International Journal of Electronics Engineering (ISSN: 0973-7383
Volume 11 • Issue 1 pp. 447-451 Jan 2019-June 2019 www.csjournals.com

Fire Accident Fighting Robot

[1]C. Vinodh Kumar, [2]R. Guna Sekhar, [3]D.R.V. Harika, [4]S. Zabiullah
[123]Student, [4]Assistant Professor
Department of Electrical & Electronics Engineering, Kuppam Engineering College, Kuppam, A.P., India.

Abstract: According to some National Crime Records Bureau (NCRB), it is estimated that more than thousands of deaths have been caused because of fire accidents in India, even though there are lot of precautions taken for Fire accidents, these Robotics it is very much possible to replace humans with robots for fighting the fire. This would improve the efficiency of fire fighters and would also prevent them from risking human lives. Generally in our day to day life, fire accidents become common and sometimes may leads to hazards that make it hard for mankind to protect human life. In such case a fire accident fighting robot is used to guard the human lives, wealth and surroundings from the fire accidents. Basic mechanism used is ARDUINO UNO, fire sensor or flame sensor(3 No's),servo motor (SG90),motor drive (N983D),photo diodes or IR sensors, battery 12 volts, DC motor(4 No's),chassis. This paper gives the design idea of fire fighting robot using automatic operation. An ARDUINO UNO is used for the desired operation. This entire operation is controlled by an ARDUINO UNO[1].

Keywords: Fire Fighting, Flame Sensors, Motors, Photo diodes, ARDUINO UNO, Automatic.

Introduction

There are many possibilities a fire can start in an industry or in any remote area. For example, in cotton mills, garments, fuel storages, parking areas etc., electric losses not only financially but also destroying the surroundings. Robotics is the emerging solution to protect human lives and their wealth and surroundings. The aim here is to design a FIRE FIGHTING ACCIDENT ROBOT using ARDUINO UNO. A robot capable of fighting a simulated household fire will be designed and built. It must be able to automatically navigate or sense through a modeled floor plan while actively scanning for a flame. It is designed to find a fire, before it rages out of control, can one day work with fire fighter greatly reducing the risk of injury to victims. The project will help generate interest innovations in the advanced technical fields and obtainable solution to save lives and mitigate the risk of property damage. This would also improve the efficiency of the fire fighters and would also prevent them from risking human lives. With the invention of such a device, people and property can be saved at much higher rate with relatively minimal damage caused by the fire. Our tasks as engineer was to design and build a prototype system that could automatically detect and extinguish the fire. Also aims at minimizing the air pollution.[2]

Block diagram of fire accident fighting robot

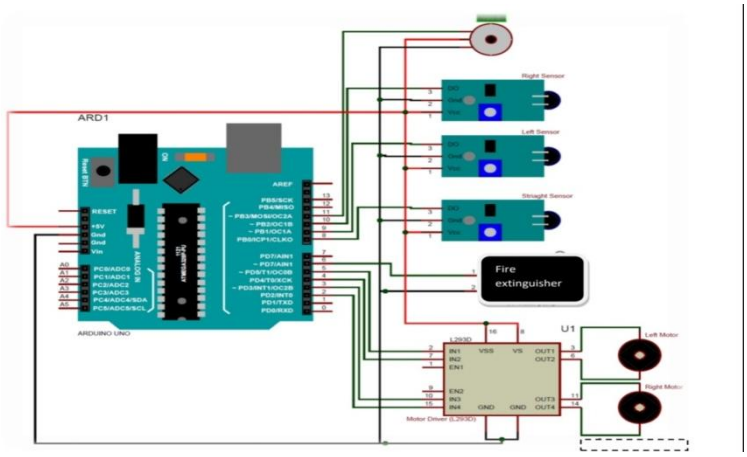

Fig .1.Blobk diagram of fire accident fighting robot

The above figure shows block diagram of fire accident fighting robot. The basic theme of this robot is to detect the fire coming out of accident, for this flame sensor is used as input sensor which is connected on the front side of robot chassis. The flame sensor senses the flame coming out of fire and it feds the signals to ARDUINO board then ARDUINO activates the motor drive to move the wheels (gear motor) according to sensors signal. When the sensors sense the fire the co2 gas releases from the cylinder with the delay of 5

seconds of time. The robot can reach the fire accident location to extinguish the fire through the sensors which are placed at (left, right, centre). So that it can releases valve of cylinder to face the fire which is efficient way of stopping fire[3].

Arduino uno : ARDUINO board is an open-source platform used to make electronics projects. It consists of both a microcontroller and a part of the software or Integrated Development Environment (IDE) that runs on your PC, used to write & upload computer code to the physical board. The platform of an ARDUINO has become very famous with designers or students just starting out with electronics, and for an excellent cause. ARDUINO is an open-source electronics prototyping platform based on flexible and easy to operate hardware and software, it's intended for artists, designers, hobbyists, & anyone interested in creating interactive objects or environments. Since ARDUINO is open source, the CAD and PCB design is freely available. Anyone can buy pre-assembled original ARDUINO board. You can build an ARDUINO for yourself. Although it is allowed to build ARDUINO boards, it's not allowed to use the name ARDUINO and the corresponding logo. Most boards are designed around the Atmel Atmega328. ARDUINO board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++.In addition to using traditional compiler tool chains, the ARDUINO project provides an integrated development environment (IDE) based on the Processing language project[4].

