

Design of Fire Fighting Robot

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ABSTRACT: Our goal is to develop an intelligent multi sensor based fire fighting robot in our daily life. We design the fire detection system using four flame sensors in the firefighting robot, and program the fire detection and fighting procedure using sensor based method. The fire fighting robot is equipped with four thermistors/flame sensors that continuously monitor the temperature. If the temperature increases beyond the predetermined threshold value, buzzer sounds to intimate the occurrence of fire accident and a warning message will be sent to the respective personnel in the industry and to nearby fire station with the GSM module provided to it. Fire Fighting Robot continuously monitors the temperature at four sensors and if fire accident is true, the robot moves to the direction to which the temperature is recorded to be the relatively maximum among the four sensors and extinguishes the fire with water pump provided to it. After extinguishing the fire it comes back to its initial position. It is more advantageous than a smoke detector as it can extinguish the fire at the inception than waiting for an object to burn and produce smoke. When a smoke detector detects fire it, sprays water all over the place, instead of that particular point of source. It voluntarily detects and extinguishes fire without human aid.

I.INTRODUCTION

Robot is defined as a mechanical design that is capable of performing human tasks or behaving in a human-like manner. Building a robot requires expertise and complex programming. It's about building systems and putting together motors, flame sensors and wires, among other important components.[1] A fire fighter robot is one that has a small fire extinguisher added to it. By attaching a small fire extinguisher to the robot, the automation put out the fire by human controlling. This paper covers the design and construction of a robot that is able to sense and extinguish fire. This robot implements the following concepts: environmental sensing, proportional motor control. This robot processes information from its various sensors and key hardware elements via microcontroller. It uses thermistors or ultraviolet or visible sensors to detect the fire accident. A robot capable of extinguishing a simulated tunnel fire, industry fire and military applications are designed and built. Ultraviolet sensors/thermistors/flame sensors will be used for initial detection of the flame. Once the flame is detected, the robot sounds the alarm with the help of buzzer provided to it, the robot actuates an electronic valve releasing sprinkles of water on the flame.[2]

II.FIRE FIGHTING ROBOT

The project helps to generate interests as well as innovations in the fields of robotics while working towards a practical and obtainable solution to save lives and mitigate the risk of property damage. Fire fighters face risky situations when extinguishing fires and rescuing victims, it is an inevitable part of being a fire fighter. In contrast, a robot can function by itself or be controlled from a distance, which means that fire fighting and rescue activities could be executed without putting fire fighters at risk by using robot technology instead. In other words, robots decrease the need for fire fighters to get into dangerous situations. This robot provides fire protection when there is a fire in a tunnel or in an industry by using automatic control of robot by the use of microcontroller in order to reduced loss of life and property damage. This robot uses dc motors, castor wheel, microcontroller, sensors, pump and sprinkler. Microcontroller is the heart of the project. Microcontroller controls all the parts of the robot by the use of programming. In this robot as the fire sensor senses the fire, it sends the signal to microcontroller; since the signal of the sensor is very weak the amplifier is used so that it can amplify

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the signal and sends it to microcontroller. As soon as microcontroller receives the signal a buzzer sounds, the buzzer sound is to intimate the occurrence of fire accident. After the sounding of the buzzer microcontroller actuates the driver circuit and it drives the robot towards fire place, as the robot reaches near the fire microcontroller actuates the relay and pump switch is made ON and water is sprinkled on the fire through the sprinkler.[3]

SMOKE SENSORS

A smoke detector also called a smoke alarm is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. Thus, it senses only the smoke. Whereas, Fire sensors used to detect the fire before it burns out and produces smoke. In this way, it is very advantageous than the smoke sensors.

