

Design & Implementation of RF based Fire Fighting Robot

Mrunalini B. Morwal¹, Karishma K. Malewar², Shubham R. Gadpal³, Nilesh S. Panchbudhe⁴

^{1,2,3}Students, Department of Electronics & Communication Engineering, Dr. Babasaheb Ambedkar College of Engineering & Research, Nagpur, Maharashtra, India.

⁴Assistant Professor, Department of Electronics Engineering, Dr. Babasaheb Ambedkar College of Engineering & research, Nagpur, Maharashtra, India.

Abstract:- This paper present the design and implementation of powerful and secure fire protection system for building based on RF technology. Detecting the fire as well as extinguishing it is a difficult job and that puts lives of fire fighters at risk. There are many fire accidents in which fire fighter loses their lives in the line of duty every year. Now a day, fire accidents are quite common and sometimes it becomes very tough for a fireman to save someone's life. It is not possible to appoint a person to every time observe for accidental fire where robot can do that. Therefore in such cases fire fighting robot becomes a powerful device to handle this. These types of robots are mostly useful in Manufacturing, Industries etc. where possibilities of accidental fire is more. Fire disaster is a common threat to lives, house and goods and hence Robots are implemented to save all of this. Hence, Robotics can be used to help fire fighters for finish the task of fire fighting and so minimize the various types of risk and the limitations that are faced by human fire fighters. This Fire fighters system is having more efficient and effective method of firefighting.

Key Word: fire fighting robot, water pump motor driver IC, transmitter, receiver, microcontroller

1. INTRODUCTION:

A robot is a programmable device which can be used to perform various challenging tasks. Many fire robots have been invented over the past few years but few of them can be controlled wirelessly by fireman. In some cases due to wrong readings of the sensors, the firefighting robot fails and robot fails to perform its task of extinguishing the fire. In this paper we have designed RF based fire fighting robot that can be operated wirelessly and more efficiently. The use of robots is more common today than ever before and it is no longer used by the production industries. The need Fire extinguisher Robot that can detect and extinguish a fire on its own. With the invention RF based fire fighting robot, people and property can be saved at a much higher rate with minimum damage caused by the fire. The Fire Fighting Robot is designed and implemented in a small floor of a house, extinguish the fire with the help of the water. Fire extinguishing is a challenging task for fireman due to physical limitations. Therefore, this RF based fire fighting robot is very useful for fire fighters. This efficient Fire fighting robot can be used for such high risk task of extinguishing fire. Our task as engineers is to design and build a prototype system that loaded with a water pump and

this water pump is connected through plastic pipe to the water tank placed outside. Robots are designed to remove the human factor from labor intensive or dangerous work and also to act in inaccessible environment and also aims at decreasing the air pollution. It is the Robot that can move through a model structure, find a candle and then extinguish it with help of water. This paper describes the design of RF based Fire Fighting Robot. This mission is divided into smaller tasks, and each task is implemented in the most efficient manner such finds the fire in a specific room approaches the fire at a very fixed distance, extinguishes it with water. The robot designed in this paper minimize the possibility of the failure of operation of extinguishing fire due to faulty sensor reading because operator is operating this device. The RF based fire fighting robot is capable to accurately locate the position of the flames by actively scanning the entire area and obstacles so that the fire which has more potential to spread fire can be detected and extinguished faster which reduces the possibility of fire getting spread and save property from the damage.

2. Constructional details:

2.1. Microcontroller: The 8051 microcontroller programmed to perform various task based on the requirements of the circuit operation. It is a smaller computer which has on-chip RAM, ROM, I/O ports. This is the main part of this project .the motor driver circuit is connected to the 8051 microcontroller .receiver send received signal to microcontroller which generates output signals which is then fed to motor driver IC. The motors change direction based on signals received from motor driver IC.

2.2. Geared Motors: The Geared motor is used to the lift heavy load and it is a 12V DC rating motor which gives 60mA max current on no-load and 300mA max current on load. Here, 10 RPM motor is used for better performance. There are the 4 Geared motors are used for movement of robot in left, right, forward and backward direction. The weight of each geared motors is 125 gm.

2.3. RF transmitter receiver module: In the transmitter section HT12E Encoder IC and in the receiver section HT12D Decoder IC is used. It works approximately in 100 meter range in open space. The RF transmitter and receiver module have frequency 433MHz. this IC's are easy for application and operated on low power

2.4. 7805 Regulator IC: Voltage in a circuit may have fluctuations in supply resulting in not produce fixed voltage outputs. A voltage regulator IC controls the output voltage at a constant value. It acts as a fixed output regulator. It acts as an excellent component against input voltage fluctuations for circuits, and adds an additional safety to circuitry. It protects the device from damage.

