera with built-in night vision support and audio transceiver, in order to establish the audio conversation between victim and robot operator.

Mr. Albert W. Y. Ko and Mr. Henry Y. K. Lau had built a low-cost autonomous mini robot equipped with thermal sensor, accelerometer, sonar, pin-hole camera, microphone, ultra-bright LED and wireless communication module is developed to study the control of a group of decentralized mini search and rescue robots. The robot can navigate autonomously between voids 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.

Jignesh Patoliya Etal [12] proposed an idea for the objective behind developing a robot for the surveillance of human activities in the war field or border regions in order to reduce infiltrations from the enemy side. The robot consists of night vision wireless camera which can transmit videos of the war field in order to prevent any damage and loss to human life and also will aid in preventing illegal activities. The war field robot consists of Arduino uno board as a controller board. It has L293D motor driver IC's along with a HC-05 Bluetooth module. Two DC motors are also used for the motion of the robot. The night vision wireless camera is attached with the robot in order to monitor the situation and the camera can be rotated 360 degrees via the android application through motor.

O. SeungSub Etal[6] had published a paper titled "A study on the disaster response scenarios using robot technology" wherein they studied different scenarios associated with deploying a robot in a disaster environment so in order to use the robot in disaster situation, the most important thing was to develop a robot utilization scenario and the crew addressed a new scenario using robots in difficult disaster to deal with only by human power. Disaster response scenarios are getting more important for presenting the advanced direction of disaster response robot technology, re-evaluating and building a database of the disaster environment. The definition of the disaster environment is not precise yet, and a number of cases is not much analysed. However, it is expected that it will be an important data that analyze typical disasters and if the data is accumulated, it can be the base to apply complex disaster situation and expand the perspective to the global. If scenarios are derived from each type of disaster, it is necessary to systematize the operational procedures for the immediate response of disaster robots and to take action based on these scenarios.

The paper on" Vision Interfaced War Field Robot with Wireless Video Transmission " by K. N. Lavanya Etal[13]takes a deep dive into the design and implementation of a real time surveillance system which functions a substitute for the humans in defence sector. The vision-based interface functions by giving gestures to control robot which overcomes the lacunae of speech recognition algorithms. This work consists of four stages i.e. capturing of the image, gesture recognition, navigation of robot, metal and fire detection. The implementation is achieved by stopping of the robot by either fire or metal detection. The impact of the work aspires at achieving more safety and reduced loss of lives in the battle field.

In the paper titled "*Robustness of Cooperative Behaviour Model on N Robot-based Multi-Robot Systems* " by Chika .O. Yinka- Etal [], a robust cooperative framework is presented for pre emergency and disaster management, in other words, safety prevention measures in the underground terrain. The system is designed for n-robots to understand the emergency and disaster behaviours of one another and cooperate while avoiding collision. The framework logically establishes a QLACS model based on Ant Colony System (ACS) and QLearning (QL) techniques. To provide a robust way of achieving pre-emergency and disaster management in the mine, the scalable QLACS was tested with 2-robots, 3-robots and 4-robots. The performance evaluation result shows that the QLACS is reliably robust in communication and search costs, and also scalable to n-based MRS**.**

