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Surveillance Robot with Human Detection

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***Abstract*—This paper proposes a robot for human rescue operation using cognitive systems in an environment which is unsuitable for any human intervention. The robot can operate manually with human input and is also capable of autonomous operation by being guided using sensors. In manual mode, human input is provided wirelessly and its operation is observed by the feedback from a mounted camera. The robot is mounted with IR and PIR sensors to help it navigate while operating autonomously. The robot will aid in rescue operations by allowing a minimal threat to human life. Practical experiments and simulation experiments are carried out to validate our design.**

I. INTRODUCTION

The main objective of the project is to detect humans in need of help who are unable to move in disastrous area. This surveillance robot is being developed as a Final year project prototype. The robot should portray abilities to move in either directions, sensor prediction, and interfacing with the operator as it searches for the victims. The objective of the project depicts a very simple idea of human detection which follows a rescue operation. A PIR is utilized in the project to detect live humans as an alive human (body) emits passive infrared rays. These passive infrared rays are detected by the PIR sensor to detect live humans. Along with the PIR sensor we will also be using IR sensors for obstacle detection and avoidance.

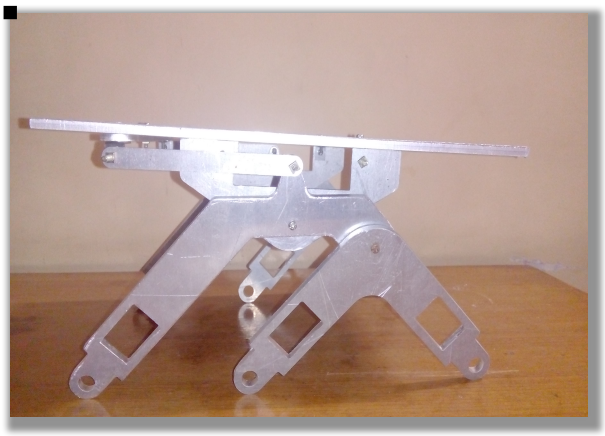
II.RELATED WORK

Looking over the robotics literature in last 30 years, USAR has always been talking about good application in robotics. In a paper titled 'Search and Rescue System for Alive Human Detection Semi-Autonomous Mobile Rescue Robot' published by Zia Uddin and Mojaharul Islam, a similar type of robot is designed by implementing microcontroller and RF module. The application is like our project but the implementation technique is different. Another paper titled 'Towards Safe Robot-Human Collaboration Systems using Human Pose detection' published by Christopher Reardon, Huan Tan, Balajee Kannan and Lynn DeRose has developed a robot with multiple sensors and camera which is operated by a mobile phone.

III. PROPOSED WORK

The robot body structure is designed by using AutoCAD software. The structure of the body is inspired from MARS rover. The main advantage of this design is that it allows more flexible motion as compared to four tyre robot structure. The robot can overcome the obstacles more efficiently as compared to other structures. The body is made of aluminium sheet as it

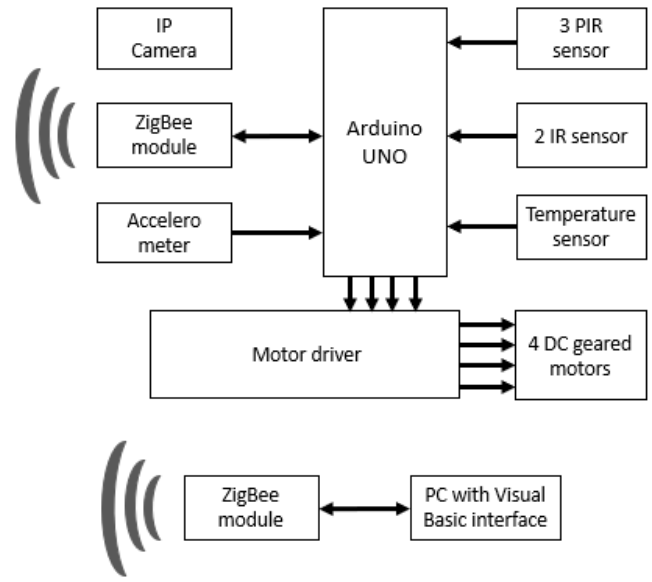
provides strength and it is also light in weight. The dimensions of the chassis are determined accordingly so that the robot can move on rough and uneven ground efficiently and to make robot robust.



The robot comprises of various components like sensors, Arduino, ZigBee, accelerometer, 12V battery, 7805 regulator and an IP camera. Arduino Uno is brain of the robot and all the processing is carried out by this Arduino itself. A 12V battery is connected as a source of power supply to the robot. The Arduino coverts this 12V into 5V but using its in-built regulators. The DC geared motors can operate on 6-12V. All the components are interfaced with this Arduino and based of the outputs of these components, Arduino generates an output which controls the movement of the robot.