TEMPERATURE SENSOR

A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of *thermal* and *resistor*. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting overcurrent protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range, typically $-90\text{ }^{\circ}\text{C}$ to $130\text{ }^{\circ}\text{C}$. [1]

UVTRON

UVTRON is an ultraviolet ON/OFF sensor tube that uses the photoelectric effect of metal and gas multiplication effect of electric current by means of discharge. It has a very narrow range of sensitivity from 185nm to 300nm and is completely insensitive to visible light. Because it used the discharge phenomenon, its sensitive is high and an adequate output voltage is obtained, making it possible to design a high sensitivity, quick response ultraviolet detection with simple circuitry.[7]

GSM Modem

GSM modem is used to intimate the occurrence of fire accident via SMS. Using GSM modem a predetermined message can be send to required persons and also to fire station so that they get alerted and reach the place quickly where fire broken out.[8]

Driver Circuit

The driver circuit generally made by using one transistor and one relay. The driver circuit was mainly operated by the Micro Controller. The Micro Controller was change the state of the output pin from the low to high that is from 0 level to the 1 level. By using this sequence to control the base of the transistor. The transistor will act as a ON/OFF switch corresponding to the input of the base. If the base of the transistor will high the transistor will act as a ON switch otherwise it will act as OFF switch[4]

DC Motors

DC motors are generally more powerful than servos in terms of speed and torque. Microcontroller could not accurately control DC motors without a motor controller. Therefore, motor Controllers are needed. An encoder used to get feedback from the DC motor.

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Chassis

Another word for chassis is base. All components of the robot are attached directly to the chassis; therefore a strong yet light chassis will be ideal. Chassis can be made from many different types of materials, some common types are aluminum, steel, acrylic, plastic, and high density polymer.[6]

III.WORKING

Robot uses microcontroller to drive four flame sensors, and transmit distance range to main controller of the fire fighting robot through series interface. To drive the all the components 5v dc and 12 v dc are required. The mains give the 230v ac so first we step down the 230v ac in to 12v ac by using step down transformer. Then the output is given to the full wave rectifier. The rectifier eliminates the negative peak voltage of the input voltage .The output of the rectifier is the pulsating dc. The error pulses are eliminating by using capacitor filter. Then the output at the parallel of the capacitor is the 12v dc. But the Micro Controller is work on 5v dc .To convert the 12v dc into 5v dc a regulator (7805) is used. The output of the regulator is constant irrespective of the input voltage. The Micro Controller requires the preset logic circuit for protection of the internal program and internal clock in case of power failure.[5]

A sudden change in the power may cause data error resulting in the corruption of the internal program. The reset logic circuit contains one capacitor and a resistor. The driver circuit generally made by using one transistor and one relay. The driver circuit is mainly operated by the Micro Controller. The Micro controller changes the state of the output pin from the low to high, i.e. from 0 level to the 1 level. The transistor will act as an ON/OFF switch corresponding to the input of the base. If the base current of the transistor is high the transistor is under ON condition else it is in OFF state. These conditions will be used to control the relay. The thermal sensors provide the senses the heat from within the room. First sensor will give the data to the micro controller if it finds the heat. The micro controller pin bit will goes low when the fire is present. The micro controller will always scan the input signal of sensors. If the first sensor gives the data about fire to the micro controller, it then finds the movement to reach the fire by calculating the input data. The micro controller can give the output to two motors. One motor is used to move in forward direction to reach the destination point and the other is used to putoff the fire. After end of fire the robot will go back to the original position.[9][10]

ROBOT MODEL



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IV. ADVANTAGES, DISADVANTAGES

A. Advantages:

1. Prevention from dangerous incidents
2. Minimization of –ecological consequences –financial loss –a threat to a human life.

B. Disadvantages:

1. Doesn't predict nor interfere with operators thoughts.
2. Cannot force directly the operator to work.

V. CONCLUSION

This paper gives a detailed mechanism about the robot that continuously monitors, intimates the respective personnel and extinguishes the fire. In the industry if any fire accident occurs, there is a need of person to monitor continuously and rectify it. In this process if any time delay takes place irreparable loss occurs since it is a cotton industry.

VI. FUTURE SCOPE

In the present condition it can extinguish fire only in the way and not in all the rooms. It can be extended to a real fire extinguisher by replacing the water carrier by a carbon-di-oxide carrier and by making it to extinguish fires of all the room using microcontroller programming. Also the robot could not be run through the batteries because at some conditions the current requirement for the circuit rises to about .8A which is very high and can not be obtained using batteries.

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