Fire Fighting Robot – An Effective Approach

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Abstract - *Firefighters put their lives in peril to rescue people in danger in case of a fire. To reduce the loss of life of firefighters as well as citizens, a design for the firefighting robot is proposed. Additionally, the current methods applied in firefighting are inadequate and inefficient. In real life, fire hazards are unpredictable. It is better to douse the fire when it is small in size. This Fire Fighting Robot uses an effective fire extinguisher mechanism made up of fire spray, which is used to extinguish both electric and normal fire. This autonomous system is designed using an Infrared flame sensor, Microcontroller, and Ultrasonic sensors. The proposed system detects fire in all the three directions viz. left, right, and forward. It has a special feature of obstacle detection and avoidance. This robot reacts immediately, which increases the efficiency and success rate of putting the fire out.*

***Key Words*: fire-fighting, extinguisher, flame sensor, IR, Ultrasonic, Microcontroller.**

1.INTRODUCTION

Robotics is considered as the World's future as nowadays the robot's world population is exceeding 8.6 million according to the last edition of world robotics This Fire Fighting Robot is designed to help people in any destructive burnt situation where this robot can extinguish the burnt area immediately using an autonomous system. This autonomous system is designed using programming in Embedded C using ATMEGA 328P controller, other additional circuits, and effective fire extinguisher mechanism.

2. LITERATURE REVIEW

Over last few decades, some the systems have been developed, namely "Fire Extinguishing Robot" [3] and "A smart fire extinguisher using fire fighting robot"[4] in which black line path is assigned so following those path robots were used to extinguish the fire. Also, robots are designed as tank robot with the flame, ultrasonic, thermal array, and compass sensor. Its simulation area is designed in miniature, it's miniature equipped with furniture, sound damper, and

uneven floor. But the use of various sensors makes the design complicated, there will be a possibility of messing up the output. This system is fully automated fire fighting robot which deals with the fire problems in the household, laboratories, small scale industries. . We can use this robot to perform those tasks that may be harmful and dangerous to humans. From the literature review it is clear that to solve problems created while operating the robot manually or through coding, intelligent design is made which constitutes addresses of various locations[2]. This makes human life easier and reduces the efforts taken by them. This system composed of an IR sensor to detect the flame from the surrounding environment based on the data from sensors, because its speed and accuracy are better than gas and smoke sensor.

 This robot also detects the obstacle in its path. When an obstacle is present it stops and resumes its running then starts ringing the buzzer. It involves the predefined computation of an obstacle-free path, which controller guides to the robot. This robot can avoid obstacles with a better security path to overcome the problem of mobile robot intelligent obstacle avoidance system.

3. DESIGN AND ARCHITECTURE

The robot is made up of acrylic material placed in the form of layers. The bottom layer consists of three flame sensors and an ultrasonic sensor and upper layer consists of spray extinguisher unit. The system is to be placed nearby a destructive burnt area. Once the system is powered ON, the robot will start moving in the forward direction and three flame sensors will continuously search for the presence of fire. The Robot will then move in that particular direction (left, right, or forward) considering it as the line of sight and ultrasonic sensor will be in continuous search for any obstacle present. If any obstacle is present a signal will be given by buzzer and the robot will stop. If no obstacle is present robot will continue to move in that direction and will stop 15cm before the burnt place. An Effective extinguisher mechanism consists of fire spray and dc motor to control the

flow, will then be used to extinguish the fire present. The control and processing part is mainly done by ATMEGA 328P controller.
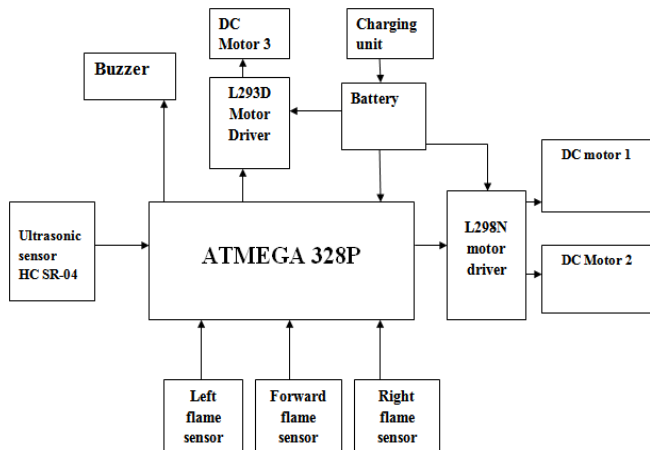

Fig 3.1 Block Diagram of System

The system components are as follows:

3.1 ATMEGA -328P Controller: It is a high performance, low power AVR based 8-bit microcontroller which has 32 pins. The controlling and processing of data is done by this controller.

3.2 IR Flame Sensors (Left, Right and Forward): IR Flame Sensors are used which is made using a photodiode. Three IR sensors mainly used to control the movement of the robot in three different directions viz. left, right, and forward. As soon as the fire is detected, a signal is given to the controller, and the robot starts moving in that particular direction.

Fig 3.2 Infrared Flame Sensor

3.3 Ultrasonic sensor HC SR-04: After finalizing the direction robot will then move in that particular direction (left, right, or forward) considering it as the line of sight and ultrasonic sensor will be in continuous search for any obstacle present. If any obstacle is present a signal will be given by buzzer and the robot will stop.

