

IoT Based Fire Exterminating Robot

R. A. Kalpana, S.Meera, R.Deepika, B. U. Roobini

Abstract Fire accidents occur often which endanger the environment and the human lives. The life of the fire fighters is always at a risk. The intention of achieving in this paper is to show the look and function of a robot which acts as a fire extinguisher. The robot is sent to the fire prone place and it puts off the fire which replaces the human work of manually extinguishing the fire. Even though the robot is small in size, it performs versatile activities of searching towards the fire using different sensors, capturing the images and sending live updates to the remote user through IoT and exterminating the fire. In addition, the proposed robot also avoids the obstacle when moving forward in search of fire in the automatic mode and sends an alert message to the remote user who then controls the robot through the web page manually based on the live streaming of the place the ip web camera attached to the robot until the fire has been detected.

General Terms Flame sensor, Ultrasonic sensor, water sprinkler, web camera, Raspberry Pi.

Keywords Internet of Things (IoT), Fire detection, Obstacle Avoidance, live streaming, email alert..

I. INTRODUCTION

In embedded systems the current worldwide trend is ubiquitous computing. It enables communication between everyday objects by embedding microcontrollers in everyday objects to make our life simpler. Devices like smart phones and wearables keep us reachable, interactable and updated to the everyday events happening around the world. It has termed that machines are used to assist people or work that humans which find difficult. They are capable of performing repetitive tasks more quickly, cheaply and accurately than humans. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space). Our motive is to design a robot which acts as an exterminator in fire places thereby avoiding human effort in such places to exterminate the fire. In addition, it also detects the obstacle using ultrasonic sensor and sends email alert.



Fig No. 1a Ultrasonic Sensor

There are 4 pins: GND, VCC, Trigger and Echo. Trigger and Echo are connected to the ESP8266 GPIO pins 12 and 13 respectively.

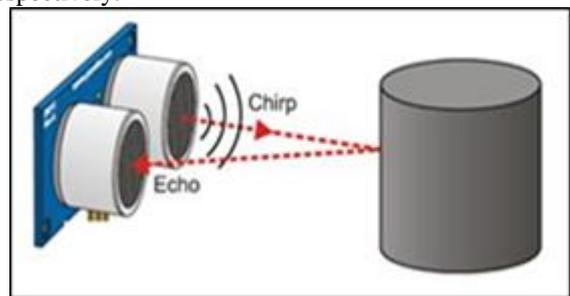


Fig No.1b obstacle detection using ultrasonic sensor

1.1 Problem Statement

To develop the robot which is able to put off the fire and also avoid obstacle which replaces the human effort to a great extent.



Fig No. 1c Flame Sensor

II. LITERATURE SURVEY

In olden days, there is no automatic extinguishing of fire. The fire brigade should be called to the fire prone area which is operated by human whose lives are at greater risk. It takes time to arrive at the fire place and mostly water is used to put off fire. Later with the evolution of technology, fire extinguishers came into existence which is filled with CO₂ limitedly. In recent years around 2016, manually controlled fire extinguishing robot came into existence which is followed by pre trained robot for particular

Revised Manuscript Received on 16 October, 2019.

R. A. Kalpana, Department of Computer Science and Engineering, Chennai, Tamilnadu, India.

S.Meera, Department of Computer Science and Engineering, Chennai, Tamilnadu, India.

R.Deepika, Department of Computer Science and Engineering, Chennai, Tamilnadu, India.

B. U. Roobini, Software Engineer, Prodapt Chennai, Tamilnadu, India.

environment like smart homes fire detection and avoidance. It also send alert to the user through Bluetooth which is capable for communication over some metres. The proposed robot uses iot for streaming live pictures of the fire prone area and puts off all types of fire by fitting it with the corresponding fire extinguishing substances depending on the fire prone area.

[1] A fire extinguisher robot designed with the look and function of a robot assembled with the intention to extinguish the fire by using a water pump as actuators. The movement of the fire extinguisher robot is controlled using Android smart phones via WiFi networks utilizing WiFi module contained in the robot. User commands are sent to the microcontroller on the robot and then translated into robotic movement. The robot was equipped with cameras and ultrasonic sensors. The camera played role in giving feedback to user and in finding the source of fire. Feedback provided by camera on the robot is displayed on a screen of the smart phone.

[2] The requirement of this proposed work is to create a robot that could fully governing itself. When the robot is kicked off by the user, the robot could maneuver itself, poke into, and quench the fire on its own without any backing. The designed robot indicates the fire through alarm. It is preprogrammed with the environment. The robot can only be used in a pre trained area like home, and not for general purpose

[3] The robot has multiple modes of operation; the first mode of operation is to regulate the movement wirelessly using a Bluetooth module interfaced with arduino Uno, paired with a smart phone application. The second mode of operation is consummated by linking the interfacing IR sensors with arduino for obstacle detection and temperature sensing using temperature sensing LM35 IC. The quenching mechanism used in the different modes of operation is a water pump. The robot proposed is trained to do the functionality of the fire brigade. The main disadvantage is using Bluetooth for communication which is restricted to a maximum of 400 metres.