2.5. Adapter: Adapter is used as a power supply for the transmitter and receiver circuit. It gives regulated voltage and current stability 12V, 2A. It is light in weight and have compact size. It is required to give power supply for 8051 microcontroller

2.6. DC water pump: The main purpose of DC water pump is extinguishing fire with high speed water flow. It pumps out water stored in a water tank connected with pipe. This DC water pump is operated on a 12V power supply for high pressure water pumping process. It is placed on the fire fighting robot and fixed as like to give movement in upward and downward direction.

2.7. Motor Drive IC: Motor controller is used drive the geared motors which give better reliability and speed, less noise and proper power consumption. Here, the L293D motor driver circuit is used for the better performance. Motor driver IC is use to drive motors in any direction. Basically motor driver IC acts as an interface between microcontroller and motors. It gives the benefits like current sense for each motor to provide better performance.

2.8. Fire detection: Fire detection follows with the help of camera fixed on the RF based fire fighting robot which is connected wirelessly to the display or with the mobile for searching fire by fire fighting robot operator who controls the operation within the range of 100 meters of system. After detecting fire, the operator pushes button from transmitter and fire fighting robot will turn on the pump in order to extinguish fire.

3. Working: In this project HT12E encoder is used as RF Transmitter module and HT12D decoder is used as a RF receiver module. Both encoder and decoder are connected to the 8051 microcontroller. When the particular push button is pressed then the program executed, delivers the corresponding data which are then transmitted. The transmitter and receiver are powered by 12V Adapter, this power is then fed to regulator IC, microcontroller decoder, motor driver IC and DC water pump. All this components and efforts make the RF fire fighting robot more efficient and capable of working faster and hence extinguish fire. This robot is designed in a way that operator can search a fire by sitting anywhere within the range of robot & extinguish it with water before the fire could spread out of range & control. This type of fire fighting robot will work faster with fire fighters and hence, reducing the danger of injury and damages. The main goal of this project is to design a

firefighting robot by using RF technology controlled by remote.

This robot is loaded with a DC water pump, receiver circuit, microcontroller, motor driver IC. DC water pump controlled by wireless communication to through water. The 8051 microcontroller is used for desired operation. At the transmitter circuit, push buttons are used to give commands to the receiver to control the movement of fire fighting robot either in forward, backward, right or left direction. The RF transmitter acts as an RF remote control, it works within the range of 100 meters. DC water pump is placed on the robot body and its operation is carried out from the microcontroller through the signal sends by transmitter. Here, water is supply to the DC water pump is given through water tank arranged outside anywhere and connected with a rubber or plastic pipe. The entire operation is controlled by a 8051 microcontroller. A motor driver IC is connected to the microcontroller for controlling the motors. A wireless camera is fixed on robot for so that the robot operating person can view the controlling operation of the robot remotely on a display.

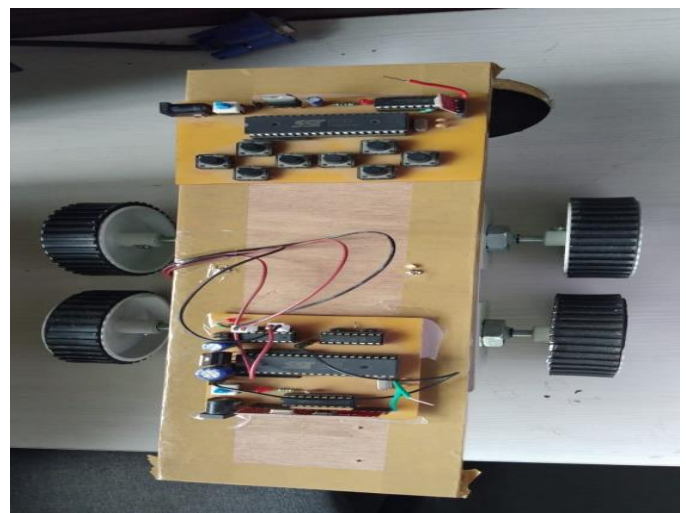


Fig. 1: Prototype of Fire Fighting Robot showing transmitter & receiver modules.