Fig 3.3 Ultrasonic Sensor Module HC-SR04

3.4 Motor drivers (L293D and L298N): Motor drivers are used in describing the direction of the movement of the robot. It is used to give high voltage and high current as an output to run the motors which are used in the project for the movement of the robot. Motor Driver used this project can drive two motors between 5-35V and 2A per channel.
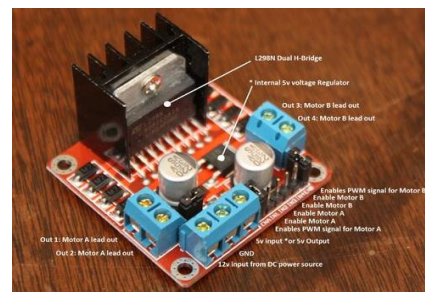

Fig 3.4 Motor Driver Module

3.5 DC Motors: Dc motor is incorporated for rotation of the wheels which are responsible for the movement of robot. Generally DC motor converts electrical energy into mechanical energy.

3.6 Battery and charging unit: A 12V LEAD rechargeable battery is incorporated to supply power to both the motor drivers which are responsible for the movement of the robot. The controller will take the input from the 5V section of the L298N motor driver. A charging module is also incorporated in order to know the status of battery charging and to recharge the battery after use.

3.7 Buzzer: Whenever any obstacle is present in the line of sight, ultrasonic sensor will send signal to controller and user will be made aware by using buzzer as an output device or alarm. A 12V piezoelectric buzzer is used here in this project.
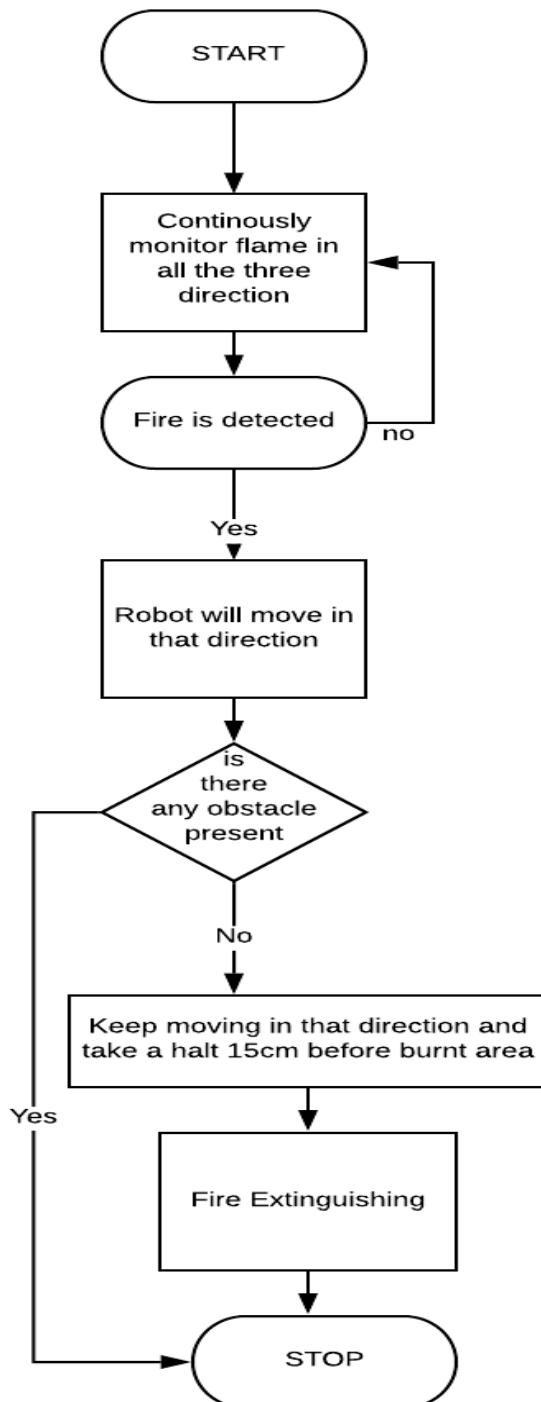
4.FLOWCHART

Fig 4.1 Flowchart of the system

As soon as system is powered ON, 5V supply is given to the microcontroller and the robot will start. The flame sensors will monitor flame in all the 3 directions. If fire is detected,

the robot will move in that particular direction. If not detected then it will continue to monitor. While moving, if any obstacle is detected in the path, the robot will stop. If not detected, it will continue moving in the direction of the flame. The robot will stop at a distance of 15cm away from the fire and then the fire extinguishing mechanism will begin and fire will be extinguished.

5. CONCLUSIONS

The proposed approach of the design of the Fire Fighting robot is a good alternative solution to help people in the destructive burnt situation. This robot can move in three directions viz. left, right, and forward. It can extinguish both electric and normal fire. The robot detects fire and extinguishes the fire with the help of an effective fire extinguisher mechanism. For extinguishing that, fire fighting robot has to reach up to there and it moves towards the target with the obstacle avoidance property. It can be extended to a real-life extinguisher by adding Bluetooth module and GSM module to make it more automated and to make it able to extinguish fires of all rooms using microprogramming.

6.REFERENCES

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