3. MODEL DESCRIPTION

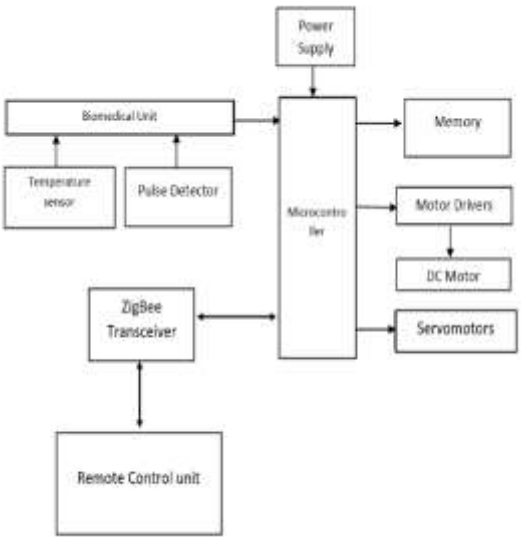

Figure 1: Block diagram of proposed system

In the basic block diagram, all the essential sections of the robots are enlisted and integrated as a whole entity. To begin with the "*power supply" module* is responsible for the proper supply of electricity to all the other units of the robot that requires power consumption for their optimal operation. The "*Bio medical unit"* is one among the most important aspects of the project which handles the measurement and procurement of bio parameters obtained from the victim in the war field. It comprises of sub modules like heart rate monitoring system and temperature measurement. Consequently the "Electro mechanical unit" is solely delegated with the task of navigating the robot to the path desired by the operator, it comprises of DC motors and drive circuits, also the mechanical block of the robot is also associated to the

microcontroller unit via the electromechanical section. Two "ZigBee transceiver" modules are used to establish communication between the rover and the operator. Finally, the remote-control unit is the control interface that allows the operator to get access to various control aspects of the robot and even displays the current status of biological parameters in it.

3.1 Biomedical Phase

In this part we aim at the bio physical parameters that serves the very essence of this project. Pulse detectors and temperature sensors deployed in the rover acts synchronously with each other. The pulse detector which is surmounted on the robotic arm is designed in the form of gripper that's allowed to cling on to the bodily parts of the potential victims in the war zones to check for the presence of pulses in the body as a result of blood flow within the body under consideration. Since the temperature variation among the dead and the alive is highly discrepant with the effective use of a precise temperature sensor we are able to continuously monitor the temperature changes that might be produced in a live victim compared to no temperature variation found in a deceased corpse. So once the temperature measurements comes to an end the data is then sent to the microprocessor engraved on the rover that performs the calculations and comparisons with a preloaded standard set of data's available and procures the result which would be transmitted to the joystick controller via a ZigBee transceiver located at a specific distance away from the rover.

The heart rate monitoring section consists of an electronic circuit that monitor the heartbeat by clipping on to a fingertip or other tangible body parts it does this by irradiating IR rays through the human finger and measuring how much light is absorbed. This goes up and down as blood is pumped regularly between systole and diastole actions of the heart respectively within the body. For the operation as an optical heart beat detector a combination of an infra-red LED and phototransistors is used. The IR transmitter emits light rays of specific wavelength and frequency which pass through the particular body part under consideration(human finger) and are picked up successfully by the photo transistor on the other end of the transmission channel which acts like a variable current source conducting different amounts of current depending on the quantitative factor of the radiation received. The voltage variations change with the heartbeat and are acquired from the collector of phototransistor.

The raw input is then passed through a high pass filter that filters out all the unwanted noise that are interjected while the signals are developed at regular intervals of time, after which the filtered signal is passed through the terminals of non-inverting op amp thus stepping up the voltage level of the signals to suitable measurable state. The output of the op amp is given to the comparator where it compares the measured signal level with a set of standard levels obtained. During the comparation process the all the high values (1) are given a corresponding positive spike and for all the low values (0) are allocated no spikes, hence we obtain a train of pulses generated within regular intervals of time. These pulse train inputs are fed to the microprocessor where the in built up-counter counts the number of pulses per minute and transfers the same data to the controller via ZigBee communication module attached to the microprocessor.

3.2 Mechanical Phase

This section plays a pivotal role in determining the optimal operability of the rover. The arm of the rover carrying the biomedical part serves as the foundation of the electro mechanical part. This part is mainly procured by a combination of mechanical hinges, metallic frameworks with rectangular cross sections, pivots, servomotors etc. and its main objective is to simultaneously work together to get the required mechanical action for the robotic arm in order to facilitate the triggering of biomedical part onto to the victim's body. Four servomotors are utilized to perform this task efficiently without causing any further delays.

