

DESIGN & DEVELOPMENT OF FIRE FIGHTING ROBOT

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ABSTRACT- The fire fighting occupation has a long history of dangerous situations. There has been numerous and devastating human losses because of lack in technological advancements. In daily life, fire hazards have become more common and it becomes the responsibility of fire fighters to overcome any difficulties and extinguish fires protecting the human life and other possible losses. But they are often exposed to higher risks while performing fire extinguishing operations, especially in hazardous environments such as in nuclear power plants and petroleum refineries. With the development in the field of robotics, human intrusion have become less and robots are being widely used in order to overcome difficulties faced by firemen. This is one of the reasons for which robots are used instead of humans to handle fire hazards. Therefore, this paper presents the development of a firefighting robot that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger. In this project, we are developing a robot which can also be used on domestic levels for fire extinguishing operations. This robot is compact in size and can be used to extinguish fires reaching the impacted areas through narrow pathways. It works on wireless technology using radio frequency transmitter and receiver to control the fire extinguishing operations.

Keywords: Fire fighting robot, compact size, wireless robot, RF controlled transmission.

1. INTRODUCTION

The term robot can be defined as an electro mechanical device which is used to follow the set of instructions to be carried out as specified by its user. Robot is a mechanical design that is capable of performing human tasks or behaving in a human like manner. Building a robot requires expertise and complex programming. It's about building systems and putting together motors, flame sensors, wires etc. among other important components. Detecting fire and extinguishing it is a dangerous job that puts the life of a firefighter at risk. There are many fire accidents which firefighter had to lose their lives in the line of duty each year throughout the world. The research and

development in the field of Artificial Intelligence have given rise to Robotics. The aim here is to design a Fire Fighting robot on the domestic level which can be easily controlled. A firefighter robot is the one which has small fire extinguisher attached to it. A robot capable of detecting and extinguishing fires is designed and built. Once the flame is detected the robot sounds the alarm or blinks the light, the robot actuates the valve as per command and releases sprinkles of water on the flame. The principles used in this design are such that it enables our robot to be a more robust system used to combat actual fires in residential or commercial settings.

2. LITERATURE SURVEY

In today's world, fire fighting is a very serious occupation. Many authors are working to develop autonomous fire fighting robots to tackle this issue.

Author Kristi Kokasih et al. has developed intelligent fire fighting tank robot. Tank robot is made from acrylic, plastic, aluminum and iron. Robot components are two servo motors, two DC motors, ultrasonic sensor, compass sensors, flame detector, thermal array sensor, white detector (IR and photo transistor), sound activation circuit and micro switch sensor. The objective is to search certain area, find and extinguish the flame for different flame positions, room configuration with disturbance. Robot is activated through DTMF transmitter and receiver.

Swati Deshmukh et al. Has developed a wireless fire fighter robot. It comprises of machine which has ability to detect fire and extinguish it. The fire fighting robot can move in both forward and reverse direction and can turned in left and right directions. Thus fire fighter can operate the robot over a long distance and there is no need for human near the area on fire. Light dependent resistors are used for detection of fire. These resistors are highly sensitive devices and are capable of detecting very small fire. The robot provides security at home, buildings, factory and laboratory. It is an intelligent multisensory based security system which contains fire fighting system in daily life.

Rohini more et al. has developed a fire fighting robot which is wireless using 8051 micro controller. They designed and built a small Fire Fighting robot, where a robot will be put in a house model where a light candle is available and the robot should be able to detect, and extinguish the candle in the shortest time while navigating through the house and avoiding any obstacles in the robot's path. Researches were trying in the beginning of the project to get more information about robotics in general and to think about the design, hardware components, and the software technique which will control the robot. This robot contains Light Sensor, 2 DC motors, and Buzzer is used in the robot's body. Two DC series motors are used to control the rear wheels and the single front wheel is free.

