



A OBSTACLE AND FIRE FIGHTING CONTROL ROBOT FOR REAL TIME APPLICATIONS

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ABSTRACT:

These days, fire incidents occur often, and firefighters sometimes struggle greatly to save a person's life. It is not feasible to assign a human to constantly monitor if an unintentional fire has started when a robot is capable of doing so. A robot will be able to remotely detect fire. The majority of sectors may benefit from these robots. Using a temperature sensor, the suggested car can identify the presence of fire and immediately put it out. The water spray on the suggested robot may be directed at an angle of 1800 degrees. It is possible to move the sprinkler in the desired direction. It is possible that it may encounter barriers while travelling in the direction of the fire; in this case, its obstacle-avoiding skill will come into play. It makes use of ultrasonic sensors to identify impediments. The robot and mobile phone will communicate over Bluetooth, and the phone will include a graphical user interface (GUI) to control the robot's movement. The module name and baud rate are determined by the mobile device first when it connects to Bluetooth. Bluetooth communication between cellphones and microcontrollers is a possible implementation. Robots controlled by Android are widely applicable in daily life, including homes, markets, businesses, and so on. An outbreak of fire is a dangerous event with many repercussions. Early detection and extinguishment of a fire may help avert a variety of mishaps. We have so far relied on human resources. This often results in endangering that

person's life. As a result, fire safety becomes crucial to preserving human life. This article describes the design and proposal of a fire extinguishing robot that locates the source of the fire and uses sprinklers to put it out when a pump is triggered. Three flame sensors are used by this robot to detect fires accurately. This suggested fire extinguishing robot model uses an Arduino to sense the existence of fire and puts it out autonomously, without the need for human intervention. When the robot senses a fire, it uses gear motors and a motor driver to regulate its movement. It then initiates the water pump to put out the fire on its own. This particular robot type is equipped with a water ejector that may spray water where a fire may start. A servo motor may be used to move the water ejector pipe in the desired direction. An Arduino UNO micro-controller powers the whole system.

INTRODUCTION

These days, industrial facilities, warehouses, and construction sites greatly benefit from the employment of mobile robots. The applications for mobile robots in material handling are expanding daily and include material handling as well. Mobile robots may be used for material handling and item analysis. Android may be used to control the motions of a mobile robot using wireless navigation. Robots are controlled using fuzzy logic control mechanisms. There is no requirement for any mathematical model governing that model. Firefighting robots were formerly operated by a variety of technological gadgets. However, this limits the firefighting



robot's control range. But thanks to more sophisticated methods, we can construct the same robot and use an Android application to direct its movements. Such robots have greatly reduced the amount of labour required by firefighters, and their actions are very efficient. Firemen can identify and put out fires with the help of an Android app. Using ultrasonic sensors, the robot can simultaneously recognise and avoid obstacles. The goal of our project is to create an Android application that will allow us to operate the firefighting robot. Through the Bluetooth module installed on the robot, the fireman is able to communicate orders to the robot. Smart phones are equipped with Bluetooth functionality, which allows firefighters to use it to control the movement of firefighting robots. Two sensors are used in the fire detection process. A temperature sensor is one, while a smoke detector is the other. When a fire is detected, the fire extinguishing system will be triggered. When the sprinkler senses fire, it will begin to sprinkle water. Two motors are interfaced to a microcontroller at the receiving end, while an Android application is utilised at the sending end.

Life, or the lives lost while attempting to save another person's life, is one of the most significant variables in a fire tragedy. Sometimes smoke, extreme heat, and explosive chemicals make it hard for firefighters to reach the scene of a fire. Many terrible things may be avoided with a quick reaction to the fire's detection. It is evident from the provided statistics (Fig. 1) that both residential and commercial settings may experience fires. A little spark may start a large-scale conflagration. The inadequate fire control system puts not only the lives of those working in industries but also the lives of those living at home at danger. Many individuals may lose their lives to fire, and many more can have lifelong

injuries. However, it is preventable by using appropriate fire safety measures. A robot that fights fires is suggested for these kinds of settings. Many robots are being suggested and developed in this age to take the place of humans in hazardous and lethal tasks. Robots are increasingly being used to securely do dangerous or labour-intensive tasks that humans find difficult or dangerous. Using IOT technology, a fire extinguishing robot is created. Our goal with the Fire Extinguishing Robot is to create a system that can detect a little flame and move to put it out by itself. With flame sensors, it will immediately detect the fire. After identifying the position of the fire breakout, it uses the built-in fire extinguishing technology to route itself appropriately to the fire source and puts out the flames. Three flame sensors are used to detect fires. There are three: one for the left, one for the forward direction, and one for the right. When a fire is detected, the fire extinguishing system will be triggered. When it reaches the breakout point, the water pump senses fire and begins to discharge water. One of this system's primary functions is to offer fire surveillance, which helps to minimise the number of human casualties and avert significant fire mishaps.

