

# Design & Development of Wireless Smart Fire Fighting Robot for Social Safety

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**Abstract:** *The security of home, laboratory, office, factory and building is important to human life. We develop an intelligent multi sensor based security system that contains a fire fighting robot in our daily life. The destructive burnt cause by electrical is the highest source. It is because security system can't detect abnormal and dangerous situation and notify us. Besides, user had difficulties to detect the small burnt cause by electrical appliances. User may take a late time to extinguish fire like finding the water source to extinguish fire when want to extinguish the fire. The fire difficulties to detect the small burnt area and location that is hard to be reach by the user Sometimes tough fire extinguished for example spaces are hard to see. So, "Autonomous Fire Protection Robot With Notification" design with extinguisher for the intelligent building to controlled by microcontroller PIC18F4520.. This robot equipped with 3 flame sensor where each sensors has its own function and commanded control by PIC18F4520. This robot will move to the fire source when the flame sensor detected the fire. This robot also programmed to stop before the robot hit the flame. This robot also can extinguish fire at 45 degree for upper side and 45 degree for lower side. This robot implicated the function of finger to clip the fireextinguisher clipper.*

**Keywords:** Robotic Vehicle, Fire detection, Bluetooth Module, Microcontroller.

## I. INTRODUCTION

Driver Fires are among the most important form of problems. Robot industry has a lot of work in this area. So today robot is more commonly used to reduce the human efforts. The need of Fire extinguisher Robot that can detect and extinguish a fire on its own. Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work and also to act in inaccessible environment. With the invention of such a device, lives and property can be saved with minimal damage caused by the fire. As an engineer's we have to design a prototype that could autonomously detect the fire and extinguish it. The Fire Fighter Robot is designed to search for a fire in the house or industry for extinguishes the fire.

The main and only work is to deploy the robot in a fire prone area and the robot will automatically work once it detects a fire breakout. This prototype helps in Rescue operations during fire accidents where the entry of service man is very difficult in the fire prone area. There are several existing types of vehicles for fire fighting at home and extinguish forest fires. Our proposed robot is designed to be able to work on its own or be controlled remotely. By using such robots, fire identification and rescue activities can be done with higher security without placing fire fighters at high risk and dangerous conditions. In other words, robots can reduce the need for fire fighters to get into dangerous situations. When we the field of fire fighting has long been a dangerous one, and there have been numerous and devastating losses because of a lack in technological advancement. Additionally, the current methods applied in fire fighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained. A recent trend that has become popular is to use robots instead of humans to handle fire hazards. This is mainly because they can be used in situations that are too dangerous for any individual to involve themselves in. In our project, we develop a robot that is able to locate and extinguish fire in a given environment. The robot navigates the area and avoids any obstacles it faces in its

excursion. Controller board acts as a brain of the whole control circuitry .Robot consist of the two sensors that are interfaced in the control circuitry.

Sensors are used to detect fire prone area all directions and moves the robot to fire location. When the robot reaches firezone then a pump extinguisher is attached on the robot comes into action to extinguish the fire



## II. LITERATURE SURVEY

Several researches are being carried out in the field of fire fighting robots to minimize the danger and prevent the damage caused by fires. Megha Kanwar has proposed the "IoT based firefighting robot" which is capable of extinguishing the fire through a water pump running on a servo motor. It can send an alert to the authorities and it can also be controlled manually. [1]

"Fighting tank Robot", Kristi Kokasih, is a robot capable of putting up fire built using iron, acrylic and plastic. Robot segments are servo engines, DC engines, compass sensors, ultrasonic sensors, fire locator, thermal sensor. The robot is initiated through DTMF transmitter and receiver.[2]

"An Autonomous Fire Fighting Robot", Ahmed Hassanein, Mohanad Elhawary, Nour Jaber, is a fire fighting robot that can extinguish fire by traversing the map to find the location of the fire and reach the location. [3]

"An Autonomous Fire Fighting Mobile Robot", H.P. Singh, is a research paper that proposes the idea of a mobile fire fighting robot made up of two optically isolated motors. There are five infrared sensors being used in the model, two for the motion control and other three for the flame sensor detection. The extinguisher is a water pump. The whole system is controlled by a microcontroller. [4]

"Fire Extinguishing System", Poonam Sonsale, is a paper that proposes of the calculation of fire location. It comprises of smoke sensor, flame sensor and temperature sensor for flame identification. It contains a framework for high security based on multisensory options. The system uses sprinkling system for extinguishing activity. [5]

"Android Phone controlled Robot", Arpit Sharma, is an android based manually controllable robotic system that is using Bluetooth. Accelerometer is used to detect the signals of the robot. The Bluetooth module is controlled by the microcontroller. It is a lightweight model compared to other models. [6]

## III. PROPOSED SYSTEM

The proposed system is autonomous firefighting robots that can move and perform extinguish operation without any manual control. It is powered by the control board. The working of the proposed system is based on Bluetooth that communicates with the flame sensors by sending and receiving data continuously. The robot is built using sensors namely flame sensor and ultrasonic sensor for obstacle detection. The robot runs on a servo motor. The proposed model is provided with an alert feature that will send an alert to the fire safety department once the fire has been detected. It also provides live video streaming of the fire location so that the fire department can know the region of fire spread and make necessary measures.

