FIRE FIGHTING ROBOT

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FIRE FIGHTING ROBOT

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ABSTRACT

Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale fire industries resulting in quite serious consequences. Thousands of people have lost their lives in such mishaps. Therefore, this project is enhanced to control fire through a robotic vehicle. With the advancement in the field of Robotics, human intervention is becoming less every day and robots are used widely for purpose of safety. In our day to day life fire accidents are very common and sometimes it becomes very difficult for fireman to save human life. In such case firefighting robot comes in picture.

Keywords: Firefighting Robot; IR Distance sensor; Flame sensor; OV7670 Camera Module; Arduino mega2560; DC motor; Driver module

I. INTRODUCTION

Fires are among the most important form of problems. Robot industry has a lot of work in this area. So today robot is more commonly used to reduce the

human efforts. The need of Fire extinguisher Robot that can detect and extinguish a fire on its own. Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work and also to act in inaccessible environment. With the invention of such a device, lives and property can be saved with minimal damage caused by the fire. As an engineer's we have to design a prototype that could autonomously detect the fire and extinguish it. The Fire Fighter Robot is designed to search for a fire in the house or industry for extinguish the fire.

The main and only work is to deploy the robot in a fire prone area and the robot will automatically work once it detects a fire breakout. This prototype helps in Rescue operations during fire accidents where the entry of service man is very difficult in the fire prone area. There are several existing types of vehicles for firefighting at home and extinguish forest fires. Our proposed robot is designed to be able to work on its own or be controlled remotely. By using such robots, fire identification and rescue activities can be done with higher security without placing fire fighters at high risk and dangerous conditions. In other words, robots can reduce the need for fire fighters to get into dangerous situations.

When we the field of firefighting has long been a dangerous one, and there have been numerous and devastating losses because of a lack in technological advancement. Additionally, the current methods applied in firefighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained. A recent trend that has become popular is to use robots instead of humans to handle fire hazards. This is mainly because they can be used in situations that are too dangerous for any individual to involve themselves in. In our project, we develop a robot that is able to locate and extinguish fire in a given environment. The robot navigates the area and avoids any obstacles it faces in its excursion. Arduino board acts as a brain of the whole control circuitry .Robot consist of the two sensors that are interfaced in the control circuitry. Sensors are used to detect fire prone area all directions and moves the robo to fire location. When the robot reaches fire zone then a pump extinguisher is attached on the robot comes into action to extinguish the fire.

II. LITERATURE SURVEY

[1] Development of Fire Fighting Robot (QRob)

Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. 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. Therefore, this paper presents the development of a firefighting robot dubbed QRob that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger. QRob 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 in narrow space. QRob 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 QRob demonstrating capabilities of identifying fire locations automatically and ability to extinguish fire remotely at particular distance. QRob is programmed to find the fire location and stop at maximum distance of 40 cm from the fire. A human operator can monitor the robot by using camera which connects to a smartphone or remote devices.

https://thesai.org/Downloads/Volume10No1/Paper_18Development_of_Fire_Fighting_Robot.pdf

[2] A Survey on Fire Fighting Robot Controlled Using Android Application

Detecting fire and extinguishing it is a dangerous job that puts life of a fire fighter at risk. There are many fire accidents which fire fighter had to lose their lives in the line of duty each year throughout the world. The research and development in the field of Artificial Intelligence has given rise to Robotics. Robots are implemented in various areas like Industries, Manufacturing and Medicines etc.

Hence, Robotics can be used to assist fire fighters to perform this task of firefighting and thus reduce the risk of their lives. Fire Fighter is a robot designed to use in such extreme conditions. It can be operated and controlled by remote user and has the ability to extinguish fire after locating the source of fire. It is equipped with a monitoring system and operates through a wireless communication system. The fire detection system is designed using the sensors mounted on the fire fighter robot. The robot is controlled autonomously using Android application. Android mobile phone platform developed by Google has gained popularity among software developers due to its powerful capabilities and open platform. Therefore, Android is a great platform to control a Robotic system. Android provides many resources and already integrates lot of sensors. This concept helps to generate interest as well as innovation in field of robotics while working towards a practical and obtainable solution to save lives and mitigate the risk of property damage.

