International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 01 | Jan 2019 www.irjet.net p-ISSN: 2395-0072

Design and Fabrication of an Autonomous Fire Fighting Robot with Obstacle detection And Fire Detection Using Arduino

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Abstract - Fire-fighting is an important but dangerous occupation. A fire-fighter must be able to reach the situation quickly and safely extinguish the fire, preventing further damage and reduce fatalities. Technology has come to rescue this issue, firefighters and machines are now having more efficient and effective method of firefighting. This paper gives you the design idea of firefighting robot using autonomous operation. The robotic vehicle is loaded with fire extinguisher and a water pump which is controlled over solenoid valve to throw water. An Arduino UNO is a microcontroller is used for the desired operation. A water tank and fire extinguisher setup along with water pump is mounted on the robot body and its operation is carried out from the microcontroller output through appropriate signal from the sensor. The whole operation is controlled by an Arduino UNO microcontroller.

Key Words: Arduino, IR sensor,

1. INTRODUCTION

Most of the fire accidents occurring in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale fire industries resulting in quite serious consequences. With the advancement in the field of Robotics, human intervention is becoming less every day and robots are used widely for purpose of safety. This project integrates auto technology for autonomous operation and uses Arduino microcontroller.Therefore, Arduino based fire fighting Robot is designed to control fire through a robotic vehicle. The put forward vehicle has a water jet spray which is capable of sprinkling water. The sprinkler can be moved in all four directions. The arrival of new high-speed technology provided realistic opportunity for new robot controls and realization of new methods of control theory. The main controlling devices of the whole system are Microcontrollers, wireless transceiver modules, water jet spray, DC motors and buzzer are interfaced to Microcontroller.

1.1 Block Diagram Description:

The Figure 1 shows the working of the circuit . The ultra-sonic sensors used mainly focus on the obstacle detection and the IR are connected in voltage divider configuration with the analog input pins of the controller. When light from the flames falls on IR sensor the resistance of the sensor changes. This change in resistance of the IR receiver results the analog voltage to vary between ground to VCC. The voltage is read from the analog input pin of the controller and converted to a digitized reading using inbuilt ADC channel. The Arduino UNO microcontroller has 10-bit ADC channels, so the digitized reading ranges from 0 to 1023[1],[2]. The sensors are calibrated to detected fire from a distance of 1 Meter. The output obtained corresponding to the calibration point is set as the threshold in the program code. The same computation is done for all the three sensors.

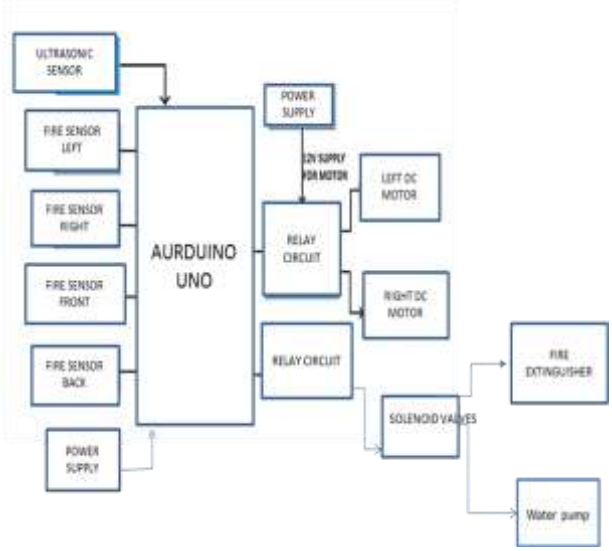

Figure 1 Block Diagram for proposed method

1.2 Working

The microcontroller recognizes the digital output at the input pins of the motor driver IC to control the motion of the robot. For the Robot movement, 12V geared DC motors are attached to the wheels. This geared DC motors are available with wide range of RPM and Torque, which allow a robot to move based on the control signal it receives from the motor driver IC. The robot motion is mainly controlled by the rear wheels. Since it is automatically, it turns left and moves forward to reach an appropriate spot if fire is sensed by the left sensor. It change towards right and moves forward to reach an appropriate spot if fire is sensed by the right sensor. The Robot moves forward or backward until it reaches an appropriate spot if fire is detected by the front sensor. ULN2803 is a High voltage, high current Transistor Array IC used here with Microcontrollers where high power

loads need to be derived. It IC consists of a eight NPN Darlington connected transistors with common Clamp diodes for switching the loads connected to the output. This IC is commonly used to drive high loads such Lamps, relays, motors etc. It is usually rated at 50v/500mA

