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Arduino Based Fire-Fighting Robot

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Abstract: According to the National Crime Records Bureau (NCRB), fire incidents in India killed over a lakh people between 2010 and 2014. The current common tendency is to use robots instead of humans to deal with fire threats where it is practicable to do so. A wildfire is a dangerous act with numerous consequences. Until date, we have relied on human resources to detect and extinguish fires. This has a significant impact on the life of the individual. As a result, fire safety becomes an essential component of human survival. This project has convinced and designed a fire extinguishing robot that locates the fire and extinguishes it with water after the pump is activated. This robot employs three flame sensors to accurately identify fires.

The entire system is programmed using the Arduino UNO board, which serves as the system's brain. Human intervention is becoming increasingly rare, and robots are increasingly being employed for safety purposes. This Arduino-powered Fire Extinguishing Robot detects and extinguishes fires without the need for human interaction. It uses gear motors to activate the water pump, which then extinguishes the fire. A water ejector is included in this model robot, which can eject water at the fire breakout spot. The water ejector pipe can be moved in any direction using the Servo Motor. The robot's design is simple, affordable, and portable, making it a viable commercial prospect. This would increase firefighter efficiency while simultaneously reducing the risk of human life.

Key words: Arduino UNO, Flame sensor, Motor driver, Water pump

I. INTRODUCTION

How did we come up with this concept? Our team was always more interested in security-related projects. We determined that our idea would be security-related, but we also wanted to create something unique, both in terms of the market and for a social cause. As a result, we devised the concept of a fire-fighting robot.One of the most crucial factors in a fire tragedy is the number of lives lost in the process of saving another's life. Because of explosive materials, smoke, and high temperatures, it is sometimes hard for firefighting workers to reach the scene of a fire. Many disastrous outcomes can be avoided if the fire is detected quickly. A single spark can start a huge conflagration. Because of an inadequate fire management system, not only industrial workers' lives are in danger, but also the lives of domestic workers. Many lives can be lost in a fire, and many more can be permanently injured. However, employing correct firefighting techniques, this can be prevented. IoT technology is used to create a fire-fighting robot. We plan to construct a Fire Extinguishing Robot that can detect and move a little flame to extinguish it. With the use of flame sensors, it will automatically identify a fire. It navigates itself to the fire source and extinguishes the fire using the built-in fire extinguishing system once it recognizes the location of the fire breakout. It employs three flame sensors for fire detection. One for each direction: left, forward, and right. When a fire is detected, the fire extinguishing system will be engaged. When the water pump detects a fire, it will begin ejecting water. The primary function of this system is to provide fire surveillance in order to prevent severe fire accidents and reduce human life loss. progress to location-dependent services and requests in wireless arrangements endures to need the progress of extra precise and reliable positioning and pursuing systems.

II. LITERATURE SURVEY

Development of Fire Fighting Robot (QRob)

A fire incident is a calamity that can result in the loss of life, property damage, and lasting handicap of the victims. Firefighters are generally responsible for putting out fires, but they are frequently exposed to greater dangers when doing so, particularly in hazardous locations such as nuclear power plants, petroleum refineries, and gas tanks. They confront additional challenges, particularly if the fire happens in a confined space, as they must investigate the remains of structures and barriers in order to extinguish the fire and save the victim. As a result, this study describes the development of QRob, a firefighting robot that can put out fires without exposing firefighters to undue danger. QRob is designed to be shorter than other conventional fire-fighting robots in order to enable entry into tight spaces and extend the reach of fire extinguishing. QRob also has an ultrasonic sensor to prevent it from colliding with any obstacles or other objects, as well as a flame sensor for fire detection. As a result, QRob was able to demonstrate the ability to automatically identify fire spots as well as the ability to extinguish fires from a distance. QRob is set to locate the fire and halt at a distance of no more than 40 centimetres from it. A human operator can keep an eye on the robot via a camera connected to a smartphone or other remote device.

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III. PROBLEM STATEMENT

Fire is one of the most dangerous problems that can cause significant financial and human loss. Because of explosive materials, smoke, and high temperatures, accessing a fire scene might be challenging at times. Firefighters' lives are also at risk in such situations. Fire-fighting robots can be useful in such situations. IoT technology is used to create this fire extinguishing robot. In Fire Extinguishing Robot, we want to create a system that can detect and go to a little flame to extinguish it. The arrival of fire fighters is sometimes delayed, which has a number of repercussions. The Fire Extinguishing Robot continuously checks the environment and extinguishes the fire as quickly as possible.

