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ENHANCED HUMAN DETECTING FIREFIGHTING ROBOT

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Abstract

There are many new inventions in the field of robot technology. Wireless operated robots are used in many fields such as defense, agriculture etc. Research is being carried out towards implementing robots for handling firefighting emergency works. This paper discusses about the invention of the human detection robot and firefighting robot. The innovations which can be possible by using this human detection system in a fire fighting robot is discussed. The simulation analysis done using proteus is also discussed.

Keywords: Firefighting robot, sensors, object identification, tracking, heat detection, human detection, pir sensor.

I. Introduction

Over the course of history, the advancement in the field of robotics is huge. Recent developments in science and technology and fabrication of new and different kinds of sensors add to the design of different kind of robots [1]. Firefighting robot is one of the new robotic design which purely works on the basis of sensors or can be remote controlled [2].

It can be used in emergency handling operations. Firefighting robot can be used in common and practical environments like house, offices and can also assist the firefighters in their line of duty [3]&[4]. By the implementation of firefighting robots in the field we might have a chance of avoiding casualties and minimal property damage [5]. The technology of firefighting robot has been improved and is improving over the time. From direct remote control system to fully autonomous bot, firefighting robot can be designed in many ways with the help of different sensors and available modules[5] & [6].

The methodology of detecting humans autonomously has been studied and developed using different types of sensors and algorithms. [7] The heat signatures or the infrared radiation emitted from the human body are vital for the process of human detection. Human detection system helps in many emergency cases like floods, earthquakes and other natural calamities or else in hostage situations like terrorist attacks [8]. the intervention of autonomous robots for detecting humans in the above hazardous areas help in recovering the loss and also help in avoiding further damage.[9] &[10].

II. Evolution

Firefighting robot mainly uses the implementation of fire sensors and the processes that happen inside the robot depend upon the status of the fire sensors[1]. In2009 Segway robotics company designed a firefighting robot which can carry 400 pounds of equipment at a speed of 18 mph and is capable of shooting 10 gallons of water per second. figure 1 shows the Segway rpm robot connected to a hose.



Fig 1. Segway Robotics' RPM Firefighting robot.

It combines a Unifier Force50(tm) water cannon with a Segway robotic platform to provide unmatched maneuverability, positioning and control[2]&[3].

Rolly Firefighter Robot, the navigation of the robot throughout the house is achieved by data fed through a line tracker and ultrasound transducers[4]&[5]. The extinguishing device is deployed by a custom arm controlled by servos. figure 2 shows the rolyly firefighting robot



Fig 2: Rolly Firefighting Robot.

There is another adaptation of a firefighting robot which detects fire using color camera based upon pinpoint location. The robot enters a room and detects the area of extreme temperature which may be the point of ignition. Now the

pinpoint camera searches for an area where there is maximum intensity of light. The robot then moves to that particular area and then its heat sensor searches for the maximum concentration of heat generated. If the above condition is satisfied, then the servo starts operation and the fan rotates trying to extinguish the fire. If the flame is still prevalent then the operation is again repeated [7]. Figure 3 shows the fire protection bot. Once the flame is extinguished, the robot leaves the spot and navigates based on the color imaging of the camera.

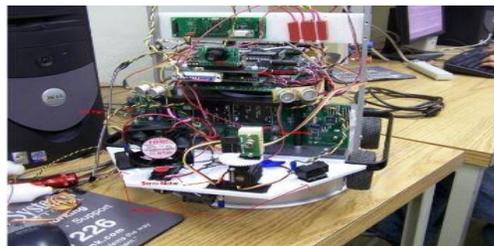


Fig 3: fire protection robot.

III. Human Detection System

Human body is detected by means of infrared waves. Every object that is above the absolute value of temperature emits infrared heat radiation which cannot be detected by human eye. So device which does not emit infra red waves but is capable of receiving and detecting infrared waves is used. PIR sensor is a sensor which is capable of detecting human movements by the tracking of human radiation emitted from the body [1]. PIR indicates passive infrared or piezoelectric infrared sensor. its termed as passive because it just detects infrared waves but does not act as source of them[8]. The construction of PIR sensor is simple, the circuitry is mounted on a small pcb and a Fresnel lens is attached to it to enhance the field of view of the sensor. The construction of the Fresnel lens determines the depth of infrared perception of the PIR sensor [9]. Figure 4 is the block representation of the Fresnel lens with pir sensor. PIR sensor is implemented in many circuits like burglar alarms, thermometric detection circuits etc... also human detection robots are being designed which use this PIR sensor to identify any human activity in the surrounding area. in a human detection robot, the pir sensor is directly interfaced to the micro controller at the receiver side.