The threshold value of the sensor is calibrated to 400. As the robot advances towards fire, the sensor value also increases. The robot halt at a spot and initiate responsive action as the sensor reading reaches a value of 900. The robot proceeds first in a direction where the intensity of fire is most and after extinguishing fire, it turns in the opposite direction. For example it had turned left, after extinguishing fire, it will turn right and vice versa.

2. Flowchart for proposed method.

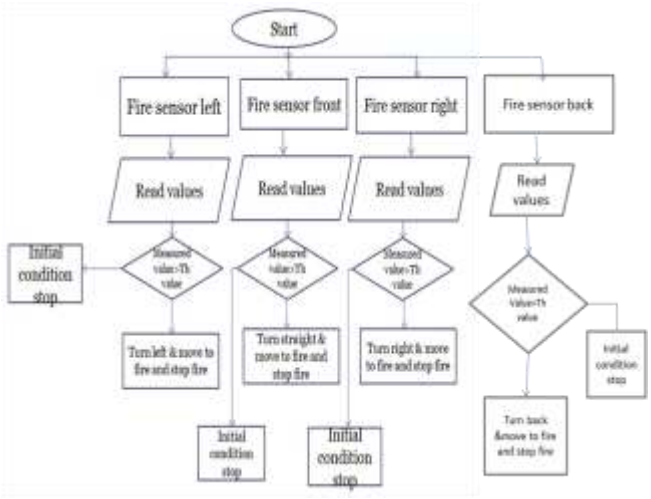

Figure 1 Flow chart for proposed method

Table 1. Direction of movements of robert

Action	RHS Motor	LHS Motor	RHS Motor		LHS Motor	
			Pin-2	Pin-7	Pin-10	Pin-15
Move forward	Clockwise rotation	Anti-clockwise rotation	LOW	HIGH	HIGH	LOW
Move backward	Anti-clockwise rotation	Clockwise rotation	HIGH	LOW	LOW	HIGH
Turn right	Stop	Anti-clockwise rotation	LOW	LOW	HIGH	LOW
Turn left	Clockwise rotation	Stop	LOW	HIGH	LOW	LOW
Stop	Stop	Stop	LOW	LOW	LOW	LOW

Results :

The Robot when detects fire, it moves on its own. Arduino will control the motor through the motor driver circuit. To rotate to either right or left direction, one motor will remain off and other one will move, thus resulting in rotation of the body. If Arduino flame sensor will detect the fire then the robot will move forward to the fire slowly. Here, algorithm is written such that it makes a slow approach of the robot towards fire. As soon as it detects fire, robot needs to stop at a certain limit and should not run over the fire. The LM35 sensor used here senses the heat. If it sensor output is greater than threshold value, it stops and moves back slightly to accommodate extinguishing. Then centrifugal pump throws water at fire to put it out. Fire extinguisher is also provided to put out fire.

Figure 2: Original Prototype of Autonomous Fire Fighting Robot

3. Applications

- It is used in hazardous places.
- Useful in controlling fire at extreme places where human being cannot reach

4. Conclusion and Future Scope

The Fire Fighting Robot is constructed with locally available materials and obstacle detection test and fire sensing working are checked to observe its effectiveness at different situation. The Fire Fighting Robot is

effective enough to fight against fire on a small area. Fire sensors works better at darker places. It can detect fire abruptly and can extinguish it before spreading. This design of robot can also fight against large fire with larger reserving capacity and an improved sensing unit can provide even an earlier detection of fire at all circumstances. Further the module an be extended to work as speech control Robert.

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