Rolly Firefighter Robot by William Dubel, Hector Gongora, Kevin Bechtold, and Daisy Diaz. This firefighting robot is designed to search for a fire in a small floor plan of a house, extinguish the fire and then return to the front of the house. The navigation of the robot throughout the house is achieved by data provided by a line tracker and ultrasound transducers. The deployment of the extinguishing device is implemented with a custom arm controlled by servos.

Fire Protection Robot by Viet Do, Ryan Norder, and Ryan Spratz. This robot designed to enter a room and seek out a spot where there is extreme heat possibly due to a fire. Upon entering the room, the robot will once again use the color camera to pinpoint a spot where there is a large concentration of light. Once the robot has driven up to the light source, the heat sensor is activated to check and see if there is a large amount of heat being generated. If there is an excessive amount of heat generated, the fan is turned on and rotated quickly with a servo motor to put out the flame. If the flame is not put out the fan will turn on again and continue to blow on the flame. Once the flame is extinguished, the robot leaves the home.

3. PROBLEM DEFINITION

1. The system is intelligent as it operates in two modes, but in autonomous mode, it will take more time to find the exact location of fire and to reach there and extinguish it due to self-alignment system of robot.
2. For fire detection purpose "infrared sensor" are used but "IR sensors" are not accurate enough and sometimes gives false reading.
3. For spraying purpose nozzles are used, but it can spray only in one direction.
4. The power requirement of the circuit could not be received using the batteries.
5. Wired firefighting robot is also used but it covers short distances based on the length of the wire.

4. OBJECTIVES

1. Design and development of low cost firefighting robot.
2. The water container will be placed on the robot chassis, so when the fire is detected, it sprays the water on the fire and extinguishes it.
3. Aligning nozzle so that it can spray in all direction which can extinguish fire in its surroundings.
4. The nozzle can move along an arc around a fixed point as well as vertically to increase the radius of spray.
5. Reduce the efforts of human labour and level of destruction.
6. Wireless operation of the robot that allows the user to operate the robot and put off the fire by standing at a safe distance.

5. METHODOLOGY

This advanced robot allows a user to control a fire fighter robot equipped with water tank and gun remotely wirelessly for extinguishing fires. For this purpose the system uses Radio frequency (RF) remote for remote operation along with RF receiver based microcontroller circuit for operating the robotic vehicle and water pump. The RF based remote transfers user's commands through radio frequency signals which are then received by the receiver circuit. The receiver circuit then decodes the data sent by the user. The receiver then forwards the data to the microcontroller. Now the microcontroller processes these instructions and then instructs the vehicle motors to run the vehicle in desired direction.

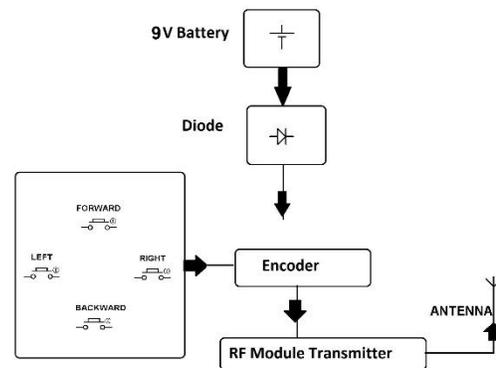


FIG 1: Transmitter block diagram.

It also operates the water pump and directs it in desired direction based on user command. This allows the user to operate the robot and put off the fire by standing at a safe distance. All this process takes place wirelessly so that the user will remain at a safe distance from the fires.