PROBLEM STATEMENT

One of the riskiest issues that may cause significant damage in terms of money and lives lost is a fire catastrophe. Firefighters may have challenges in reaching the scene of a fire due to the presence of explosive materials, smoke, and elevated temperatures. Firefighters are also at danger for injury in such circumstances. Robots that combat fires may be helpful in these kinds of settings. The IOT technology underpins this fire extinguishing robot. Our goal with Fire Extinguishing Robot is to create a system that can detect a little flame and move to put it out by



detecting its position. There are many repercussions when fire fighters arrive late. The robot that extinguishes fires keeps an eye on its surroundings constantly and puts out fires quickly.

EXISTING SYSTEM

Sprinklers, hand-held portable fire extinguishers, and fire brigades are among the standard traditional firefighting techniques. These traditional methods take a long time to get to the scene of the incident. For example, the fire department has to dispatch personnel from the fire station, navigate traffic, and reach the area where the fire occurred. Portable extinguishers are also not free because they are typically located on a building's corner, where they can be tricky to reach and require ongoing maintenance. However, the sprinkler and smoke detector setup is a highly unreliable system since enormous areas might be covered by sprinkler lines with defects that could not produce adequate pressure.

PROPOSED SYSTEM

This moveable prototype of our selected system is equipped with a pump control relay that detects and extinguishes fires, gear motors and motor drivers for robot movement, and flame sensors. Prototype movement is usually carried out at a steady, gradual pace. The microcontroller receives certain signals proving the presence of a fire when the sensor picks up a fire in the area. The microcontroller then puts out the fire. The prototype will halt at the fire location, activate the pump, and spray water using a sprinkling nozzle after smoke has been eliminated upon a positive fire detection. The robot may be controlled autonomously thanks to an Arduino that is connected to an infrared sensor for all overall controls. This paper's main idea is to automatically detect environmental

fires and put them out without the need for human involvement. The three components of the technique are separated. The hardware description comes first, then the design structure, and ultimately the programming design. Following the assembly of these three components, tests were run to create a system that could put out the fire that was started.

LITERATURE SURVEY

A firefighting robot model was proposed by Tawfiqur Rakib and M. A. Rashid Sarkar. It comprises a base platform composed of "Kerosene wood," an LM35 sensor for temperature detection, flame sensors for fire detection, and a one-litre water container made of sturdy cardboard that is water resistant. The robot can move on its two wheels. [1] Saravanan P. and Soni Ishawarya suggested a model in which the robot is separated into three fundamental sections based on their functions: a locomotive unit, a fire detection unit, and an extinguisher unit. The model employs an Atmega2560 micro-controller. Every unit carries out its assigned duties with the goal of putting out fires. With the aid of four infrared and four ultrasonic sensors, the locomotive unit moves the robot and helps it avoid obstacles. The temperature sensor and LDR are employed by the fire detection device to identify fire. The extinguishing equipment uses a BLDC motor and a water container to put out the fire. To guide itself in the right direction, the robot is equipped with a Bluetooth module that is linked to cellphones. [2] S. Jakthi Priyanka and R. Sangeetha presented an Arduino UNO R3-powered android-controlled firefighting robot. The robot's components include a gas sensor for detecting fires, a gear motor and motor drive for movement, and a bluetooth module for controlling the robot from a smartphone and connecting it to an Android device. Sprinklers



and a water pump are also used in this. Programming and implementing code on the Arduino UNO requires the use of the Arduino IDE, an open source program. [3]

A fire extinguishing robot was proposed by Nagesh MS, Deepika T V, Stafford Michahial, and Dr. M Shivakumar. It uses DTMF (Dual Tone Multi Frequency Tones) technology for navigation and a flame sensor for fire detection that can detect flames with wavelengths ranging from 760 to 1100 nm and sensitivity varying from 10cm to 1.5feet. [4]

Abhideep Bhatti, Varenyam Sharma, Sushrut Khajuria, and Rakesh Johar suggested an Arduino-based firefighting robot that uses RF remote control to run both the robot and the water pump. The user may operate the robot up to seven meters away. Additionally, it has a wireless camera that allows the operator to steer the robot in the desired direction. [5]

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going. The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a

Page | 92

serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

- 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilise the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.
- A more robust RESET circuit.
- The 8U2 is replaced with an ATmega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.



