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Arduino Based Fire-Fighting Robot

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Abstract: In recent years, there has been an increasing focus on the development of autonomous systems to assist in emergency situations, particularly in firefighting scenarios. This abstract presents an overview of an Arduino-based fire fighting robot, designed to detect and extinguish fires while ensuring the safety of human personnel.The Arduino-based fire fighting robot combines the power of the Arduino microcontroller platform with advanced sensors and actuators to provide an efficient and reliable solution for fire suppression. The robot's primary objective is to detect and locate fires in an indoor environment using a combination of flame and smoke sensors. Once a fire is detected, the robot autonomously navigates through the environment using sensors and sparys water over it.

Keywords: Arduino UNO, Sensors, Fire detection, Water pump, Motor driver

I. INTRODUCTION

In recent years, the development of autonomous robotic systems has revolutionized various industries, including emergency response and firefighting. The need for efficient and effective fire suppression techniques has led to the exploration of innovative solutions, such as the integration of Arduino microcontrollers with advanced sensors and actuators to create Arduino-based fire fighting robots. These robots offer promising capabilities in detecting and extinguishing fires while minimizing human exposure to hazardous environments.The Arduino-based fire fighting robot represents a significant advancement in the field of firefighting automation. It combines the power of Arduino, an open-source electronics platform, with specialized sensors and actuators to create a versatile and adaptable firefighting solution. The integration of Arduino allows for flexibility in design, programming, and customization, making it an ideal choice for developing sophisticated robotic systems.The primary objective of an Arduino-based fire fighting robot is to autonomously detect, locate, and suppress fires in various environments, including indoor spaces. This is achieved through the integration of sensors, such as flame and smoke detectors, which enable the robot to identify fire incidents accurately.The development of an Arduino-based fire fighting robot involves a multidisciplinary approach, combining aspects of mechanical design, electronics, sensor integration, and software programming. Researchers and developers can leverage the open-source nature of Arduino to collaborate, share knowledge, and build upon existing designs. This encourages innovation and continuous improvement in the field of firefighting robotics

II. LITERATURE SURVEY

Tawfiqur Rakib, M. A. Rashid Sarkar proposed a fire fighting robot model which consists of a base platform made up of 'Keosene wood', LM35 sensor for temperature detection,flame sensors to detect the fire and a water container of 1 litre capacity which is made up of a strong cardboard that makes it water resistant. The robot has two wheels for its movement [1].

S. Jakthi Priyanka.R. Sangeetha proposed an android controlled fire fighting robot which uses Arduino UNO R3. The robot consists of gas sensor for fire detection, gear motor and motor drive for the movement of robot, a bluetooth module to connect the robot with the android device and to control the robot with the smartphone as well [2].

Nagesh MS, Deepika T V , Stafford Michahial, Dr M Sivakumar proposed a fire extinguishing robot which employs DTMF (Dual Tone Multi Frequency Tones) technology for the navigation of the robot and uses a flame sensor for fire detection that is capable of sensing flame of the wavelength range 760 to 1100nm and sensitivity varies from 10cm to 1.5feet [3].

Shang Gao, Zhiyang Zhang, Zihan Zhao, Mohsin M. Jamali "Vision and Infra-Red Sensor Based Fire Fighting Robot".The authors describe the design and architecture of their fire-fighting robot. The robot is equipped with vision sensors, which enable it to detect fires based on visual cues such as flame color and intensity. Additionally, it incorporates infrared sensors to detect heat sources associated with fires. The integration of these two sensor modalities enhances the accuracy and reliability of fire detection.[4]

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J Jalani1 , D Misman1 , A S Sadun1 and L C Hong1 proposed a automatic fire fighting robot with notification. This robot consists of three flame sensors for fire detection in left, right and centre direction [5].

