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A Review on RF based Fire Extinguishing Robot

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Abstract: *A Robot suitable for automatically extinguishing the fire during fire accidents is presented in this paper. Fire Extinguisher Robot is a Hardware based model used to automatically extinguish the fire during fire accidents. The Robot finds its applications in Rescue operations during fire accidents where the possibility for service men to enter the fire prone areas is very less. Robot is defined as a mechanical design that is capable of performing human tasks or behaving in a human-like manner. By attaching a small fire extinguisher to the robot, the automation put out the fire by human controlling. 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 decreases the need for fire fighters to get into dangerous situations.*

Keywords: *ATmega 8, ATmega 16, R.F. Module, I.R Photodiode, DC Water pump, DC Motor*

1. INTRODUCTION:

This paper deals with a topic of much contemporary relevance. It proposes a unique and economical method for improving the safety of fire accidents which is a leading cause of death and injury worldwide. Survey says 54 people die daily due to fire accidents. Fire fighters try their best to fight and extinguish fires when in need. But at the household level, it is observed that if the fire can be extinguished at an early stage, many major accidents can be averted. The aim here is to build a robot that can detect and extinguish fire. A Robot is a re-programmable, multifunction manipulator designed to move materials, parts, tools or special devices through variable programmed motions also be defined as an automatic device that performs functions normally ascribed to humans or a machine in the form of a human. The Robot in this paper is an Automatic Fire Extinguisher which detects and extinguishes the fire sensed by a sensor. 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. The RF module makes it possible for the operator to control the robot manually from a distance, thus allowing surveillance facility.

2. CONCEPT:

In our daily life, fire accidents are very common problem. This causes great damage to property, economy and also losses life. Fire accidents having serious consequence in terms of loss of human life, injury, damage to property. The concept of the model is to detect and extinguish fire using microcontroller.

3. COMPONENTS:

This fire extinguishing robot is a prototype of the actual one. Sensors used here are simple infrared (IR) photodiodes that detect IR rays coming out of the fire. Sensors are equally spaced at 45° each. These act as the eyes of the robot. The pump used here symbolizes the fire extinguishing mechanism, and is used as a substitute in the prototype.

IR waves: Wavelengths longer than visible and up to 1mm are termed as IR waves. The light emitted by a burning source comprises IR waves, so by using IR photodiodes as sensors we can detect a fire. This principle has been used in the designing of the sensor board.

DC water pump: A DC water pump is used for the purpose of extinguishing fire. It pumps out water stored in a bottle.

RF module: A pair of 433MHz RF transmitter-receiver module is used. It allows transmission and reception of serial data without physical connection.

The frequency of an RF signal is inversely proportional to the wavelength of the field.

4. CIRCUIT DIAGRAM AND WORKING:

The robot can be made to work in manual as well as in autonomous mode. Different modes of operation are given in Table I.

TABLE I
Mode Selection Using DIP1 Switch

PD3	PD4	PD5	PD6	Mode select
1	1	1	1	Manual
0	1	1	1	Reset
1	0	1	1	Autonomous
1	1	0	1	Water pump on
1	1	1	0	LED test mode

Table-1

The fire extinguishing robot works in three stages:

Stage 1: Fire detection (autonomous mode): IR photodiodes are connected in reverse bias as shown in the circuit diagram of the sensor module. Anodes are commonly connected to the ground and cathodes are connected to the 5V via resistors of 1MΩ each**.**

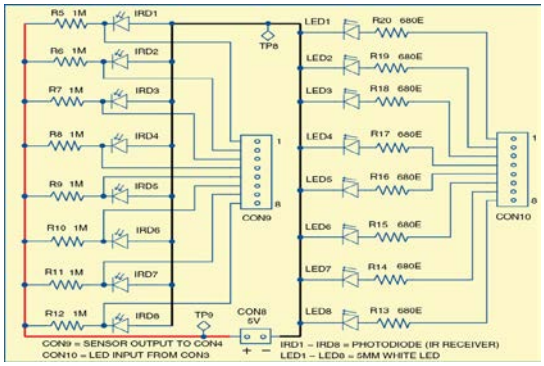

Fig. 1: Sensor Module

Voltage across the photodiode is given as input to ADC pins (PA0 through PA7) of ATmega16. When IR waves fall on the IR photodiode, its resistance decreases from 650kΩ to 150kΩ, reducing the voltage across the photodiode, thus changing the input voltage at the ADC pin. By proper quantization, the presence and absence of the flame can be distinguished. Similarly, eight IR photodiodes mounted in a circular fashion on the sensor board help detect the fire; the corresponding LED glows if fire is detected. The cone of detection of the IR photodiode is large, thus decreasing the resolution of the system. This problem can be solved by properly shielding IR photodiodes.

