

FIRE FIGHTER ROBOT USING ARDUINO

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Abstract—Fire accidents are considered as one of the most dangerous form of accidents. It can cause loss of life, permanent disabilities (like permanent blindness, loss of body parts and major physical damages), property damage etc. Here when such incidents occur the first person we call upon for rescue is Fire Fighters. Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing fire, especially in hazardous environments such as in nuclear power plant, petroleum refineries and gas tanks. They are also faced with other difficulties, particularly if fire occurs in narrow and restricted places, as it is necessary to explore the ruins of buildings and obstacles to extinguish the fire and save the victim. With high barriers and risks in fire extinguisher operations, technological innovations can be utilized to assist firefighting. Therefore, this paper presents the development of a FIRE FIGHTER ROBOT that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger. FIRE FIGHTER ROBOT is designed to be compact in size than other conventional fire-fighting robot in order to ease small location entry for deeper reach of extinguishing fire. This robot is also equipped with an ultrasonic sensor to avoid it from hitting any obstacle and surrounding objects, while a flame sensor is attached for fire detection. This resulted in robot ease the capabilities of identifying fire locations automatically and ability to extinguish fire remotely at particular distance. Robot is programmed to find the fire location and stop at maximum distance of 40 cm from the fire.

Keywords — Fire accidents, fire fighters, hazardous, extinguisher

I. INTRODUCTION

The project that is being presented is focused on a firefighting robot. Robots are capable of performing tasks in a more

efficient, cost-effective, and accurate manner than humans. It has grown in popularity as technology has advanced, making human work simpler. The firefighting robot is programmed to scan for and extinguish fires in affected areas. A wireless robot can conduct successful work, allowing the robot to be operated from a distance .

The act of sprinkling water on a fire is known as firefighting. The robotic vehicle is equipped with water tanks and a pump. As a result of a fire outbreak (or) fire explosion, we are demanding that we use human resources that are not secure to put out the fire. It is very much possible to replace human work in putting out a fire in a dangerous environment by using higher technology, specifically robotics. This strategy would free firefighters from dangerous tasks, increase their efficiency, and reduce the number of fires.

II. MODELING AND DESIGN

The proposed model of Fire Fighter robot system uses the following components

- ARDUINO UNO
- IR/FLAME SENSORS
- ULTRASONIC SENSOR
- DC BO MOTORMOTOR DRIVERS
- SERVO MOTOR
- WATER PUMP
- RELAY
- ROBOTIC CHASSIS
- SWITCH

A. Ultrasonic sensors



Ultrasonic sensors are used primarily as proximity sensors. They are used in robotics for obstacle detection. ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent range accuracy and stable readings in an easy-to-use package. Its operation is not affected by sunlight or black material like Sharp rangefinders. Similar in performance to the SRF005 but with the low-price of a Sharp infrared sensor. This sensor is a high performance ultrasonic range finder. It is compact and measures an amazingly wide range from 2cm to 4m. This ranger is a perfect for any robotic application, or any other projects requiring accurate ranging information.

Features of HC-SR04 Ultrasonic sensor module:

- Working Voltage :DC 5V
- Working Current: 15mA
- Working Frequency: 40Hz
- Max Range: 4m
- Min Range: 2cm
- Measuring Angle: 15 degree

B. DC BO Motor



Fig.shows the BO motor. BO Motor is a dual shaft motor having 300 rpm .It converts electrical energy into mechanical energy .It is the replacement to our metal gear DC motors .Our robot uses four dual shaft motors. BO motor (Battery Operated) lightweight DC geared motor which gives good torque and rpm at lower voltages. Here you can get BO motor with

varying rated speed. This motor can run at approximately 200 rpm when driven by a single Li-Ion cell.

C. Water Pump



The water pump is operated at 5v which can be interfaced with Arduino. Water Pump is ideal for making automatic watering system using Arduino. The water pump is an important part of the robot as it will pump water to extinguish the fire.

D. Servo motor



A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision.It has a limited rotation, typically 180°. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism.

E. Arduino uno



Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6

can be used as PWM outputs), 6 Analog inputs, a 16 MHz quartz crystal, a USB FIG : ARDUINO connection, a power jack, an ICSP header and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE).