Fig: ARDUINO UNO

POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c.



power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

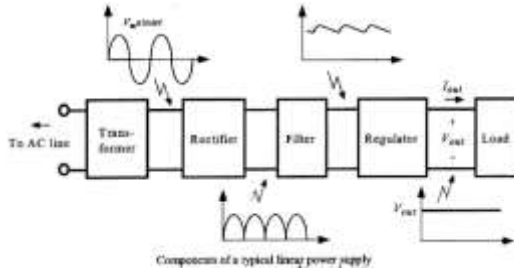
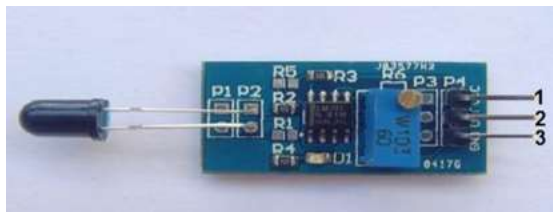


Fig: Block Diagram of Power Supply

Fire/Flame Sensor Module

Since flame sensors are the most light-sensitive, flame alarms are often activated by their response. This module can identify flames or light sources with wavelengths between 760 and 1100 nm. The microcomputer's IO port may be directly linked to a single chip or small plate output interface. To prevent the sensor from being damaged by high temperatures, there should be a specific distance between it and the flame. If the flame is larger, test it from a further distance; the shortest test distance is 80 cm. The flame spectrum is very sensitive because of the 60-degree detecting angle. There is a 60-degree detecting angle.



LCD DISPLAY

The model shown here is the one that is most often utilised in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets,

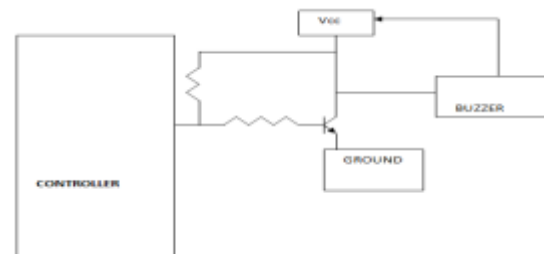
Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.



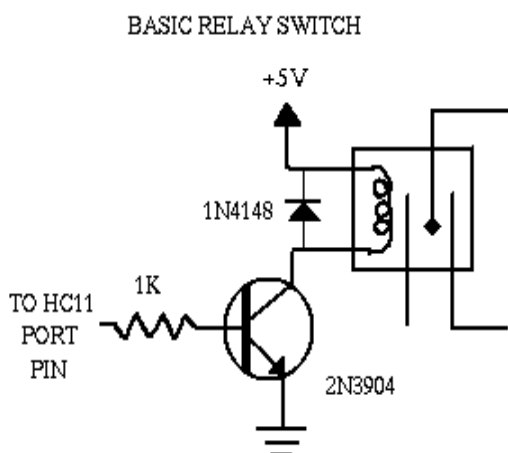
Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



RELAY



The fundamental circuit is shown in the following diagram.

An electrically powered switch is called a relay. It turns on in a manner that switches on. It flips the opposite way when it's off. Relays may be used to turn high current devices on and off. A lightweight switch and an electromagnet known as a coil are found within a relay. The coil's magnetic field attracts a portion of the switch when it is energised, turning the switch on or off.

Mechanical relay:

A typical connecting pin for a mechanical relay

This is a crucial part of the article. This electrical control switch is introduced as a relay. Essentially, it is an electrically operated mechanical switch activation mechanism. This is not the same as a manually triggered switch. Put another way, it's a gadget that transforms electrical signals into mechanical energies and back again. They may be referred to as 2P2T, single pole double throw, etc., much like mechanical switches.