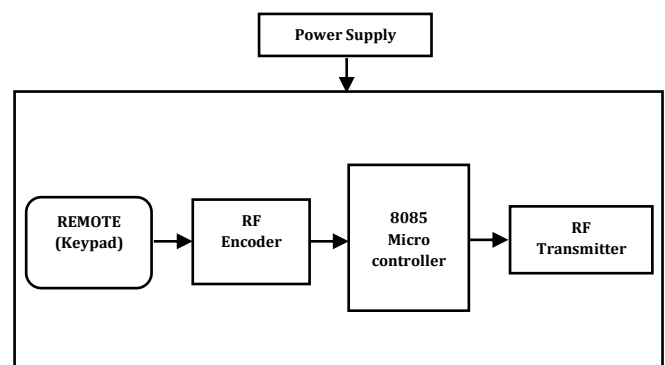


Fig. 2: Block diagram of Transmitter Section

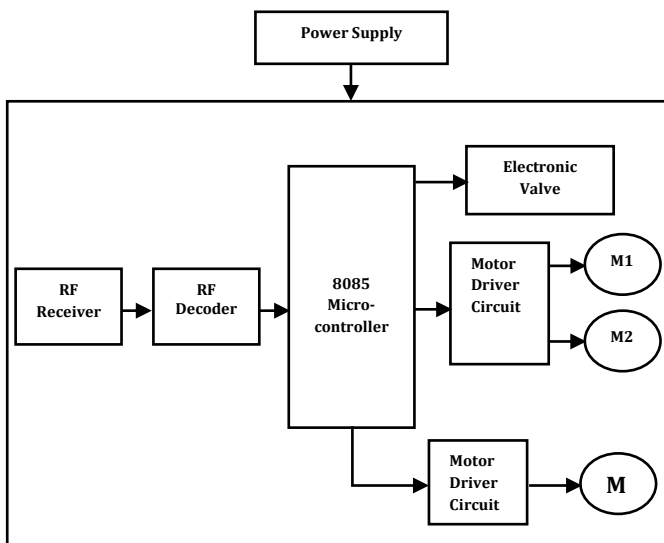


Fig. 3: Block diagram of Receiver section

4. Need of fire fighting robot:

A firefighting robot is capable of extinguishing the fire where it is not possible for fireman to go there then the RF based fire fighting robot is very useful and convenient machine and the fireman can easily extinguishes the fire and saves people, goods from damage by means of this robot helps in saving people and properties safely from the fire accidents. The firefighting robot has pump water attached with water tanker through plastic pipe and it is capable of spray water using DC water pump on fire. It is controlled by RF wireless communication. here, 8051 microcontrollers are used for the desired operation.

5. CONCLUSION:

This RF based Fire Fighting Robot work is easier and faster. It controlled smoothly and comfortably by remote. The operator can easily watch the fire by the camera placed on the robot and easily extinguishes it by throwing water through DC water pump. The controls placed on RF Transmitter remote are very easy to handle and understand. When fire occurs in building or in factories or any tight places of the building where fireman can't go for extinguish fire then RF based Fire Fighting Robot can be very efficiently use for extinguishing fire with least risky human intervention. This project presents a RF based fire fighting robot using RF Transmitter and Receiver and it is designed and implemented with 8051 Microcontroller.

REFERENCES:

- 1) Manish Kumbhare,s Kumbhalkar, R.Malik, "Fire Fighting Robot", an approach, Indian Streams Research JournalVol.2,Issue.II,March:12pp.1-4.
- 2) Rutuja Jadkar, Rutuja Wadekar, Shweta khatade, Sayali Dugane, "Fire Fighting Robot Controlled

Using Android Application",Vol.4,Issue11,November 2015.

- 3) Swati Deshmukh, Karishma Matte, Rashmi Pandhare,"Wireless Fire Fighting Robot", International Journal For Research in Emerging Science and Technology,Vol.2,Issue2,March2015.
- 4) S.Jakhti Priyanka, R. Sangeetha, "Android controlled Firefighting Robot", International Journal of Innovative Science Engg.and Technology,Vol.3,2017
- 5) Puneet Sharma, Chandani Goel, "Fully Automated Fire Fighting Robot With Radio Frequency Module", Journal of Academic and Industrial Research (JAIR)Vol.3, Issue7, December 2014.
- 6) P. Saravanam, Design and Development of Integrated Semi-Autonomous Fire Fighting Mobile Robot, International Journal od Engineering Science and Innovative Technology (IJESIT)", VOL.2, March 2015.