Stage 2: Extinguishing fire: Constant feedback from sensors is fed to the main module through CON4, and hence position of the fire with respect to the robot is determined. The main module includes an ATmega16 microcontroller, two L293D motor driver ICs to drive motors, a water pump and RF receiver RX1. The circuit diagram of the main module is shown in fig.

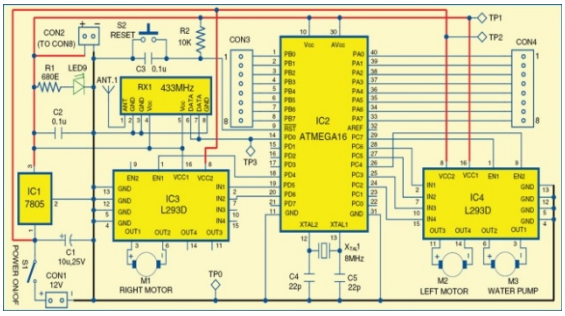

Fig. 2- Receiver Module

The basic function of the algorithm is to orient the front sensor in front of the fire so that the nozzle of the pump comes directly above the fire source. When this is achieved, the pump starts and extinguishes the fire. The robot moves with the help of two motors, whose sense of rotation is controlled by the controller, depending on the feedback from the sensor.

Stage 3: RF communication and manual control (manual mode): The robot is controlled by the operator with the help of a wireless remote (circuit diagram) that uses an RF module for communicating with the robot.

Switches, push buttons and joysticks are provided on the remote that controls various tasks such as autonomous mode selection, reset and starting the pump. For each command, the remote sends a specific character that is received by the robot and the corresponding operation is performed.

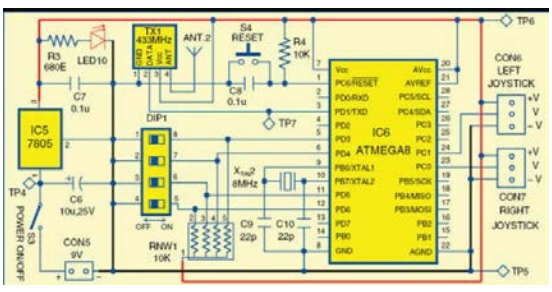

Fig. 3- Transmitter Module

5. RESULT:

The FIRE EXTINGUISHING robot made under this project can move in both forward and reverse direction and can turned in left and right directions. Thus we can operate a robot over a very long distance and there is no need for human to go even near the area on fire. Robot can be controlled by manual mode and when it detect the fire it automatically extinguish fire. This robot is very useful in areas where human access is difficult.

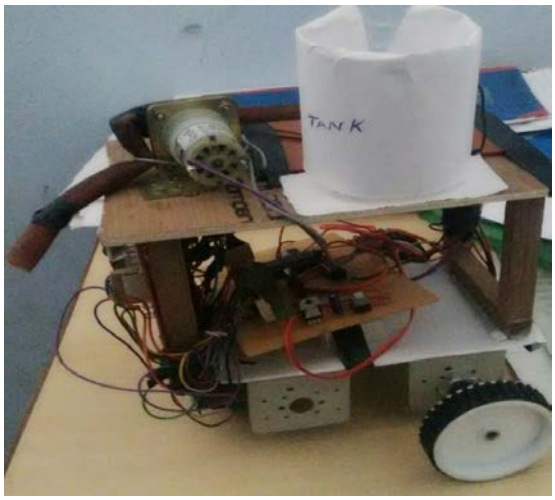

Fig. 4- Prototype of Fire Extinguishing Robot

6. CONCLUSION:

The fire extinguishing robot designed by us is an amateur attempt at creating a moving machine, aid us in fighting the emergency off. When fire occurs in building, factories or any closed spaces, fighting it is quite risky for us as one may get trapped in such closed spaces. In such cases, a robot, on the as designed by us, can be very efficiently use for fire fighting, with least risky human intervention. The conclusion is to provide security of home, laboratory, office, factory and building which is important to human life. We develop an intelligent multisensory based security system that contains fire fighting system in our daily life. We design the fire detection system using sensors in the system, and program the fire detection and fighting procedure using sensor based method. This project presents a fire fighting robot using RF communication and it is designed and implemented with Atmega16.

7. FUTURE SCOPE:

Based on the responses and reports obtained as a result of the significant development in the working system of FIRE BRIGADE SYSTEM, this project can be further extended to meet the demands according to situation. In the future we can use sensors such as smoke detectors, temperature sensor and thermal image processing for feedback and to improve the accuracy and reliability of the system further. Replace IR photo sensors with more dependable ones, which have filters, because IR sensors even take sunlight as a source of IR waves, leading to errors and false alarms.

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