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Fire Fighting Robot

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Abstract. 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 when a fire breaks out in a confined space, since they must investigate the ruins of structures and overcome obstructions in order to extinguish the fire and save the victim. As a result, this study describes the construction of a fire-fighting robot that can put out fires without exposing firefighters to undue danger. The robot is build using sensors, motors, Arduino and pump. These robots are mainly used in industrial areas for where there is high risk of fire. Fire-fighting robots provide greater access into small spaces and to extinguish fire in narrow places.

1. Introduction

Fighting the fire and rescue the casualties is a dangerous profession. Extinguishing fires can be dangerous for firefighters. Firefighters put out a fire in high-rise buildings, drag heavy lines, climb ladders, and transport victims from one structure to another. In addition to extended and inconsistent working hours, firefighters endure hostile conditions such as high temperatures, dust, and low humidity. They also have to deal with life-threatening situations such as explosions and collapsed buildings. There is a consistent number of fire fighter deaths every year, which necessitates the use of fire fighting machines to assist firefighting personnel in handling dangerous situations in order to avoid deaths. By using a robot, which is controlled remotely or can act independently, the risk of this firefighting task will be reduced. A robot is a mechanical device that is intended to undertake high-risk activities such as firefighting. A robot can be a permanent robot, a mobile robot, an underwater robot, a humanoid robot, a space robot, or a medicine robot, among many other characteristics .Due to their structure, fixed base robots have limited workspace. By using a mobile platform, the robot's workspace can be increased. We call these robots mobile robots. Besides mining, military, forestry, and security, mobile robots can extinguish fires in tunnels, industries, hospitals, laboratories and even homes. By using a firefighting robot, fire fighters will not have to put themselves in danger. In addition, the robot will reduce the workload of firefighters.

2. Literature Survey

Advance Virtual RISC based Fire Fighting Robot by Shraddha K. Dubai, Supriya S. Kadam, Pratima S. Mane, Dipali A. Mali: In this paper, we examine a firefighting robot based on the AVR Infrared wavelengths can't be seen with the naked eye. They are detected using an infrared sensor. In this circuit, radio signals are sent or received in the range of the carrier frequencies. With GSM devices, data is sent and received wirelessly using radio frequencies. They work with a wireless carrier sim card, and can detect the incident's location It has a buzzer that informs persons in the area. Specific area since a buzzer is mounted on it. By displaying the location, the robot sends a message to the fire brigade. Implementation methods of fire fighting robot by Mrs. Bhavna K. Pancholi, Miss. Kena Patel: This robotic is a real-time operating embedded instrument. The robot is written in the C programming language. The robot monitors the environment in automatic mode to locate flames. A transistor in this robot amplifies the output of the IR sensors. The output of the amplifier is fed to the microcontroller's pin. The microprocessor runs the motors and fires the actuators if a fire is detected. Mounted on the frame is a DC pump motor with a 10 rpm speed that pumps water from the reservoir. Water is poured on the fire to put out a fire. Voice control is demonstrated. Using the speech system, the robot can be operated. Hand-free operation and speedy data input are two main advantages of robotics. The disadvantage is that this is influenced by atmospheric or external noise. Fire Extinguishing Robot using Arduinoby Abdulkadir ; AKIR, Nyan Farooq EZZULDDIN: This simulation aims to locate a fire in the labyrinth using a flow chart then extinguish it with a fan once it's been located. A mobile robot was assembled from various mechanical and electronic components. It was eventually necessary to program the constructed robot to perform its intended functions. The robot is controlled by touch (via a camera, for example).

3. Block Diagram

The Arduino is the project's main brain. where the program for the fire fihting robot is dumped in it, We use temperature sensors and LDR's to detect the fire. Fires are detected using these sensors. Fire produces a small quantity of infrared energy, which is detected by pushing motors through the L293D module to move closer to the fire.