Motor driver l293d : L293D IC is a typical Motor Driver IC as ahown in below fig.2. which allows the DC motor to drive on any direction. This IC consists of 16 pins which are used to control a set of two DC motors instantaneously in any direction. It means, by using a L293D IC we can control two DC motors.

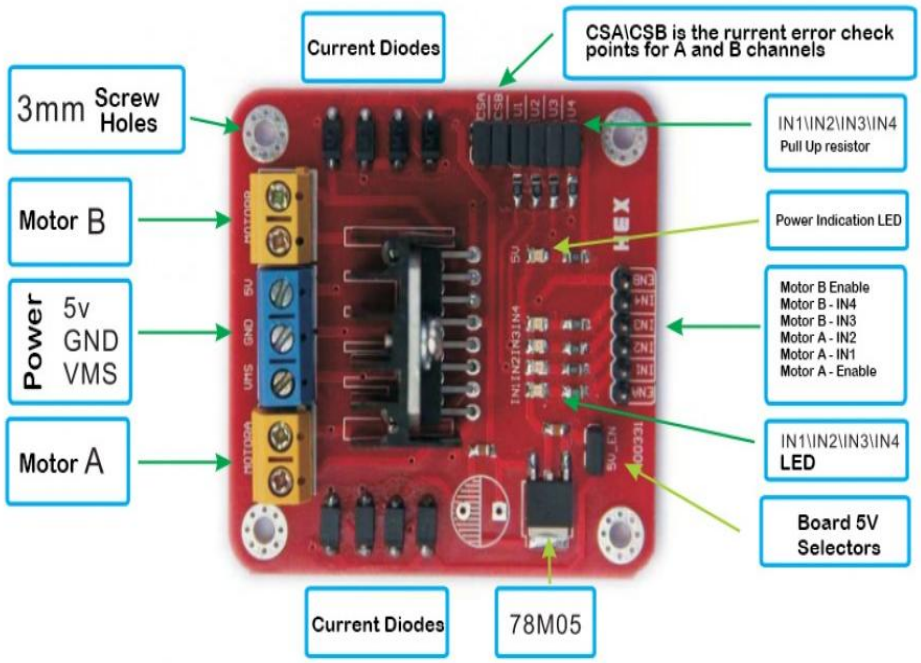

Fig .2. Motor driver l293d

As well, this IC can drive small and quiet big motors. L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC). [4]./

flame sensors : A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces[5].

Servo motor : Servos are DC motors with a potentiometer connected to the motor shaft. This potentiometer tells the servo driver in which position the shaft is. This way you can turn this shaft very accurate, but only

for a limited angle. Most common servo's can only turn for about 180 degrees. In lots of projects (RC cars, model planes etc.) only 90 degrees is used. As shown in fig.3. A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit.

Fig.3. servo motor

First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes[5].

Photo diode : A photodiode is one type of light detector, used to convert the light into current or voltage based on the mode of operation of the device. It comprises of optical filters, built-in lenses and also surface areas. These diodes have a slow response time when the surface area of the photodiode increases. Photodiodes are alike to regular semiconductor diodes, but that they may be either visible to let light reach the delicate part of the device. Several diodes intended for use exactly as a photodiode will also use a PIN junction somewhat than the usual PN junction[6].

Battery : here battery is used to power up all the connected equipments and sensors

Motors : Motors are one of the primary mechanisms by which robots move. Some motors can be attached to wheels that drive a robot around. Other motors might cause joints in a robot limb to move. Yet others might move the control surfaces of a robotic airplane or submarine. A robot might have many different kinds of effectors to perform specific tasks, but many of these effectors are being moved around by motors[6].

Fire extinguisher: here fire extinguisher is used to stop the fire

Picture of fire accident fighting robot

The fire accident fighting robot is shown in below fig.4.

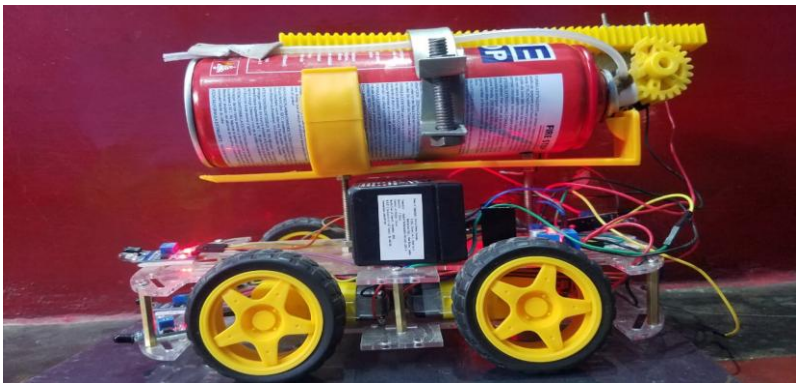

Fig.4. fire accident fighting robot

Working

The Fire Accident Fighting Robot consists of three Flame Sensors (Left, Right And Centre Flame Sensors), two Photo Diodes, Motor Driver, Battery 12V, ARDUINO UNO, Robot Chassis, Servo Motors, four DC Motors (150 rpm), Gear Motor (30 rpm), Fire Extinguisher (CO2 Gas).