3.3 Electrical Phase

This part takes into consideration the mobility and navigational control of the robot. It comprises of DC motors and and its control circuitry. Two Dc motors are delegated with the task of providing movement to the robot by drawing equal quantities of power from a 12 V DC battery. The drive circuitry is synthesized using combinations of SPST and DPDT relays for controlling the power coming to each of the motors and thus controlling the direction of rotation for both of them. Whilst One SPST relay is used for the delivery/cutoff of power line to the dc motors respectively and two DPDTs are used tentatively to manipulate the direction of rotation of the two DC motors thus allowing free movement of the robot in any direction desired by the controller along the ground.

4. HARDWARE DESCRIPTION

4.1 CAMERA MODULE: The camera module consists of a wireless camera and it is fitted at the front portion of 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. The function of camera also helps 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.

4.2 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. The output voltage can easily be interpreted to obtain a temperature reading in Celsius.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 oC temperature rise in still air. In this system LM35 sensor is used for the continuous monitoring of body temperature and is deployed in the rover.

4.3 SERVOMOTOR: A Servo Motor is a small device which is used to control the angular or linear movement, velocity and acceleration. A regular motor always rotates in 360 degrees but servomotor can rotate in 0 to 180 degree. Servo motor has very lighter in weight and smaller in size that is why it can install in any small place easily. Servo motor has a feedback system and works in a closed loop system that is why it can be controlled very accurately and precisely.in this system, servo motor is mounted in every joint of a robotic welding arm, actuating movement and adding dexterity. Thus the robot can move the arm without failure.

4.4 RELAY DRIVE: 4 relays are used to run 2 motors in the proposed system. Relays are electromagnetic switches which are used switch between different voltages. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. In the proposed system we use single pole single throw and double pole double throw relays. The SPST relay has a total of four terminals. Out of these two terminals can be connected or disconnected. The other two terminals are needed for the coil to be connected. The DPDT relay is the biggest of all. It has mainly eight relay terminals. Out of these two rows are designed to be change over terminals. They are designed to act as two SPDT relays which are actuated by a single coil. In this system, relays are used to obtain 12V output which is necessary to run motors from available 3.3V output from microcontroller. The different sequences of output from relays run the motor in different directions. The user gives the input from transmitter side and the controlling signal is passed to receiver side. The receiver antenna receives and decodes the signal and it is processed by the microcontroller to run the robot. The sensors sense the obstacles or human that come on the way of robot and corresponding outputs from the sensors are processed by the microcontroller and robot stops at the moment.

4.5 MICROCONTROLLER: The microcontroller is used to gather the data from the sensor unit in real time and transfer the corresponding information data to the PC 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 robot. In this system PIC89C51 microcontroller is used and it is used for initiating the required calculations and actions for the joystick-based controller, And another one in the rover for carrying out the operations in association with robotic arm control via servo motors along with dc motor control and navigation, coupled with biomedical analysis and measurements part.

4.6 ZIGBEE MODULE: Zigbee is an IEEE yu802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs. ZigBee transceiver is used to send and receive data between robot and the control unit. ZigBee is a digital wireless communication protocol. It is a very low power communication technology. ZigBee is a very versatile communication technology motor. In the receiver section the ZigBee receiver receives the data form the ZigBee transmitter. A RS 232 cable is needed to connect to a PC. The GUI interface is nothing but a software application in order to record monitor or manipulate the data received. It consists of AT89C52 microcontroller, MAX232 level converter which converts RS-232 voltage level to TTL voltage level and TTL voltage level to RS-232 voltage level.

4.7 DC MOTOR: Motor drive is the interfacing circuit between microcontroller and robot. The project uses two 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.

5. DESIGN AND IMPLEMENTATION

The Robotic rover we use here is a remote-controlled car that can be moved in all the four directions with the transmitter section attached with it. The ZigBee transceiver module receives the control information from the Remote Control Unit(RCU) wirelessly. The microcontroller drives the motor of the robotic rover with effective aid from the corresponding motor drives that work in unison to balance the motion of the rover as per the given situation and input command given. Motor is connected to the microcontroller through relay drivers. The system monitors the pulse & temperature variations continuously. If rays are detected a high value is sent to microcontroller. Then the microcontroller reads the latitude and longitude information from the GPS Receiver connected to the microcontroller. The ZigBee Transceiver it is used to send and receive data between robot and the control unit.