Anantha Raj P, Srivani M " Internet of Robotic Things Based Autonomous Fire Fighting Mobile Robot"
The authors begin by providing an overview of the Internet of Things (IoT) and its application to robotics The paper presents the design and architecture of the proposed fire-fighting mobile robot. The robot is equipped with various sensors, including flame sensors for fire detection, temperature sensors for environment monitoring, and gas sensors for detecting toxic fumes. It also incorporates actuators for extinguishing fires, such as water spraying mechanisms. The integration of these sensors and actuators allows the robot to autonomously detect fires, assess the severity of the situation, and initiate appropriate fire suppression actions.[6]

Megha Kanwar, Agilandeeswari L. "IOT Based Fire Fighting Robot"The paper describes the architecture of the proposed IoT-based fire-fighting robot. The robot is equipped with various sensors, including smoke and temperature sensors, to detect the presence and severity of fires. These sensors continuously monitor the environment and transmit data wirelessly to a central control unit.[7]

Mittal, Shiva, Manish Kumar Rana, and others. A fire engine was created to help firefighters in real-time emergencies. The robot can extinguish the flames with water and carbon dioxide sprays and protect itself from heat using fog sprays [8].

III. PROPOSED SYSTEM

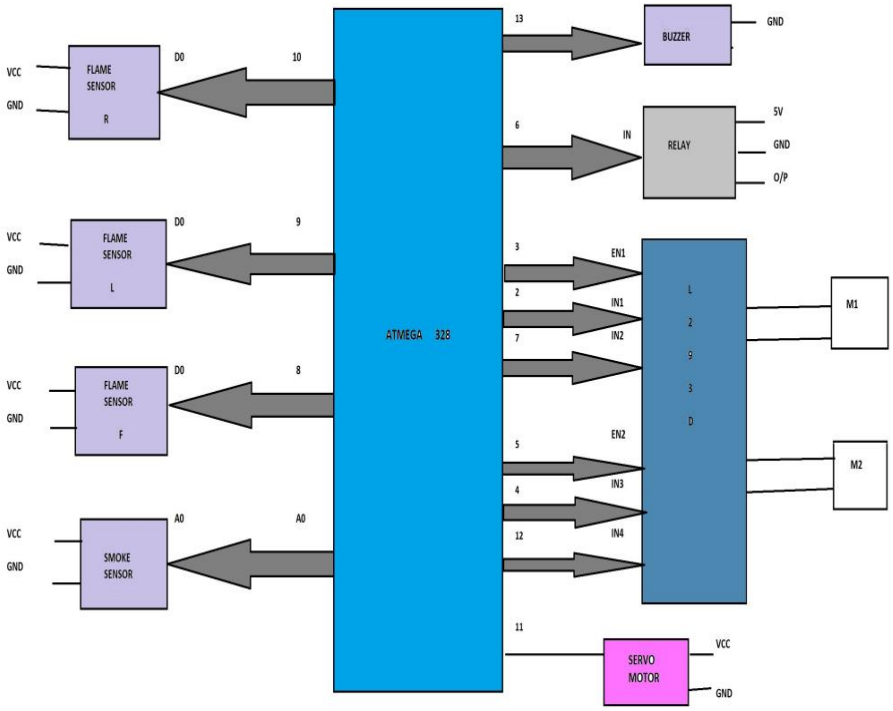

Fig 1 . System block diagram

This proposed device is capable of detecting fires in the environment and extinguishing them with water from the container. This method is extremely useful for putting out fires in areas where people have yet to set foot. The system is controlled by an Arduino Uno microcontroller, and flame sensors are used for fire detection.