There are two Zigbee transceivers used in the project. The first Zigbee module is interfaced with the Arduino and the second module is connected to the PC or laptop by using a TTL USB driver. Zigbee requires a 3.3V supply which is given directly from the 3.3V pin of Arduino. It performs serial transmission with a baud rate of 9600.

PIR, IR and temperature sensor requires 5V supply which is provided by a 7805 regulator. The motor driver requires a 12V and a 5V supply and is given by directly connecting it to the 12V battery and the 7805 regulator. The IP camera operates on its independent battery source and it will continuously transmit the video on the laptop irrespective to the mode on which robot is operating. An accelerometer is used to plot a graph in X-Y axis which will be useful to trace the path of the robot. It requires a 3.3V supply which is given by the Arduino.



This robot is operated by using three modes i.e. automatic, manual mode and stepping mode.

Automatic mode: The robot is switched in the automatic mode with the help of an interface created by using by Visual Basic software which is carried out by using two Zigbee transceivers. The Arduino will continuously monitor the sensors and when logic of any sensor will change, based on the programming the Arduino will operate the motor drivers which will further control the movement of wheel. In this mode the robot will operate independently by using IR and PIR sensor. The values of sensors and accelerometer is continuously monitored and the readings are send to the PC through Zigbee. The temperature sensor will monitor the temperature of the environment and in case of rise in temperature it will send a command to the Arduino and the robot will stop and change its path. This mode

will prove helpful in the areas where the range of the ZigBee is not sufficient to control the robot.

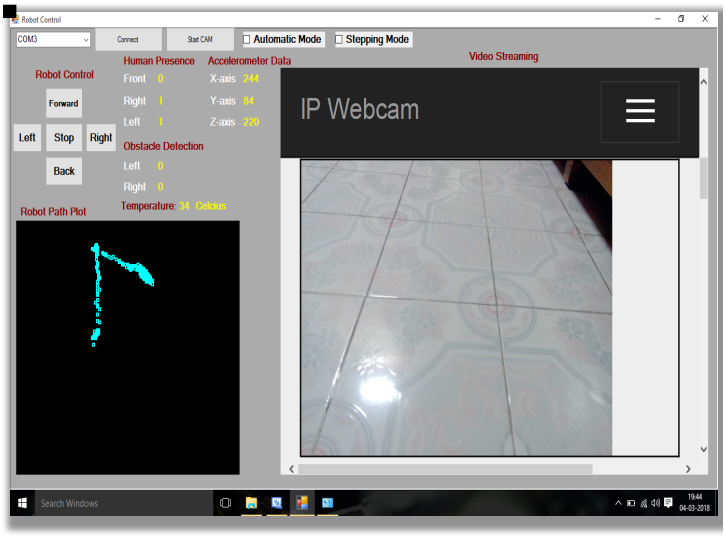
Manual mode: In this mode the robot is operated manually through a PC which is at a remote location. The Zigbee is operating in a duplex mode as the commands based on the movement of robot is sent by the user. Depending on the commands sent by the user the Arduino will control the motor drivers and will control the movement of robot. The Arduino will send the readings of temperature, obstacle occurrence or any motion detected with will help the user when there is adequate amount of light.

Stepping mode: This mode is implemented for troubleshooting of PIR sensor for the user point of view. This mode uses the five motions, i.e. forward, back, left, right and stop. When a forward command is given, the robot will move in the forward direction for 5seconds and after this it will wait in its place until next command is given to the robot.

connect the PC with the Zigbee module on the robot.The below window shows the operating modes of the robot which can be switched between by selecting the appropriate panel. The motion of the robot in the manual mode is operated by the robot control.

The human presence gives the output of PIR sensor, logic 1 defines that the human is detected by the sensor. The obsctable detection gives the output of IR sensor. The temperature of the enviroment is displayed on the command window by using an on-board temperature sensor. By clicking on 'Start CAM', live video streaming takes place on the screen of the command window.

The accelerometer data plots the X-Y-Z axis data of the on-board acceleromter. The robot path plot is simply the representation of the accelerometer data in order to track the movement of robot.



IV. RESULT ANALYSIS

The command window of the robot is develpoed using Visual Basics. The common port and connect options are used to

V. CONCLUSION

This paper proposes a human detection robot which can operate in an environment which is not suitable for humans. The main objective of this paper is to provide a low cost human detection robot for countries human rescue missions in extreme situations. This robot can operate flexibily in either manual input mode, automatic mode or stepping mode. During the manual mode, control commands are provided wirelessly. The automatic mode allows operation in areas beyond communication range. The sensors used in this project are cheap and easily available. This system is based on two level of human sensing in order to reduce power consumption and get higher efficiency in rescue missions. The first level is PIR and IR sensors and the second level is an IP camera to confirm the existance of human in disasters. This two level human detection system make the robot more reliable for rescue missions.

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