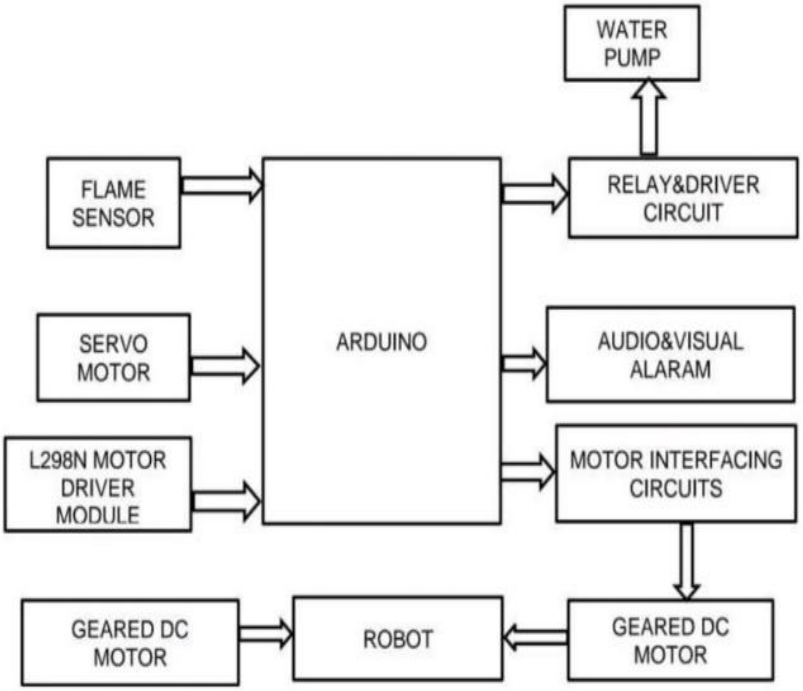

FIGURE 1 Identifying Block diagram of this project is below

The L293D module is given voltage supply by the lithium battery. The servo motor used to find direction of the fire area. The sensor module's LDR is used to reprogram it. We can use this method for determining the location of the fire. for the execution of the fire fighting robot is dumped in the Arduino nano. The robot is move used to DC motor from one place to another. When we are near a fire, we need to use water to put it out. We may transport water using a small container, and a 5V pump is inserted in the container and attached on top of a motor driver, permitting us to determine the position in which the water must always be spray.

4. Hardware Specification

ARDUINO:

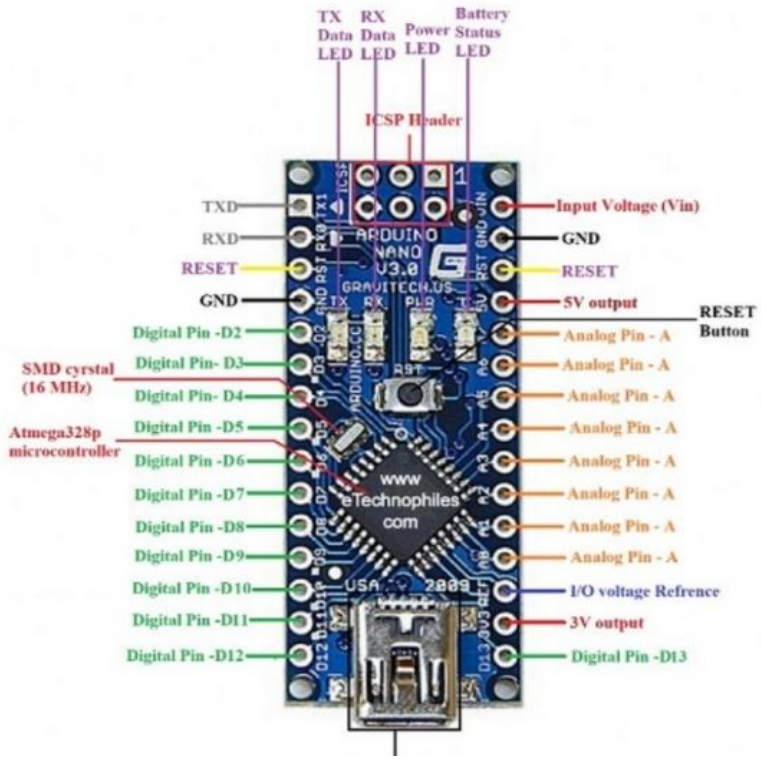

FIGURE 2

The Arduino Nano is a type of microcontroller board invented by Arduino.cc. It can be built using a microcontroller such as the Atmega328. The Arduino UNO also uses this microcontroller. It's a simple board that's also adaptable to various of applications. The Nano, much like Arduino UNO, is equipped with an ATmega328P microprocessor.

Specifications and Features: Vin Pin: To power the board, an unregulated 6-12V can be provided to the Vin pin. It is controlled to +5V by the on-board voltage regulator. +5V Pin: If you've a regulated +5V supply, you can connect it directly to the Arduino's +5V pin. Input/output: There are14 digital pins and 8 analogue pins on just this circuit. Sensors will be used as input or output pins by using digital pins. As interfaced or loads can be driven. Serial Pins 0 (Rx) and 1 (Tx): Pins Rx and Tx are used to receive and transmit TTL serial data. To connect them, an ATmega328P USB to TTL serial chip is used. External Interrupt Pins 2 and 3: Low values, rising or falling edges, or changes in value can all trigger interrupts. PWM Pins 3, 5, 6, 9 and 11: The analog Write () function generates an 8-bit PWM signal from each of these pins. In-built LED Pin 13: This pin is connected to a built-in LED. The LED is turned on when pin 13 is HIGH. The LED is turned off when pin 13 is low. I2C A4 (SDA) and A5 (SCA): Wire library is used for IIC communication

Servomotor: Servomotors (or servo motors) are rotating or linear actuators that permit for perfect angular position, velocity, and acceleration control. They are powered by an electric motor coupled to a position feedback sensor.

