Mitigation of household fire with the help of fire extinguishing robotic vehicle

Nitin S. Motgi[1], Sunil Dambhare[1], Keval Nikam[1*], Rupesh Patil[2]and Appaso Parit[3],
[1]Mechanical Engineering Department, Dr. D. Y. Patil Institute of Engineering,Management & Research, Pune
[2]Navsahyadri Education Societies Group of Institutions
[3]NTPC, Ltd
***Corresponding Author : nikamkeval26@gmail.com**

Abstract.

A vehicle capable ofthe fighting a simulated household fire will be designed and built. This robot will be able to autonomously navigate through a modeled and given floor plan while actively scanning for a flame. LDR will be used for initial detection of flame. Once the flame is detected, the robot will proceed toward the flame and there will be another LDR in the middle which is most required to come close to the fire in order to position itself and extinguish it within shortest period of time and return to its initial stage. To extinguish the flame, the robot starts the blower onto the flame. The model will help generate interests as well as innovations in the fields of industry and robotics while working towards a practical and obtainable solution to save lives and mitigate the risk of property damage.

Keywords: Household fire, LDR, Robot, flame extinguisher
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1 Introduction

Humans cannot work in all conditions which are hazardous to their life where temperature is very high, by using firefighting robot helps to prevent loss of life and environment and destruction of property. These firefighting robots stop when fire is detected and pump motor pumps water if fire is fire is not detected then the robot moves in all directions where fire sensor senses the fire(1). Current work is designed to develop a firefighting robot using RF technology for remote operation. An 8051 series of microcontroller is used for loaded robotic vehicle with water tank along with water pump over wireless communication through water. For movement of robot (forward/backward/left/right) push button, command sent to receiver. By using proper antenna RF transmitter adequate up to 200 m range, before feeding from DC motor to microcontroller via IC of motor driver the receiver decodes for necessary work(2). On the robot body the water pump with water tank is mounted and its operation is done from transmitting end of motor IC through appropriate signal via microcontroller

output and it interfaced to the microcontroller through which the controller drives the motor.
The objective of this work is to design and develop low cost firefighting robot which detects and extinguishes fire. The flow of water through wireless RF technology is revealed. Movement of robot occurs automatically or through remote operation using RF technology. If the fire is detected robot stops and pumps water if fire is not detected then robot move in all directions to detect fire the pump motor pumps water to extinguish fire which is controlled by microcontroller.

2 Methodology and System Development

For human life guard the Fire fighter vehicle machine is human made machine, because uncountable accidents occurred during the fire extinguishing process. The main function of vehicle is to move the vehicle for automatically detecting the fire to extinguish from a safe distance using water. Its movement is fully controlled by Arduino programming. This robot act like vehicle to move in defined direction in order to find extinguish the fire. The vehicle has an infrared camera and thermal camera and mounted over it. For detecting fire thermal camera is used and the temperature and the night vision imaging the infrared camera is used to provide the live recording of all process of fire extinguishing. The recording viewed in computer.

In the proposed system, 8051 series microcontroller, fire sensor, RF(Tx-Rx), battery, motor pump (DC motors) are used. The controlling of these devices is done by using At89S52 microcontroller(3),(4).

In this firefighting robot vehicle system, wireless RF module operation and transceiver module to the microcontroller and interfacing of RF are used efficiently and effectively the basic hardware components used in the Project are

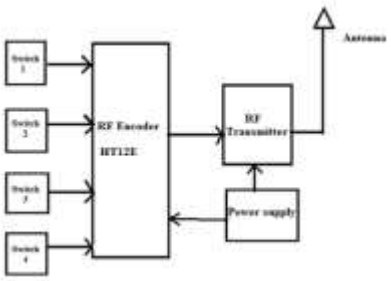
1. AT89S52 microcontroller
2. RF TX_RX
3. Fire sensor
4. DC motors
5. Motor driver L293D
6. Battery
7. Robot body with water tank

The system software's are

1. Embedded 'C'
2. Keil µ Vision
3. Prog 'ISP'

A. Block Diagram

The block diagram of firefighting robot vehicle system is designed using AT89S52 microcontroller, battery, fire sensor, motor pump (DC motors), RF Tx-Rx, robot body with water tank, L293D-driver as shown in figure 2.1 and figure 2.2



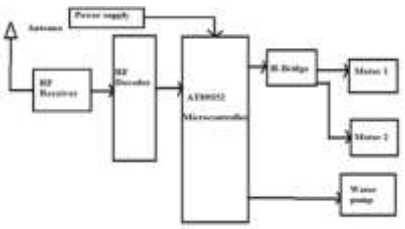


Figure 2.1: Block diagram of transmitter

Figure 2.2: Block diagram of receiver

From the figure 2.1, at transmitting end using push buttons, commands are sent to the receiver to control the movement of the robot either to move forward, backward, left, right etc. From fig. 2.2 it is seen that two motors are used for vehicle movement and one motor is used for robot arm positing. As range of RF transmitter up to 200 meters received decodes prior feeding to another microcontroller for necessary.