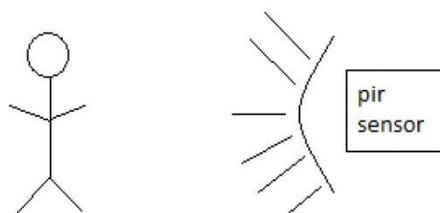


Fig 4: Pir sensor with Fresnel lens.

IV. Proposed System

This paper aims at interfacing the human detection system in the firefighting robot. this can be achieved by using pir sensor in place of any other sensors such as obstacle sensors etc... the pir sensor can be connected to the interrupt pin of the micro controller so that when the pir sensor detects [3] it sends electric pulse to the interrupt pin which makes the robot halt indicating the presence of a human[4] or the pir sensor can be interfaced to a gsm module so that whenever pir sensor detects the count can be displayed[9][6].

V. Simulation Analysis

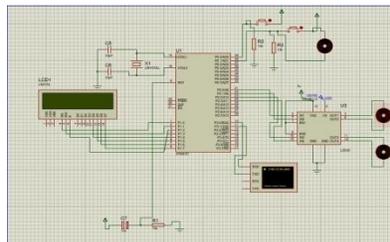


Fig 5: Simulation of this system is done using proteus.

Here the simulation is done using the at89c51 micro controller. Figure 5 shows the overall circuit representation. The pir sensor and fire sensor are indicated by using push buttons. The fire sensor push button sw2 can be connected to motor for water outlet. the pir sensor push button sw1 can be connected to microcontroller. the inputs for the movement of the robot are fed through the virtual terminal. Keyword 'f' denotes the forward movement.

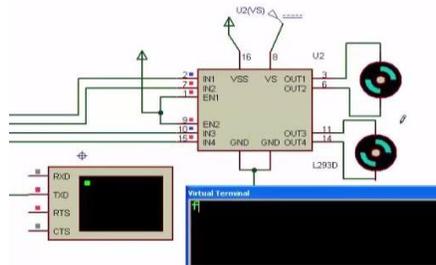


Fig 6: keyword 'b' denotes the reverse movement.

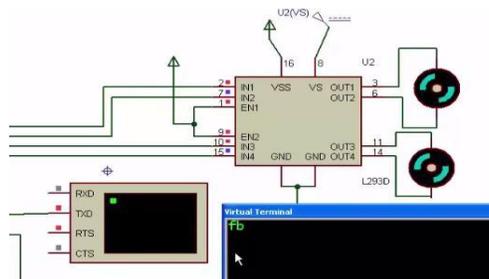


Fig 7: Keyword 'l' denotes the left movement.

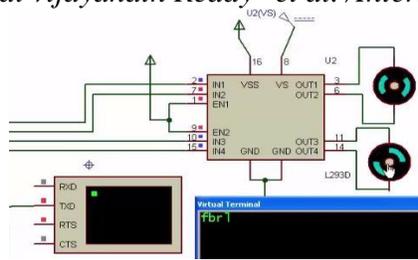


Fig 8: Keyword 'r' denotes the right movement of the robot.

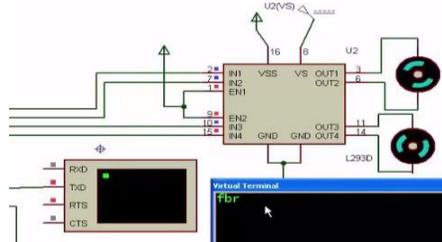


Fig 9: denotes the forward movement.

This way the movement of the robot is controlled.

Now the fire sensor sends electric impulse which drives the motor.

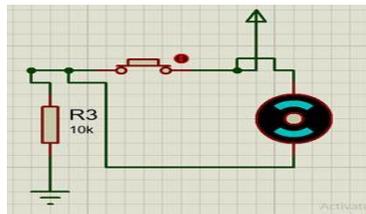


Fig 10: Fire sensor motor representation.

the sw1 push button represents the pir sensor. When it is active it will send signal to the micro controller indicating the presence of a human and the programmed message will be displayed on the lcd.

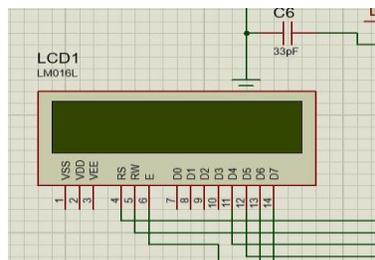


Fig11: LCD display.

VI. Conclusion

This project is all about creating a fire fighting robot with human detection capability. The fire fighting and the human detection systems are unique and different through this project we achieve the goal of including both the systems in one robot.

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