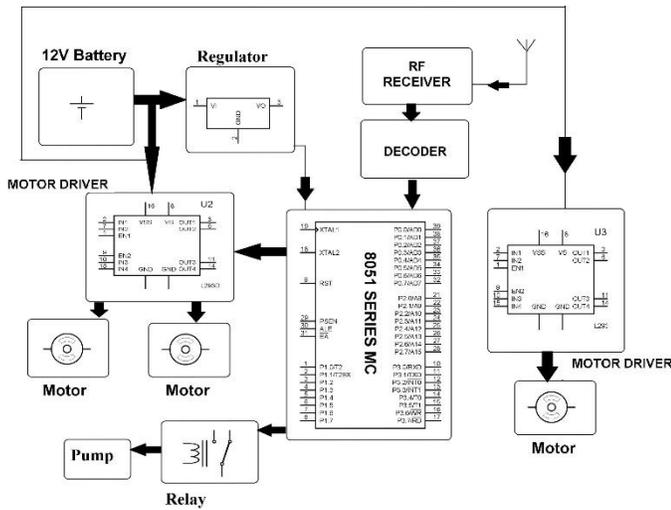


FIG 2: Basic building blocks of fire fighting robot using 8051 microcontroller.

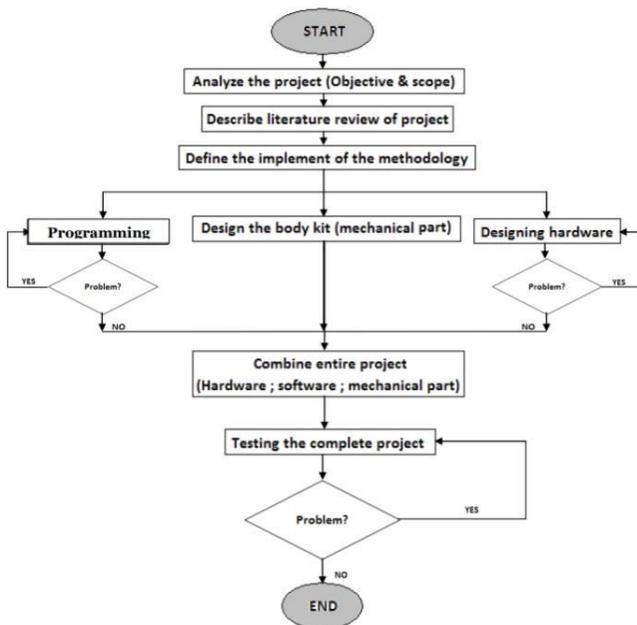


FIG 3: Methodology flowchart during making of fire fighting robot.

5.1. Hardware specifications

- 8051 microcontroller
- Radio frequency transmitter and receiver
- Chassis
- Water tank
- Spray nozzle tube
- Water pump
- RF encoder IC
- RF decoder IC
- Resistors, Capacitors, Transistors
- Cables and connectors

- Diodes, LED
- PCB
- Switch, push buttons
- IC and IC sockets

5.2. Software specifications

- Keil μ Vision IDE
- MC programming language 'C'

6. CONCLUSION

This paper explains the designing and construction of microcontroller based wireless fire fighting robot. The required experimental work has been carried out successfully and the commands given to the robot through RF remote works perfectly and the microcontroller carries out the necessary operation based on the user command. It has advantageous features such as it can be operated by the user from a safe distance from fire hazards as it works on wireless technology using RF circuit. Overall, we can say that this project is successful and the robots works flawlessly in extinguishing fires.

7. REFERENCES

1. Kristi Kosasih, E. Merry Sartika, M. Jimmy Hasugian, danMuliady, "The Intelligent Fire Fighting Tank Robot" , Electrical Engineering Journal Vol. 1, No. 1, October 2010.
2. Swati A. Deshmukh, Karishma A. Matte and Rashmi A. Pandhare, "Wireless Fire Fighting Robot", International Journal For Research In Emerging Science and Technology.
3. Rohini More, Shrilekha Survase, Shubhangi Patil, Prof. S.D. Panchal 2017 "Fire fighting wireless controlled robot using 8051"
4. "Rolly Firefighter Robot", William Dubel, Hector Gongora, Kevin Bechtold, and Daisy Diaz, Florida International University, Miami, 2003
5. "Fire Protection Robot", Viet Do, Ryan Norder, and Ryan Spraetz, Moscow.