http://www.ijirset.com/upload/2015/november/51_7_A_Survey.pdf

III. EXISTING SYSTEM

The common conventional firefighting methods involve fire brigades, portable fire extinguisher (hand held) and sprinklers. These conventional methods consume lot of time to reach the place of the mishap like the fire brigade must be deployed from the fire station and should get through the traffic and reach the fire struck area, the portable extinguisher is also no gift because it is generally place at one off the corners of the building which may be difficult to reach and it needs constant maintenance. On the other hand the sprinkler and smoke detector set up is very non reliable method because the sprinkler pipes has any defect may not provide enough pressure and it is suited to cover large areas.

PROBLEMS IN EXISTING SYSTEM:

The problem with existing system is that exposure to the hazardous and chaotic fire environment, rather than to the fire itself, is the most significant cause of injury and death in fires. The reachability of precise information in real-time on

the conditions directly at the center of the fire ground is a crucial factor in the guidance of rescue actions together with feasible counter-plans. Unfortunately the firefighting environments are normally hard to reach and restricted in accessibility by obstacles, tumbledown architectures and visibility by smoke, dangerous gases or dust. Therefore, the fire scene is an information-poor environment due to lack of information on location of fire, firefighters and victims, and the search and rescue opportunities are previously unimaginable due to lack of situational conditions and real-time information for targeted decision making.to this the accidents occurs. Additionally, the current methods applied in firefighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained.

IV. PROPOSED SYSTEM

The proposed model is able to detect presence of fire using flame sensor and calculates object distance using ultrasonic sensor and moves the robot to fire accident location. It contains gear motors and motor driver to control the movement of robot. When it detects fire it communicates with microcontroller (Arduino MEGA) and the robo will move towards the fire affected area. The fire extinguisher is mounted on the robotic vehicle which is then controlled over the wireless communication so that it extinguishes the fire automatically.

ADVANTAGES OF PROPOSED SYSTEM

- The robot will be used at places where it is dangerous for humans to enter.
- Capability of sensing accurately with increased flexibility.
- Reduce human effort.
- Reliable and economical.
- It reduces the time delay in reaching fire affected area.
- It reduce the errors and the limitations that are faced by human fire fighters.
- Sensors have long life time and less cost.

V. 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 flame 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 5 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 fire extinguisher or water pump to sprinkle the water on fire object.