Figure 2.3 shows the systems hardware, designed for implementing of AT89S52 microcontroller-based fire detecting system. The operating voltage of AT89S52 microcontroller is 5V. L293D driver is interfaced to the AT89S52 microcontroller at port 1 to supply enough operating voltage to load. The output current of microcontroller is very less in the range of µAmps and is not enough to run the load. Hence L293D driver circuit is used to increase the current gain. The load here is a DC motor pump.

B. System hardware:

Figure 2.3 System Hardware

C. Schematic Diagram of RF TX and RF RX

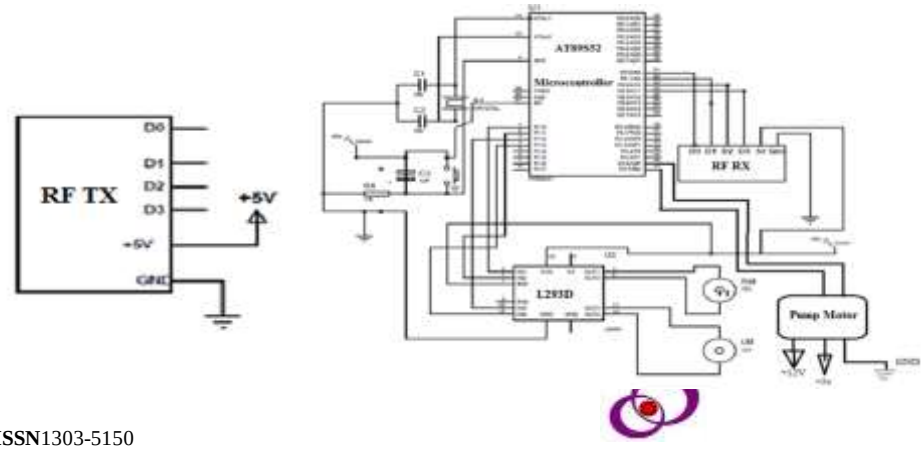


Figure 2.4 Schematic Diagrams of RF TX and RF RX

D. Flow Chart

The figure 2.5 shows processing flow chart of data is carried out in the proposed system

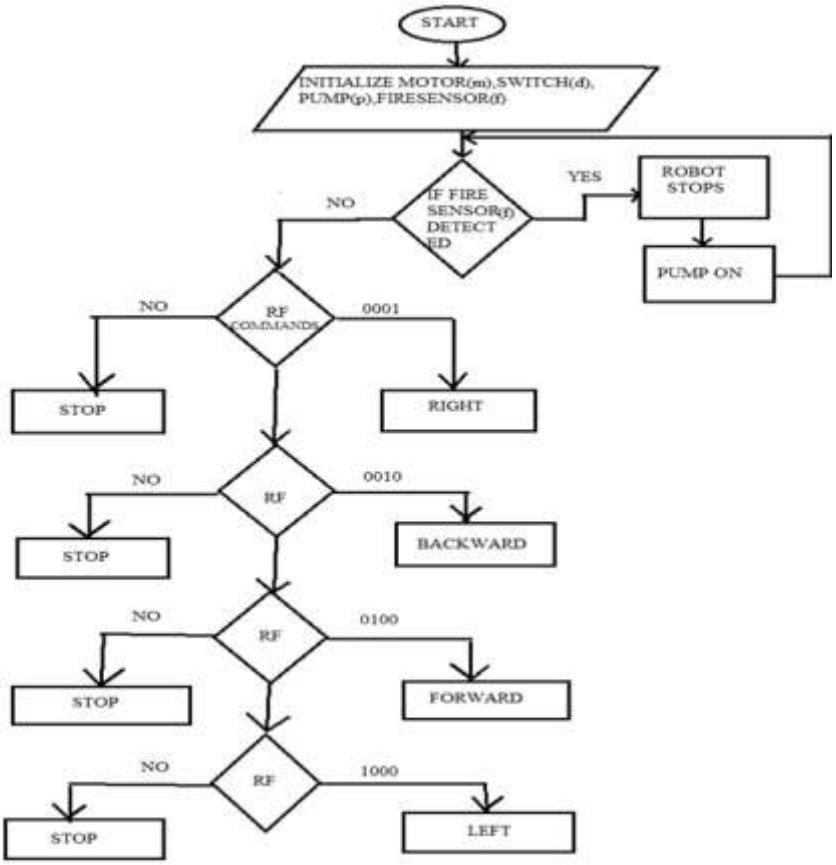


Figure 2.5 flow chart

3. Working conditions

The proposed system has been tested for the following cases and noted the working of the system in each case,

Case I: - If the fire sensor detects fire then the running vehicle stops and starts pumping water as pump motor will be in the ON state and extinguishes fire as shown in figure 3.1.