Firstly, if the fire takes place nearer to the Robot the flame sensor activates and then send Corresponding signal to the digital pins of the ARDUINO UNO board. After receiving the signal from the ARDUINO UNO the Motor Driver changes its direction or movement. The movement of the Robot's direction is depends upon the activation of sensors

Case (i): When Left Sensor Is Activated

In this case the robot has to move left side in order to face the fire, this movement can be done by rotating the left wheels of the robot in backward and the right wheels of the robot forward so that the robot can go near to the firer place to stop the fire

Case (ii): When Right Sensor Is Activated

In this case the robot has to move right side in order to face the fire, this movement can be done by rotating the left wheels of the robot in forward and the right wheels of the robot backward so that the robot can go near to the firer place to stop the fire

Case (iii): When Centre Sensor Is Activated

In this case the robot has to move forward in order to face the fire, this movement can be done by rotating the left wheels of the robot in forward and the right wheels of the robot forward so that the robot can go near to the firer place to stop the fire

Case (iv): When Left And Right Sensor Is Activated

In this case the robot has to move forward in order to face the fire, this movement can be done by rotating the left wheels of the robot in forward and the right wheels of the robot forward so that the robot can go near to the firer place to stop the fire

Case (v): When Left And Centre Sensor Is Activated

In this case the robot has to move left side for 500 ms then it has to move forward in order to face the fire, this movement can be done by rotating the left wheels of the robot in backward and the right wheels of the robot forward. After a delay of 500 ms the left and right wheels of the Robot should be in forward direction so that the robot can go near to the firer place to stop the fire

Case (vi): When Right And Centre Sensor Is Activated

In this case the robot has to move right side for 500 ms then it has to move forward in order to face the fire, this movement can be done by rotating the left wheels of the robot in forward and the right wheels of the robot backward. After a delay of 500 ms the left and right wheels of the Robot should be in forward direction so that the robot can go near to the firer place to stop the fire

Case (vii): When the entire Sensor Is Activated

In this case the robot has to move forward in order to face the fire, this movement can be done by rotating the left wheels of the robot in forward and the right wheels of the robot forward so that the robot can go near to the firer place to stop the fire

Conclusion/Future Work

This paper gives a detailed mechanism about the real time industrial fire accident fighting robot that can move according to position of fire which is sensed by flame sensors, find a candle and then extinguish it with the help of CO2 Gas. The movement of the robot is controlled by the sensors which are fixed on the chassis of robot Experimental results are carried out for a four wheel robot to illustrate the proposed methodology. The results show that the proposed robot model is successfully implemented.[7]

Advantages

1. Human control required is less
2. Maintenance cost is less
3. Easily repairable
4. Protection of property from loss
5. Not sensitive to weather conditions
6. Simple in construction
7. No remote control weather conditions[8].

Applications

1. Commercial areas such as shopping malls, restaurants, hospitals, public areas
2. Industrial areas
3. Cotton mills
4. Parking areas
5. Crackers manufacturing industries[9].

References

[1]. Anthony M., Ivan O. and Randy S. (2001), EE 382–Junior Design Fire fighting Robot Project, pp. 1-48.
[2]. Chien T. L., Guo H., Su K. L. and Shiau S. V. (2007), Develop a multiple Interface based fire fighting robot, IEEE International Conference on Mechatronics, pp. 1-6
[3]. Kumbhare M., Kumbhalkar S. S. and Malik R. (2012), Fire fighting robot: an Approach, Indian Streams Research Journal, pp. 1-4
[4]. Kumar P. S., Ratheesh B. R., Gobinath B., Kumaran K. M., Venkataraman S., Gesture Controlled Fire Extinguisher Robot with Audio and Video Capture, Journal of Electronics and Communication Engineering, pp. 1-5.
[5]. Tan C. F., Liew S. M., Alkahari M. R., Ranjit S. S. S., Said M. R., Chen W., Rauterberg G. W. M., Sivakumar D. and Sivarao (2013), Fire Fighting Mobile Robot: State of the Art and Recent Development, Australian Journal of Basic and Applied Sciences, 7, 220-230.
[6]. Sahulhameed K., Raj W. N. D., Samsudeen S., Noorulhak K. and Nagamani G. S. (2013), Artificial Eye and Sensory based an Intelligent Robot for Fire Extinguishment Task, International Journal on Advanced Computer Theory and Engineering, 2, pp. 101-105.
[7]. Chattunyakit S., Kondo T. and Nilkhamhang I. (2013), Development of Robotic Platform for Swarm Robots in Fire Detection Application, Kasetsart Journal Natural Science, 47, pp. 967-976.
[8]. www.wikipedia.com
[9]. www.atmel.com