How does it operate? The relay's coil will be turned on by an electrical voltage. When the coil

is cranked up, a magnetic force is produced that draws the lever in. The mechanical contact will be switched when this lever is drawn in the direction of the magnetised coil.

Mini Submersible Pump

Generally speaking, submersible pumps are designed to be completely immersed in water. Because submersible pumps are installed within the reservoir of water that has to be pumped out, they are often used for pond filtration, sewage pumping, drainage during floods, and pond emptying. This article will especially discuss the workings of the tiny submersible pump, a smaller kind of submersible water pump. A tiny submersible pump is a scaled-down form of a submersible water pump that is quiet, portable, light, and uses minimal energy. In the home, a little submersible water pump is often used for space heating, cooking, cleaning, bathing, watering flowers, and other purposes. A small submersible water pump rotates its impeller to force water outward; this kind of pump is known as a centrifugal water pump. It is powered by a motor. Situated under a watertight seal, the motor is intimately linked to the water pump's body, which it drives. A particular kind of miniature submersible water pump is used in the filtration systems within aquarium fish tanks. To remove water where it is required, a small submersible water pump is mounted within the fish tank itself.

Mini submersible water pumps have the benefit and disadvantage of being very efficient due to the fact that they don't need a lot of energy to draw water into them while submerged. The small submersible water pump's acknowledged drawback is that its seals erode with time, perhaps allowing water to flow into the motor. When this occurs, the motor may become



unusable and become very difficult to remove and fix.

appropriate for solenoid or motor applications when the right data inputs are provided.

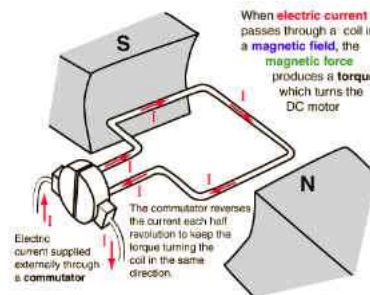


L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive

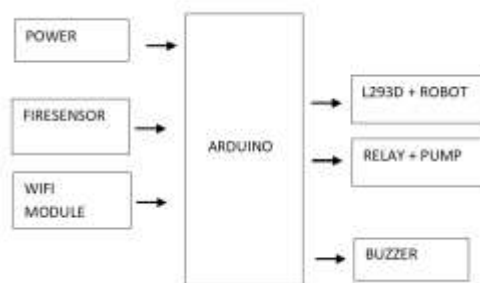
DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearing motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



BLOCK DIAGRAM AND HARDWARE DESCRIPTION

4.1. BLOCK DIAGRAM:



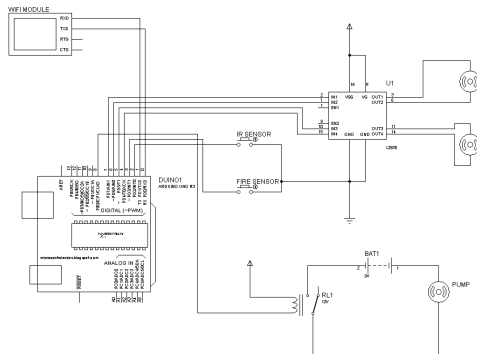
WORKING:

The main improvement over a regular robot is its ability to detect and put out fires. Other than that, fire fighting robots do the same tasks. The Arduino serves as the project's brain, but three fire sensor modules—the left, front, and right sensors—are used to detect fire; fig. 6 illustrates these modules. By running our motors via the



L293D module, we are able to determine the direction of the fire and utilise that information to manoeuvre closer to it. When a fire breaks out, we must use water to put it out. We use a tiny container to store water, and when a fire is detected, we can regulate the direction of the sprayed water by placing the pump within the container and the whole container on top of a servo motor.

SCH:



CONCLUSION

Fire-related accidents have the potential to inflict serious harm as well as property damage. This study gives a comprehensive evaluation of several fire-fighting robots, together with autonomous robot fire detection and extinguishment techniques. Without a doubt, this will lead to an improved system for monitoring the quality of the water, and prompt action may make the water resources safe. Even though many effective firefighting tools have been developed, the study issue is still challenging. An overview of current research attempts to improve the intelligence, affordability, and efficiency of firefighting robots is given in this study. The use of wireless communication standards for increased efficiency and the use of state-of-the-art sensors for monitoring different quality requirements.

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