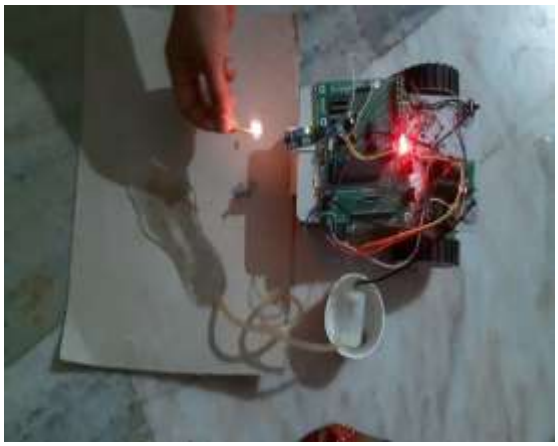


Figure 3.1 Sensor detects fire and pumps water

Case 2: - If the fire is not detected then the vehicle does not stop and move according to the given command from RF transmitter to the RF receiver. If the command is given as 0001 then the vehicle moves towards RIGHT side where switch d3 will be one as shown in figure 3.2. In this case right wheel will be in OFF state as two conditions are same motor stops and only left wheel will be in ON state. So, the vehicle moves in right direction until fire is detected if fire is detected then in other condition the vehicle stops.

Case 3: - If fire is not detected when moving in right direction the vehicle does not stop and move in other direction according to the given command from RF transmitter to RF receiver. If the given command is 0010 then the vehicle moves in BACKWARD direction where the switch d2 will be one as shown in figure 3.3. In this case both the wheels move in backward direction as no two conditions are same the motor does not stop and move in anticlockwise direction. If fire is detected then the vehicle stops in other condition.

Figure 3.2 Vehicle moves in right direction

Case 4:- If fire is not detected when moving in previous two directions the vehicle does not stop and move according to the given commands from RF transmitter to RF receiver .if the command given is 0100 then the vehicle moves in FORWARD direction where the switch d1 will be one as shown in figure 3.4. In this case both the wheels move in forward direction as no two conditions are same the motor does not stop and move in clock wise direction. if the fire is detected in other condition the vehicle stops

Case 5:- If the fire is not detected when moved in previous conditions then the vehicle does not stop and move according to the given commands from RF transmitter to RF receiver .if the command given is 1000 then the vehicle move towards LEFT side where switch d0 will be one as shown in figure 3.5. In this case left wheel will be in OFF state as two conditions are same the motor stops and only right wheel will be in ON state and rotate. Vehicle moves in left direction until fire will be detected and if fire is detected then in other condition the vehicle stops.

Figure 3.3 Vehicle moves in backward direction

4. Conclusion

Figure 3.4 Vehicle moves in forward direction

Figure 3.5 Vehicle moves in left direction

This paper motivates to design a system, without any human intervention that can detect fires and takes appropriate action, this work represents firefighting robot using Radio Frequency communication is designed and implemented with atmel89s52 or 8051 microcontroller and in embedded system domain experimental work has been carried out successfully. The result shows by using embedded system the higher efficiency is

indeed achieved. This method is highly beneficial for industry and security purpose.

References

1. IEEE 15th International Colloquium on Signal Processing & its Applications (CSPA 2019), 8 -9 March 2019, Penang, Malaysia { Kalaivani A/P Perumal, Musab A. M. Ali (Faculty of Information Sciences & Engineering, Management & Science University, 40100 Shah Alam, Malaysia) Zainab Hussein Yahya(Computer sciences, Knowledge university, Erbil, Iraq)}.

2. IJSRD - International Journal for Scientific Research & Development| Vol. 5, Issue 01, 2017 | ISSN (online): 2321-0613{Prof. Samantha Cardoso(Assistant Professor), Amira Salkar(Student), Cressida Gomes(Student), Anaska Gomes(Student) Department of Electronics & Telecommunication Engineering Don Bosco College of Engineering, India}.

3. International Research Journal of Engineering and Technology (IRJET) Makhare Sonal, Mane Bharat, Sapkal Saraswati, Prof.V.U.Bansude, Dept. of E&tc Engineering, S.B. patil college,Indapur, Maharashtra, India.

4. International Journal of Innovation and Scientific Research ISSN 2351-8014 Vol. 22 No. 2 Apr. 2016, pp. 375-383 Sunil Mathew(UG scholar), Gaikwad Sushanth(UG scholar), KR Vishnu(UG scholar), V. Vishnu Nair(UG scholar), and G. Vinoth Kumar(Assistant Professor), Department of Mechanical Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India