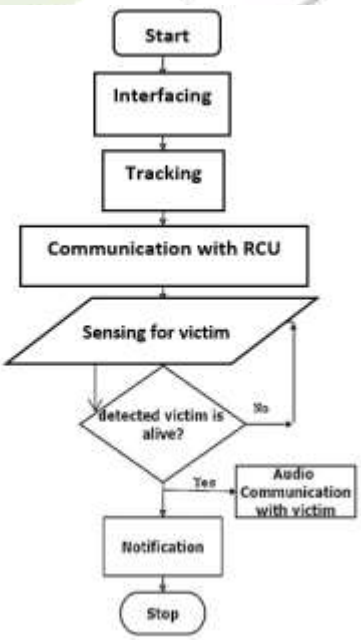

Figure 2: Flow chart of system.

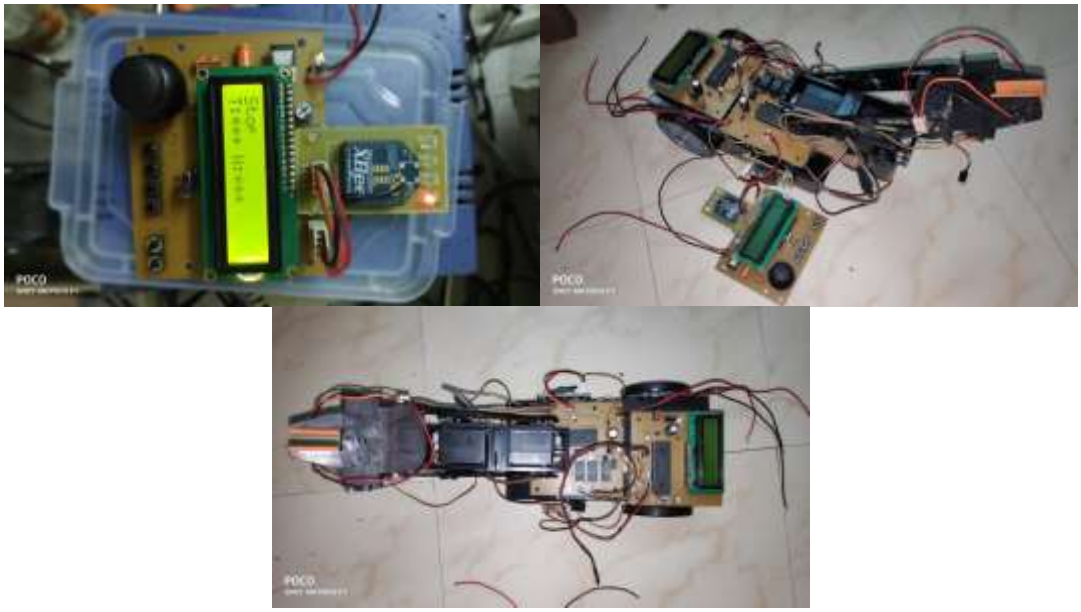

Figure 3. Hardware

6. RESULT AND CONCLUSION

The prototype of the proposed robot is found to be working satisfactorily. With the help of this robot, search and rescue operation could be much reliable and easier. We intend to realize this robot using a microcontroller and robotic arm actuators via stepper motors that are working synchronously. The robot is controlled wirelessly using a remote-control unit at a distance from the target site under observation. The need of an autonomous robot in dangerous conditions is very necessary as human lives is quintessential need of the hour. Also, human intervention would be mostly ineffective. This robot is designed in such a manner that it has all the necessary sensors, monitoring systems and dynamic operability with a multipurpose robotic arm to detect and monitor alive humans and report them and allows proactive human intervention for effective and efficient risk handling.

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