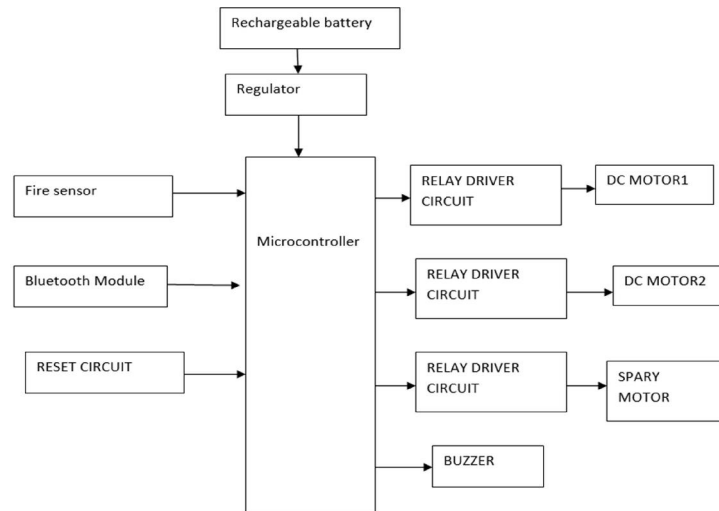


Fig. 1. Block Diagram

### PIC 18f4520 Microcontroller

It is an 8-bit enhanced flash PIC microcontroller that comes with nanoWatt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

Divided into 256-byte banks

There are total of F banks

Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bit

Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.

Program memory stores the program and also static data in the system.

On-chip External

On-chip program memory is either PROM or EEPROM.

The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).

Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000



*Fire sensor*

Iris recognition is a type of biometric technology that enables a person to be authenticated automatically via his criteria through machines. Compared to other biometric traits, iris possess lesser false acceptance and rejection rate due to its Flame sensor is the most sensitive to ordinary light that is why its reaction is generally used as flame alarm purposes. This module can detect flame or wavelength in 760 nm to 1100 nm range of light source. Small plate output interface can and single-chip can be directly connected to the microcomputer IO port. The sensor and flame should keep a certain distance to avoid high temperature damage to the sensor. The shortest test distance is 80 cm, if the flame is bigger, test it with farther distance. The detection angle is 60 degrees so the flame spectrum is especially sensitive. The detection angle is 60 degrees so the flame spectrum is especially sensitive.

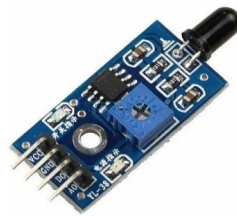


Fig. 3. Fire Sensor

*Bluetooth Module*

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).



Fig. 4. Bluetooth Module

*DC Motor*

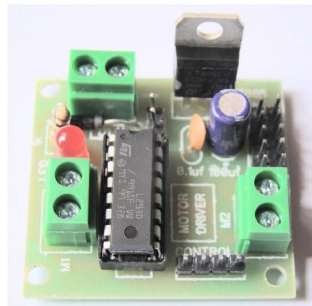
A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation. DC motors use magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depends upon both the electrical input and the design of the motor. The term 'DC motor' is used to refer to any rotary electrical machine that converts direct current electrical energy into mechanical energy. DC motor scan vary in size and power from small motors in toys and appliances to large mechanisms that power vehicles, pull elevators and hoists, and drive steel rolling mills. DC motors include two key components: a stator and an armature. The stator is the stationary part of a motor, while the armature rotates



Fig. 5. DC Motor

#### *Motor Driver IC L293D*

The L293D Motor Driver Module is a medium power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L293 motor driver IC. It can drive 4 DC motors on and off, or drive 2 DC motors with directional and speed control. The driver greatly simplifies and increases the ease with which you may control motors, relays, etc from micro-controllers. It can drive motors up to 12V with a total DC current of up to 600mA. You can connect the two channels in parallel to double the maximum current or in series to double the maximum input voltage. This motor driver is perfect for robotics and mechatronics projects for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors for micro-mouse, line-following robots, robot arms, etc



#### **IV. RESULT**

The paper not only demonstrates the effective implementation of a firefighting robot, but also adds new features that make it more realistic to recognize the severity of the fire and the form of gases present, which is critical to preventing further fire spread.

#### **V. CONCLUSION**

This project describes about the real time firefighting robot which moves in a constant speed, identify the fire and then extinguish it with the help of pumping, mechanism. It has advantageous features such as ability to detect location of fire automatically besides having a compact body and lightweight structure. The robot can be used at a place that has a small entrance or in small spaces because it has a compact structure. The system can potentially be useful to accompany fire fighters and prevent an outbreak. The operator is able to extinguish fire using remote control from longer distance. Operators can also monitor the environmental conditions during the process of firefighting by using the camera. From the experimental results, the robot can sense smokes and fire accurately in a short

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