SG-90 servomotor: Standardised industrial servomotors and gearboxes with interchangeable mounting flanges. Robotics, CNC machinery, and automated manufacturing all make use of servomotors.

FIGURE 3

The voltage range of a servo motor, we can produce more torque at higher voltages, such as 4.8V and 6.5V, but the most prevalent voltage is 5V. Due to its gear box, a servo motor can only rotate from 0° to 180°, therefore be sure your project will perform with the half circle. If not, use a motor with a 0° to 360° range or adapt the motor to make a complete circle.

Flame Sensor:

FIGURE 4

The fire sensor is used as the eye of a firefighting robot to discover the source of fire in most firefighting robots. Using wavelengths of light between 760 nm and 1100 nm, it can be used to identify fire.

DC Motor

FIGURE 5

Suitable materials for this project are DC geared motors with rubber wheels. Replaces 2WD and 4WD car chassis with this DC motor. In DC motors, the voltage is between SV and 10 V DC, and the gear ratio is 48:1. The recommended current is 73.2 mA. The robot is moved to the fire location by a DC motor.

L298N motor driver module:

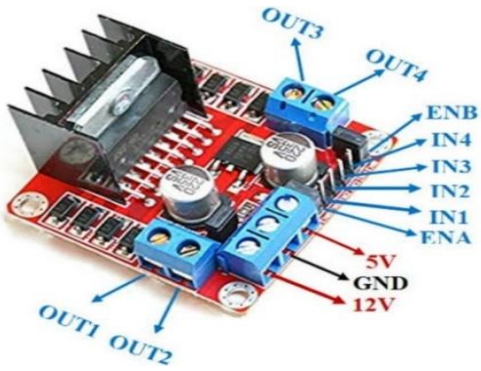

FIGURE 6

A high-power motor driver module, the L298N is designed to drive Motors that are both DC and stepper. A L298 motor driver IC and a 78M05 5V regulator are included in this module. The L298N Motor Driver module consists of an integrated circuit that includes an L298N Motor Driver IC, a 78M05 Voltage Regulator, resistors, capacitors, a Power LED, and a 5V jumper.

5. Result

It is very possible for a fire to break out in a remote area or in an industrial setting. The fire and harm caused by electric leaks may be immense in garment Cotton mills, godowns, and fuel storage tanks are all examples of this type of structure. A fire can cause heavy financial and human losses both in the worst case scenario.A firefighting robot will gradually collaborate with firemen, drastically minimizing risk of victim injury. Robotics is by far the most effective method to protect human lives, property, and environment. In addition, This firefighting robotics project will stimulate interest in the topic of robotics while also supporting in the construction of a pragmatic and reachable solution can save lives by reducing property damage.The main aim of this study is to create an Android-based remote-control firefighting robot. A tanker on an automatic firefighting robot pumps water and sprinkles it on the fire.Using an Android application, the proposed system sends signals to drive the robot forward, backward, right, or left from the transmitter to the receiver .The 8051 microcontroller interfaces two motors on the receiver side, two of which drive the vehicle, and one of which moves the robot arm. Remote control is provided by a tablet or smartphone running an Android OS.

FIGURE 7

6. Conclusion

The Android device can be used as a controller and has a greater range. A Bluetooth device is built into the receiver, which is transmitted to a microprocessor that regulates DC motors through a motor driver IC. The above explained is about the already exiting proposed method, where the microcontroller is used which causes the delay of the robot to move to the fire location. In this project instead of microcontroller, Arduino Nano is used which overcomes the delay occurring in the existing method. The simple working process of this project is first the lifht of the fire is detected by flame sensor which indicates on sound the buzzer. By the voltage supply given to the L298 Motor driver module using lithium battery, the motors used, that is DC motor and Servo motor are operated. The voltage regulator in the L298 Motor driver module controls the flow of the voltage to the motors. By activating the motors, the servo motor finds the direction of fire and DC motor move on the location. After moving to the fire area, the water pump sprays the water on the fire and extinguishes, Cotton mills, go downs, and fuel storage tanks are all examples of this type of structure. Aside Besides having a small body and a light structure, it has several advantages, such as being able to detect fires automatically. Because of its compact design, the robot can fit into small spaces or enter small entrances. The system can not only assist fire fighters, but also help prevent an outbreak of fire. Users can use remote devices to put out a fire from a larger distance. Cameras can also be used by operators to monitor the environment during firefighting. In the experiments, the robot detected smoke and fire accurately within seconds. The concepts used in this particular field have been viewed in a unique way in this paper.

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