AUTONOMOUS FIRE FIGHTING ROBOT
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Abstract—This project is used to extinguish the fire in case of fire accidents. This fire fighting robot is controlled autonomously using an Arduino UNO microcontroller which is considered as brain of the robot. It is a three wheeled robot, with forward & reverse movement using two DC gear motor. Our robot can move in any directions. The robot can avoid any obstacles in the path. It senses the obstacle using ultrasonic sensor. This robot consists of water pumping system, which is actuated to spray the water and it senses the fire by using flame sensor. Robots designed to find a fire, before it rages out of control, can one day work with fire-fighters greatly reducing the risk of injury to victims. The project will help 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.

Keywords—Arduino; Fire Fighting Robot; Microcontroller;

1. INTRODUCTION
This is the project to develop the fire fighting robot to prevent from the fire accidents occur in the home. This robot using the Arduino UNO microcontroller for the desired operations. Arduino Uno controls the all components of the robot. This robot consists of water tank and pumping system. It is used to spray when the fire occur. This systems are controlled by the Arduino. The robot consists of three wheeled chassis to carry the components of all. Ultrasonic sensor is fixed in front of the robot to sense the obstacles while moving in forward directions. If any obstacle is detected by the sensor it will automatically moves to desired direction. These instructions are given by the microcontroller.

To find the fire accidents the flame sensors are used, it will detect the fire by temperature. The robot is set to ON at certain temperature so that the robot can go to area of accident. The flame sensor will find the temperature in 60 degree angle only.

The four flame sensors are fixed in four sides of the robot chassis. Motor drivers connected with the Arduino to control the two DC gear motors used in it. This will help to move the robot in any directions. These operations are programmed to do the actions at the time of accidents.

2. ARDUINO UNO MICROCONTROLLER
A microcontroller often serves as the “brain” of a mechatronic system. Like a mini, self-contained computer, it can be programmed to interact with connected hardware and/or a user, much like a PC connected to a small network of hardware. As the computer industry has evolved, so has the technology associated with microcontrollers. Every year microcontrollers become much faster, have more memory, and extend their input and output feature sets, all the while becoming even cheaper and easier to use.

The Arduino Uno is a microcontroller board based on the ATmega328 datasheet. It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

3. BLOCKDIAGRAM

4. COMPONENT DESCRIPTION
Controller Used:
Arduino UNO microcontroller is used in this project. It is the central processing unit of the project.
Motor Driver IC:
L293D is a dual H-bridge motor driver integrated circuit. They are used to control the two motor used in project.
There is one motor driver IC used in this project connected to the rear motors.

**Flame Sensor:**

Flame sensor is designed to detect and respond to the presence of a flame or fire. A flame detector can often faster and more accurately than a smoke or heat sensor. It will sense the Flame up to 600 Angle.

**Water Pump:**

Water pump is a device that moves fluids by mechanical action. Pumps are commonly rated by flow rate, outlet pressure in meters of head etc.

**Ultrasonic Sensor:**

Ultrasonic sensor transmits ultrasonic waves into the air and detects reflected waves from an object.

**Motors:**

A device that converts electrical energy into mechanical energy or imparts motion.

**Battery:**

A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.

5. **WORKING**

There are several possibilities a fire can start in homes, any remote area or in an industry. For instance, in garments, cotton mills, fuel storages electric leakages will result in immense harm. Also, it's a worst case scenario, causing heavy losses not only financially, but also conjointly destroying areas surrounding it. Robotics is the rising answer to guard the human lives, wealth and surroundings. A Fire fighting robot, designed and built will be designed with an embedded system. It should be able to separately navigate through a modelled floor plan, whereas actively scanning for a flame. The robot will even act as path guide in normal case associated as a fireplace device in an emergency.

These robots are designed to search out a fireplace, before it ranges out of control, will sooner or later work with fire fighters greatly reducing the danger of injury to victims. The Fire fighting robot project will help generate interest as well as innovations within the fields of robotics operating towards a sensible and obtainable solution to save lives and mitigate the danger of property harm.

Fire fighting robot is operated using Arduino microcontroller, the program has developed for the robot using Arduino ISIS software and simulated using proteus IDE software first we have to assemble the components, in a proper procedure on the chassis, then program will be upload to the Uno board after that the fire detects by the flame sensor the robot will turn ON and move in to the place where fire exists during the movement of robot, any obstacle will stop the robot so we using the ultrasonic sensor to avoid the obstacles in robots path then the robot will reach the fire existing area. It will stop in safety distance then pumping system will be actuated to spray the water on the fire.

6. **CIRCUIT DIAGRAM**

![Circuit Diagram](image)

7. **SOFTWARE SECTION**

**Arduino IDE (Arduino Integrated Development Environment)** Contains a text editor for writing codes, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine Hardware to upload program and communication with them.

Programs written using Arduino software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension (.ino). the editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also display errors. The console display text output by Arduino software including complete error message and other information’s.

**Proteus Software (for Simulation of Electronic Circuit)**

Proteus professional is a software combination of ISIS schematic capture program and ARES PCB layout program. This is a powerful and integrated development environment. Tools in this suit are very easy to use and these tools are very useful in education and professional PCB designing. As professional PCB designing software with integrated space based auto router, it provides features such as fully featured schematic capture, highly configurable design rules, interactive SPICE circuit simulator, extensive support for power planes, industry standard CADCAM & ODB++ output and integrated 3D viewer.
8. APPLICATIONS

- Used in Hydrogen Stations.
- Used in Gas-Fueled cookers.
- Industrial heating & drying systems and Industrial gas turbines.
- Used in houses and industrials.
- Schools, colleges and hospitals are used.
- The main purpose is to rescue the people by extinguishing fire in a building.
- It can be used in record maintaining rooms where fire can cause lose of valuable data.
- It can be used in Server rooms for immediate action in case of fire.

9. CONCLUSION

This project presents a fire fighting robot using Arduino microcontroller and it is designed. Experimental work has been carried out carefully. The result shows that higher efficiency achieved using the embedded system. The proposed method is verified to be highly beneficial, through this we can conclude that a robot can be used in place of human reducing the risk of life of the fire fighters. We can use them in our homes, labs, office etc. At present the robot is capable of throwing water with high flow rate only. At future the robot will also capable of throwing water with controlled robotic arms and object detection using camera on it. It can be used as further extension of the project to achieve all the features. Hence, this robot can play a crucial role.

10. FUTURE SCOPE

In future we can implement following factors:

- Use of CO2 gas cylinders, dry chemical powder, foam & wet chemical.
- Using wireless remote control helps to control robot manually.
- Use of high resolution Zooming camera.
- Implementing Smoke & sound Sensors in future.
- Can use GSM (Global System for Mobile Communication)

REFERENCES

[4] Implementing a fire fighting robot as an effective sensor by Prof. Bong D.M.K.