A. DESIGN

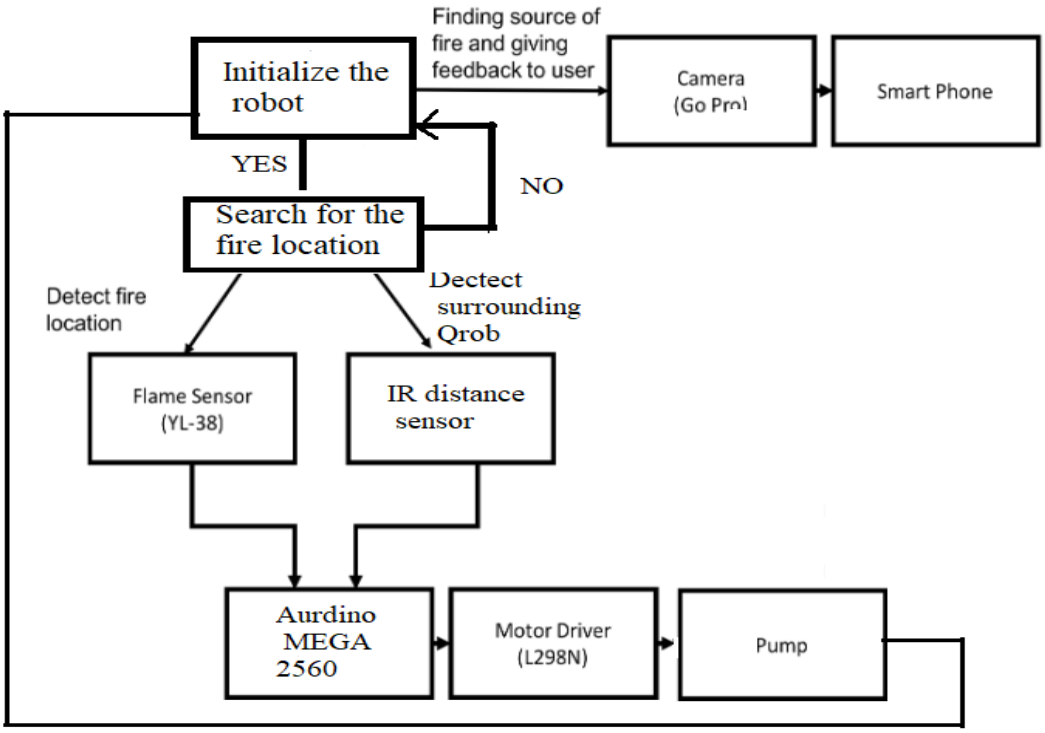

Fig 1: Block Diagram

B. HARDWARE IMPLEMENTATION

This robo consists of several types of sensor and the vital part of this robo is arduino mega2560 which controls all other components. Fig1 shows that arduino is used as a microcontroller connected with other components. Motor Driver is used to activate the moving of the DC motor. It also consists of flame sensor and IR distance sensor as input of the system. Fire extinguisher is mounted on robot to reduce fire.

1) *Flame Sensor:* This sensor is mainly designed for detecting as well as responding to the occurrence of a fire or flame. It detects the fire with 5 flame sensors which are arranged with 30 degrees. Detection range is 700-1100nm. Detection angle is 600.

2) *Temperature sensor:* LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. Minimum and Maximum Input Voltage is 35V and -2V respectively. Typically 5V.

3) *IR Distance Sensor:* This sensor provides accurate distance measurements within the 10-80cm (4-32") range. Infrared proximity sensors work by detecting the reflection of an invisible infrared light. It is a sharp GP2Y0A21 IR Infrared Distance Sensor is an analog proximity sensor with a range of 10-80cm. Operating voltage: 4.5 V to 5.5 V. Distance measuring range: 4 to 30 cm.

4) *DC Motor:* A DC Motor is a type of electric motor that converts DC electrical power to mechanical power i.e. a DC supply is converted to rotation or movement. Although motor gives 500 RPM at 12V, motor runs smoothly from 4V to 12V and gives the wide range of RPM, and torque.

5) *Driver Module:* Motor drive module comes with its own four HG7881 chip. Can drive 4 DC motors, or two 4-wire 2-phase stepping motor. Suitable for the motor range: motor operating voltage 2.5V-12V.

6) *OV7670 Camera Module:* It is a FIFO camera Module available from different Manufacturers with different pin Configurations. TheOV7670 provides full frame, windowed 8-bit images in a wide range of formats. The image array is capable of operating at up to 30 frames per second (fps) in VGA. The OV7670 camera module is a low cost 0.3 mega pixel CMOS color camera module, it can output 640x480 VGA resolution image at 30fps.