F. Flame sensor



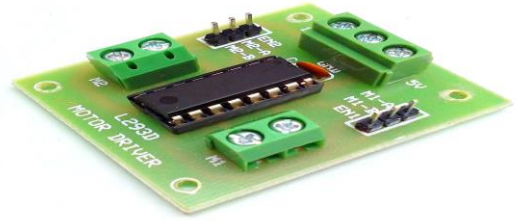
A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

G. Robotic chassis



4-Wheel Robot Chassis Kit, an easy to assemble and use robot chassis platform. The Chassis kit provides you with everything you need to give your robot a fast four wheel drive platform with plenty of room for expansion to add various sensors and controllers.

H. DC Motor Driver



DC Motor driver converts an Alternating Current (AC) into Direct Current (DC) to run a DC motor. Higher motor speed generates more voltage in the tachometer and the drive references this voltage to make sure the motor is running at the correct speed per-user settings. This is used mainly for good speed regulation.

I. Relay



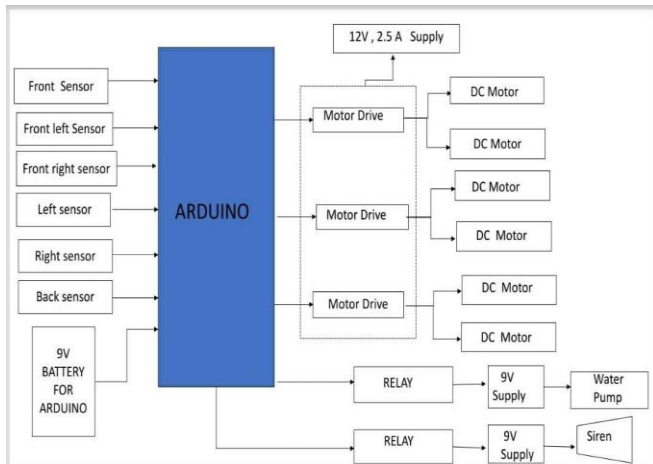
A Relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

J. Switch



a switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another.

III. BLOCK DIAGRAM



IV. METHODOLOGY

Initially we need to make sure all the components are connected and give power supply through an external device. The robot remains idle initially, later it starts rotating in 360 degrees to detect the presence of object with the help of sensor. If the object is not within the range it moves ahead and then again checks the presence of object within the range. The signal is sensed to the one of the channel flame sensor and then robot moves if it signals to center sensor so that we can move to the object accurately. After detecting the flame it moves to certain distance and again checks the range of distance until it moves near the flame object. After it reaches it then in turn activates water pump to sprinkle the water on fire object.

