

Fire Fighting Robotic Machine

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Abstract: *A fire outbreak is a hazardous act that leads to numerous consequences. Detecting a fire at an early stage and extinguishing it can aid in prevention of various accidents. Till now we rely on human resource. This often leads to risking the life of that person. Therefore, fire security becomes an important aspect to save human lives. In this paper a fire extinguishing robot has been proposed and designed which detects the fire location and extinguish fire by using sprinklers on triggering the pump. This robot uses three flame sensors for accurate fire detection. This proposed model of Fire Extinguishing Robot using Arduino used to detect presence of fire and extinguishing it automatically without any human interference. It contains gear motors and motor driver to control the movement of robot when it detects any presence of fire and will automatically start the water pump to extinguish that fire breakout. This model robot has a water ejector which is capable of ejecting water at the fire breakout place. The water ejector pipe can be move towards the required direction using servo motor. The whole operation is controlled by an Arduino UNO micro-controller.*

Keywords: Arduino UNO, Flame sensor, Motor driver, Water pump.

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. 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 thermo resistors 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/thermo resistors/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. 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 so that it can amplify 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.

II. BLOCK DIAGRAM AND WORKING

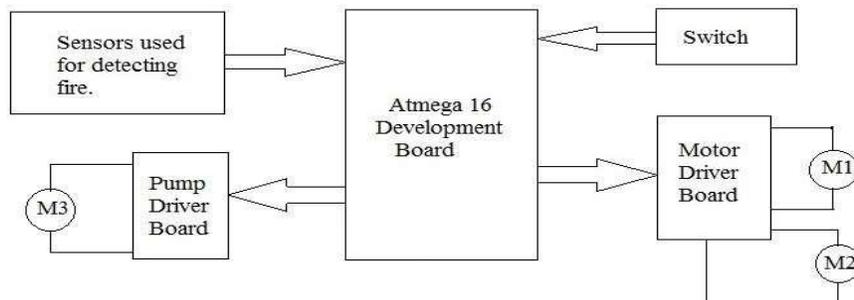


Figure 1: Block Diagram of Fire Detector & Extinguisher Robot

The main components are:

- IR sensors
- Joysticks
- Motor drivers
- DC motors
- Pump

Fire Detector and Extinguisher Robot is operated to detect the fire and also to extinguish it. It can be operated in two modes one is manual mode and other is autonomous mode. Manual mode is operated using joysticks, even pump is operated manually. In autonomous mode IR sensors are used to detect the fire and robot is coded accordingly to move in the direction of detected fire. In this robot has a switch which is used to switch between manual and autonomous mode. The main brain of this project is the Arduino, but in-order to sense fire we use the Fire sensor module (flame sensor) that is shown below.

2.1 Fire or Flame Sensor Module

As you can see these sensors have an IR Receiver (Photodiode) which is used to detect the fire. How is this possible? When fire burns it emits a small amount of Infra-red light, this light will be received by the IR receiver on the sensor module. Then we use an Op-Amp to check for change in voltage across the IR Receiver, so that if a fire is detected the output pin (DO) will give 0V (LOW) and if there is no fire the output pin will be 5V (HIGH). So, we place three such sensors in three directions of the robot to sense on which direction the fire is burning.

2.2 Flame Sensor Setup on Fire Fighting Robot Chassis

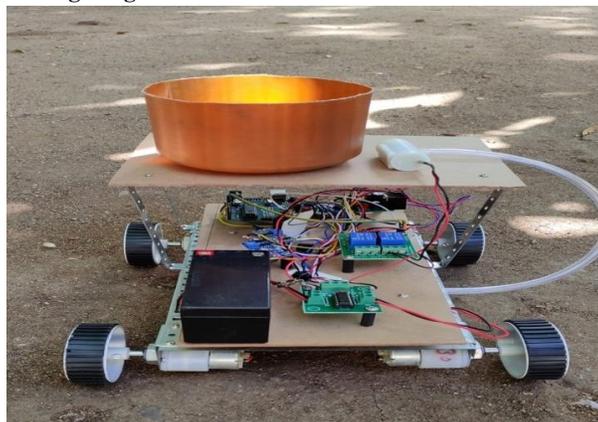


Figure 2: Output Module

We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the L293D module. When near a fire we have to put it out using water. Using a small container we can carry water, a 5V pump is also placed in the container and the whole container is placed on top of a servo motor so that we can control the direction in which the water has to be sprayed. Let's proceed with the connections now.

The Fire Detector and Extinguisher Robot has been successfully executed. In its automatic mode it can detect the fire and try to extinguish it and also by using its manual mode we can extinguish.

III. CONCLUSION

This paper has presented a unique vision of the concepts which are used in this particular field. It aims to promote technology innovation to achieve a reliable and efficient outcome from the various instruments. With a common digitalized platform, these latest instruments will enable increased flexibility in control, operation, and expansion; allow for embedded intelligence, essentially foster the resilience of the instruments; and eventually benefit the customers with improved services, reliability and increased convenience. The nineties witnessed quantum leaps interface designing for improved man machine interactions. The Mechatronics application ensures a convenient way of simplifying the life by providing more delicate and user friendly facilities in computing devices. Now that we have proven the method, the next step is to improve the hardware. Instead of using cumbersome modules to gather information about the user, it will be better to use smaller and less intrusive units. The day is not far when this technology will push its way into your house hold, making you more lazy.

This paper presents the major features and functions of the various concepts that could be used in this field in detail through various categories. Since this initial work cannot address everything within the proposed framework and vision, more research and development efforts are needed to fully implement the proposed framework through a joint effort of various entities. This autonomous robot successfully performs the task of a fire fighter in a simulated house fire. Benefited from this technology, since the expense of activating other types of fire extinguishers may outweigh that of a robot, where product stock could be damaged by imprecise fire control methods.

IV. ADVANTAGES

- Prevention from dangerous incidents
- Minimization of
 - Ecological consequences
 - Financial loss
 - a threat to a human life
- Needs no micro-controller programming.
- The reconstruction of the curse of operator's work.

V. FUTURE SCOPE

- The project has been motivated by the desire to design a system that can detect fires and take appropriate action, without any human intervention. The development of sensor networks and the maturity of robotics suggests that we can use mobile agents for tasks that involve perception of an external stimulus and reacting to the stimulus, even when the reaction involves a significant amount of mechanical actions. This provides us the opportunity to pass on to robots tasks that traditionally humans had to do but were inherently life-threatening.
- Fire-fighting is an obvious candidate for such automation. Given the number of lives lost regularly in fire-fighting, the system we envision is crying for adoption. our experience suggests that designing a fire-fighting system with sensors and robots is within the reach of the current sensor network and mobile agent technologies. Furthermore, we believe that the techniques developed in this work will carry over to other areas involving sensing and reacting to stimulus, where we desire to replace the human with an automated mobile agent.
- Of course, this project has only scratched the surface. As in the design simplifications and the implementation constraints in suggest, our project is very much a proof-of-concept. In particular, a practical autonomous fire-fighting system must include a collection of robots, communicating and cooperating in the mission; furthermore,

such a system requires facilities for going through obstacles in the presence of fire, and ability to receive instructions on-the- fly during an operation. All such concerns were outside the scope of this project.

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