C. FLOWCHART WORKING

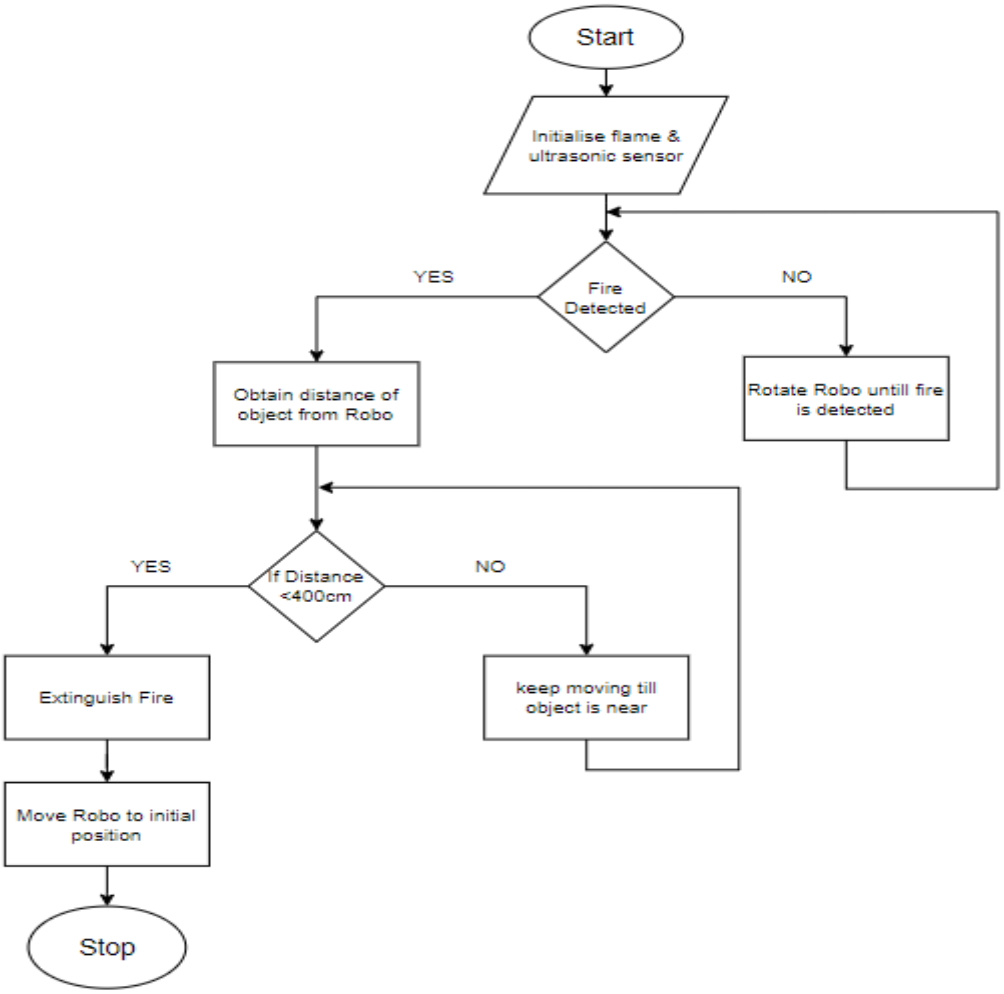

Fig 2: Flowchart of Robot

VI. EXPERIMENTAL RESULTS

- ***Initialization Of Robot***

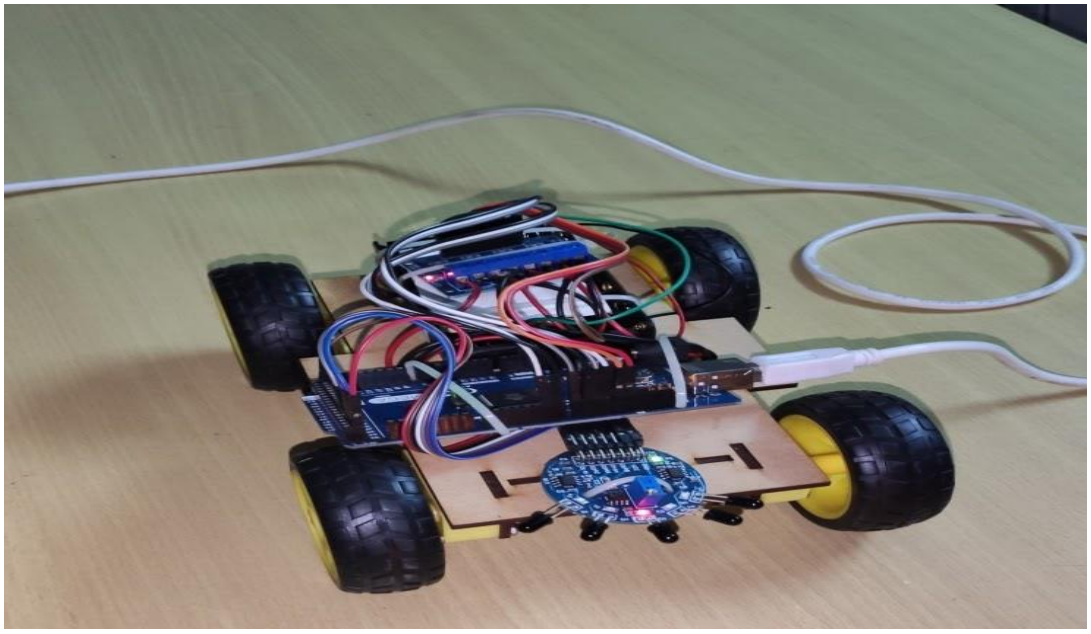

Fig 3: Initialization

- ***Detection of fire by robot***

Fig 4: Fire Detection

- ***Movement of robot towards fire detected object***

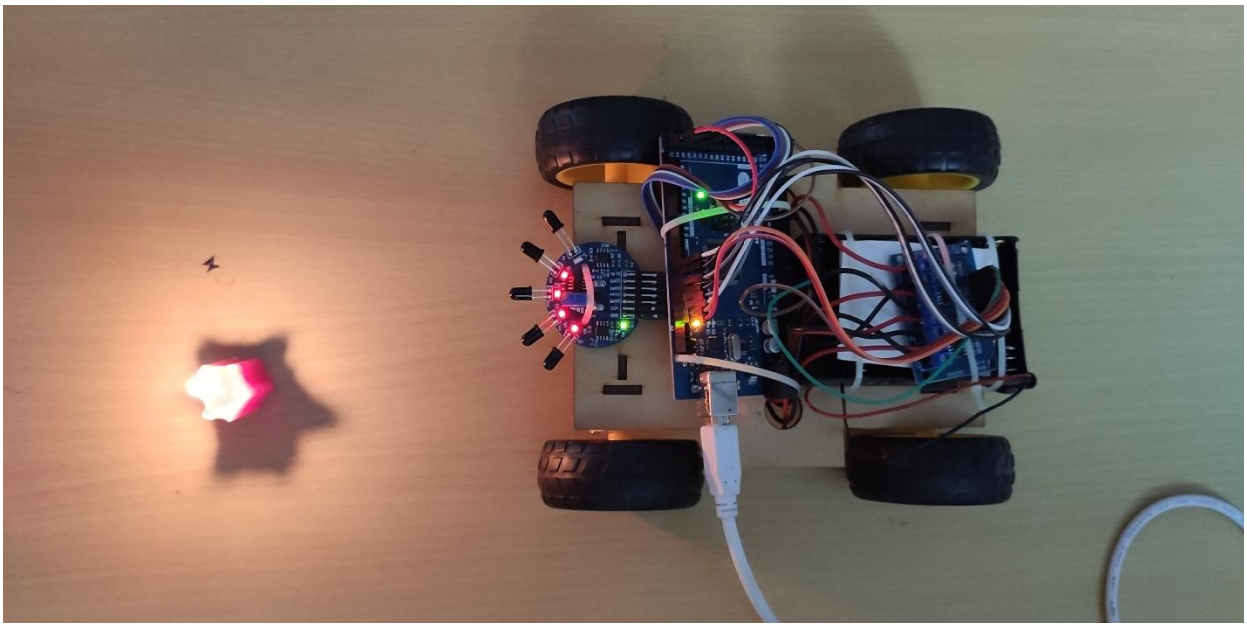

Fig 5: Robot moves near to object

VII. CONCLUSION

This project describes about the real time firefighting robot which moves in a constant speed, identify the fire and then extinguish it with the help of pumping mechanism. It has advantageous features such as ability to detect location of fire automatically besides having a compact body and lightweight structure. The robot can be used at a place that has a small entrance or in small spaces because it has a compact structure. The system can potentially be useful to accompany fire fighters and prevent an outbreak. The operator is able to extinguish fire using remote control from longer distance. Operators can also monitor the environmental conditions during the process of firefighting by using the camera. From the experimental results, the robot can sense smokes and fire accurately in a short time.

VIII. FUTURE ENHANCEMENT

- Some of interfacing applications which can be made are controlling home appliances, robotics movements, Speech Assisted technologies etc.
- By making it GPS enabled, robot can be controlled from remote station also.
- A CO2 booster can be attached to make it powerful extinguisher.
- It can be further expanded with voice interactive system facility.

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