V. EXPERIMENTAL RESULTS

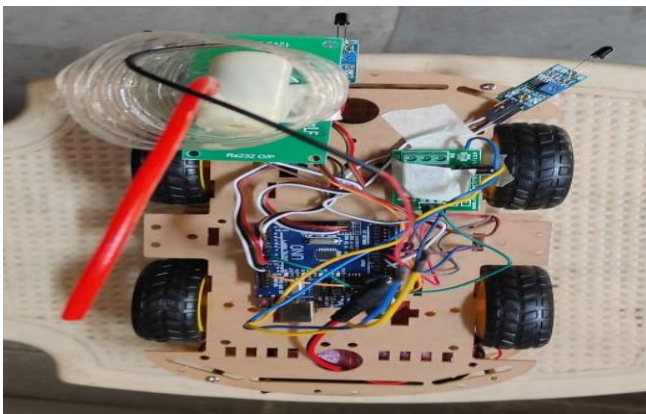


Fig . Fire Fighter Robot top view

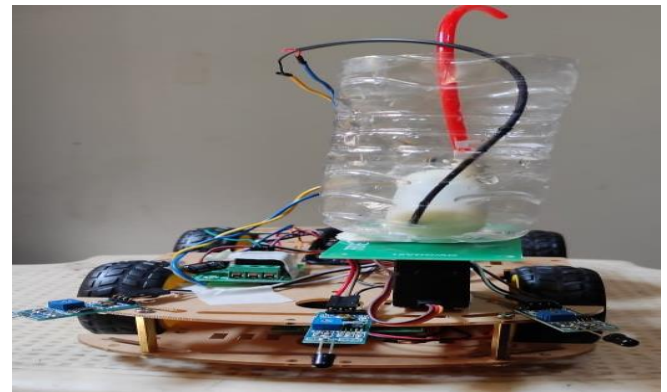


Fig. Fire fighter robot side view

Fire fighter robot has been developed to find the location of fire. it has a ability to find the location by using flame sensor & ultrasonic sensor . When flame sensor find the fire , the DC motor will stop from the fire . Finally, the robot extinguishes the fire with the help of water pump and servo motors.

VI. APPLICATIONS

- Robotic firefighting systems are designed with certain tasks in mind.
- These include analyzing and locating fires.
- conducting search and rescue operation.
- monitoring hazardous variables and the primary task of fire control and suppression.
- Fire fighter robot can be used in the Area where a human can't go.
- Fire fighter robot can be used at big kitchen
- Fire fighter robot can be used it School's, College's, Cooperative office, Buildings etc

VII. ADVANTAGES

- Prevention from dangerous incidents. □
- Minimization of ecological consequences financial loss can be prevented.
- a threat to a human life can be minimized.
- No supervision is required to control robot

VIII. DISADVANTAGES

- It is applicable only for shorter distance.
- Time is taken to reach the fire prone area.
- Have to refill the water tanks.
- It cannot extinguish larger fire instead can stop it from spreading

IX. FEATURE SCOPE

The project has been motivated by the desire to design a system that can detect fires and take appropriate action, without any human intervention. Fire-fighting is an obvious candidate for such automation. Given the number of lives lost

regularly in fire- fighting, the system we envision is crying for adoption. Our experience suggests that designing a fire-fighting system with sensors and robots is within the reach of the current sensor network technology.

X. Conclusion

implemented an automatic Fire Fighting Robot using Arduino and sensors. Fire causes tremendous damage and loss of human life and property. It is sometimes impossible for the fire fighter personnel to access the sight of fire because of explosive materials, smoke and high temperature. Through this we can conclude that robot can be placed where human lives are at risk. The robot can operate in the environment which is out of human reach in very short time. In such environments, Fire Fighting robots can be useful for extinguishing fire. The robot accurately and efficiently finds the fire within minimum time after the fire is detected. This project presents the design and the implementation of a fire fighting robot that moves towards the fire and pump out water to extinguish the fire.

[7] J Jalani¹ , D Misman¹ , A S Sadun¹ and L C Hong¹, "Automatic fire fighting robot with notification", IOP Conference Series: Materials Science and Engineering, Volume 637, The 3rd International Conference on Robotics and Mechantronics (ICRoM 2019) 9–11 August 2019, Sabah, Malaysia

XI. REFERENCES

- [1] Tawfiqur Rakib, M. A. Rashid Sarkar, "Design and fabrication of an autonomous firefighting robot with multi sensor fire detection using PID controller", ICIEV Volumn 23 issue-1 JUNE 2016.
- [2] Saravanan P. ,Soni Ishawarya, "Android controlled intergrated semi-autonomous firefighting robot", Ineternational journal of innovative science Engg. and Technology 2015.
- [3] S. Jakthi Priyanka,R. Sangeetha, "Android controlled firefighting robot",Ineternational journal of innovative science Engg. and Technology ,Volumn 3, 2017.
- [4] Nagesh MS, Deepika T V , Stafford Michahial, Dr M Shivakumar, "Fire Extinguishing Robot", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, Issue 12, December 2016.
- [5] Sushrut Khajuria, Rakesh Johar, Varenym Sharma, Abhideep Bhatti, " Arduino Based Fire Fighter Robot", International Journal of Scientific Engineering and Research (IJSER), Volume 5 Issue 5, May 2017
- [6] Khaled Sailan, Prof. Dr. Ing. Klaus- Dieter Kuhnert "Obstacle avoidance stratergy using fuzzy logic steering control of amphibious autonomous vehicle", International journal of innovative science Engg. and Technology ,Volumn 2, 2015