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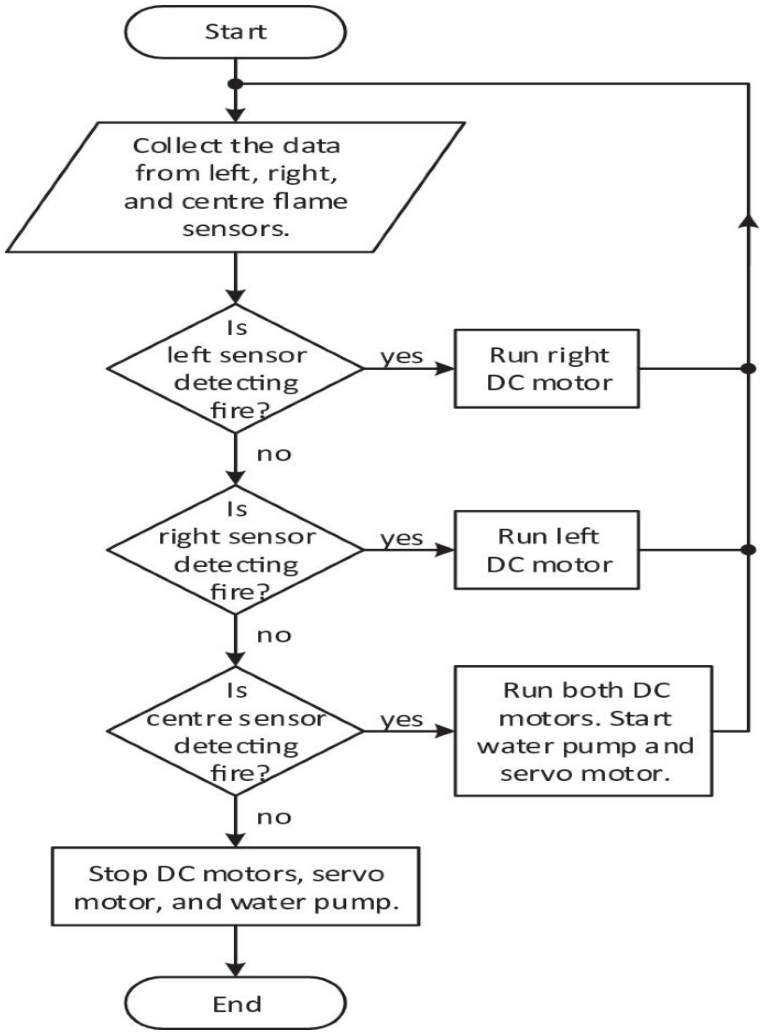

Fig 2. Flow chart

IV. METHODOLOGY

A fire fighter robot is one that has a small fire extinguisher or water tank added to it . By attaching a small water tank to the robot, the fire detection and controls are automatic. The robot works with sensor for searching the fire and when fire is detected then automatically spray the water over it. Flame and gas sensors were used to detect the fire and smoke. These two sensors can automatically detect fire and smoke and the robot navigates itself to the source of the fire and start extinguishing it by using water tank.

HARDWARE IMPLEMENTATION:

This robot is made up of numerous different types of sensors, and the Arduino controller is the heart of the robot. Arduino is a microcontroller that is linked to other components. The Motor Driver is used to get the DC motor going. The system's input also includes a flame sensor and an IR distance sensor. To combat fire, the robot is equipped with a fire extinguisher.

1) Flame Sensor: This sensor is primarily intended to detect and respond to the occurrence of a fire or flame. It detects fire using five flame sensors set at a 30-degree angle. The detection wavelength range is 700-1100nm. The detection angle is 600 degrees.

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2) DC Motor: A DC motor is an electric motor that transforms DC electrical power to mechanical power, or translates a DC supply to rotation or movement. Despite the fact that the motor runs at 500 RPM at 12V, it runs smoothly from 4V to 12V and provides a wide range of RPM and torque.

3) Driver Module: The motor drive module includes four HG7881 chips. Can drive two 4-wire 2-phase stepping motors or four DC motors. Motor operating voltage 2.5V-12V is suitable for the motor range.

4) Servo Motor: A servomotor is a linear or rotary actuator that can control linear or angular position, acceleration, and velocity with precision. A motor is connected to a position sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotor use. A servo motor is used when you need to spin an object at a specified angle or distance. It's simply a servo mechanism with a simple motor. DC servo motors use DC power, while AC servo motors use AC power.

V. CONCLUSION

In this project we aim to reduce the effect of fire accidents which usually start from small flame , therefore people life and money would be saved. The robot can successfully find fire and reach it without running into obstacle. We have managed to construct the robot comfortably and user friendly.

VI. FUTURE SCOPE

Future work can include the transformation of the experimental robot prototype into a practical robot, which requires improvement in its overall performance. Face detection system are developed for a fire-fighting robot to rescue human beings caught in fire. The face detection system alerts the presence of human beings caught in fire to facilitate their rescue. The ultrasonic sensor can also be.

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