IV. PROPOSED SYSTEM

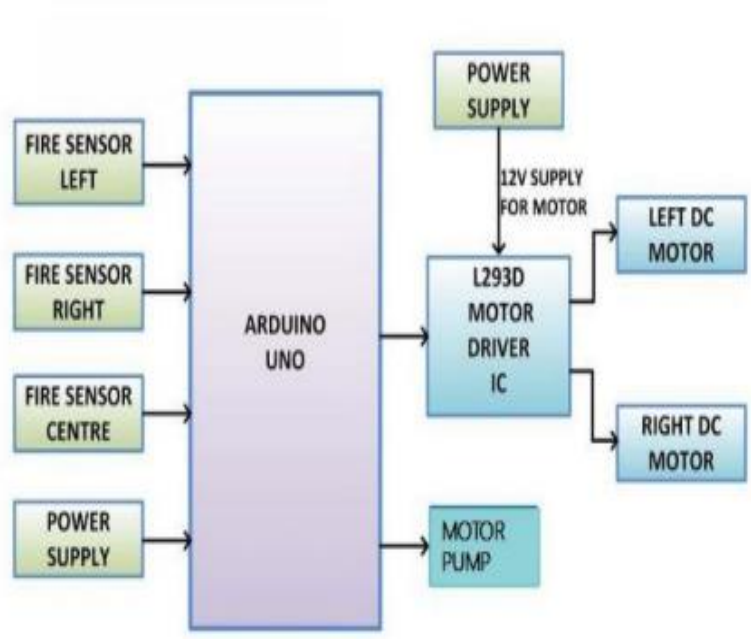

Fig: - System Block Diagram

This proposed device is capable of detecting fires in the environment and extinguishing them with water from the container. This technology also has the ability to identify obstacles in the road and adjust the direction autonomously. 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.

V. METHODOLOGY

To begin, ensure sure all of the components are connected and provide power via an external device. The robot is initially motionless before rotating in 360 degrees to identify the presence of an object using a flame sensor. If the object is not inside the range, it continues on and tests again for the presence of the object. The signal is detected by one of the five-channel flame sensors, and the robot moves if the signal is detected by the center sensor, allowing us to precisely travel to the item. It advances to a specific distance after detecting the flame and then checks the range of distance again till it gets close to the flame item. It moves to a specific distance after detecting the flame and then checks the range of distance again till it gets close to the flame item. It then activates a fire extinguisher or a water pump to spray water on the fire.

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) **Ultra-Sonic Sensor:** An ultrasonic sensor is an electronic device that emits ultrasonic sound waves and converts the reflected sound into an electrical signal to determine the distance between a target object and the sensor. Ultrasound waves travel at a faster rate than audible sound waves (i.e. the sound that humans can hear). The transmitter (which uses piezoelectric crystals to generate sound) and the receiver are the two primary parts of an ultrasonic sensor (which encounters the sound after it has travelled to and from the target).

5) **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.

Design Schematics:

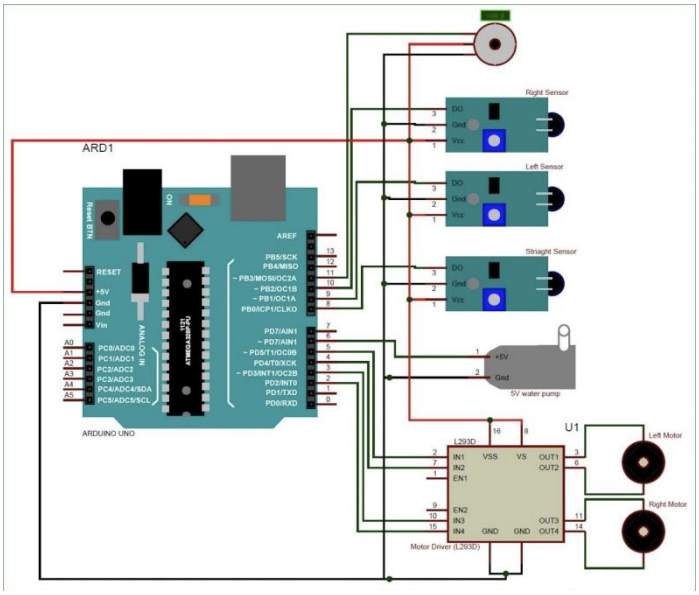

Fig:- Schematic Circuit Diagram

VI. RESULT & CONCLUSION

This Fire Extinguishing Robot model helps to distribute the strain of firefighting tasks among firefighters. Our project's goal is to create a real-time firefighting robot that can detect a fire and then extinguish it with the help of a pumping mechanism. Basic hardware components attached to the robot were used to identify and extinguish the fire. For starters, infrared flame sensors are used to detect fire. Second, the robot is navigated to the fireplace using BO Motors and Rubber wheels. Finally, the robot uses a submersible water pump and servo motors to put out the fire.

VII. FUTURE SCOPE

In future, we can implement following factors:

1) **Use of Co2 Gas Cylinders:** Co2 is the most often used gas onboard ships to extinguish fires following accidents due to its physical and chemical qualities.

2) **Use of Foam:** Foam has been used to put out fires involving flammable and combustible liquids. Water, foam concentration, and air are the three constituents that make up foam.

3) **Can use Higher Resolution Zooming Camera:** By using higher resolution zooming camera we can detect the fire from the long distance.

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