[4] The goal of the proposed work is achieved by training the robot as a fire fighter with remote operation. The robot has a water tanker unit and a pump unit. Both the units are self – restrained by wireless communication along with a PIC microcontroller, the flames of the fire are quenched by spraying the water. The transmitter end, send commands to the receiver using push buttons which helps in the robotic movement in all the directions. The remote control that has the range of up to 100 metres with apposite antenna ,the decoder decode in prior feeding it to another microcontroller to drive DC motors via motor driver IC to make the robot in fire fighting.

[5] The primary stipulation of the robot is to perform the obstacle detection. The robot wangles information from the circumambient area buttoned up with sensors on the robot. Sensing devices used for obstacle unmasking are ultrasonic sensor, bump sensor, infrared sensor etc. The Ultrasonic sensor is of low cost and its ranging capability is high. When the robot is in movement the ultrasonic sensor transmits the ultrasonic waves repeatedly from the sensor head. When the obstacle is in the path of the robot the ultrasonic waves are reflected back from the object and the

information is lingered and reached to the microcontroller. The motors are controlled based on the ultrasonic signals. The speed of the motors is regulated with pulse width modulation (PWM).

III. SYSTEM ARCHITECTURE

New Products could be promoted; new system could be developed with the aid of a system’s architecture.

The robot sends alert message when obstacle or fire is detected to the remote user through email who can then control the robot through the web page.

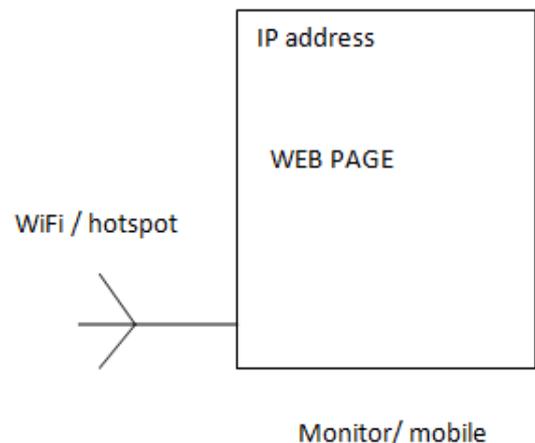
Entire system design consists of following major modules:

- (a) Hardware unit
- (b) Web page
- (c) Mobile Device or PC

Transmitter



Receiver

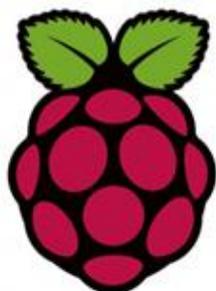


IV. EVALUATION OF SYSTEM& RESULTS

SYSTEM DESCRIPTION

The functionality modes of the proposed robot are automatic and manual mode. The robot ransacks for fire flames and obstacles in the vicinity in its automatic mode. The robot uses the flame sensors placed in the front for ransacking the fire. The fire sensors interfaced in the control circuitry realizes the fire intensity and proceeds accordingly in the fire prone zone and the robot will initiate action once

it detects a fire breakout. The control circuitry of the robot is built on Raspberry pi. When the obstacle is heading, the user will be prompted with an email alert. The user can then control the robot movement through the web page based on the live streaming of the fire place through the ip camera fixed in front of the robot which becomes the manual operation. Once the fire is detected, it is put off by using the water sprinkler attached with the robot.



4.1 Advantages

Completely replaces the human effort of putting of the fire. Enables live streaming of the fire place to the remote user. Sends an email alert once the obstacle is detected. The Robot performs well in manual and automatic mode.

4.2 Disadvantages

When the robot is superintended by means of web page the robot depends upon the network signal and its quality. The ultrasonic sensors are calibrated which is a deployment time overhead. Expensiveness of the system is also difficult to scale up.

4.3 Applications

The robot could be owned in any environment where humans cannot go and put off the fire. Also the live updates about the fire place are streamed to the user continuously.

V. CONCLUSIONS

Thus the robot is built to exterminate the fire in the fire prone areas using flame sensor and live streaming of the place is updated to the user through web page by using the web camera. In the vicinity, the ultrasonic sensor helps to notice the obstacle and sends alert mail to the user if any obstacle is found. The user can also control the robot through the web page and once the fire is detected, the water sprinkle is activated and the fire is exterminated. The proposed robot is tested for various environments to test the performance of the robot and the user also gets the

streaming updates as mentioned above through IoT web page.

SCREENSHOTS:

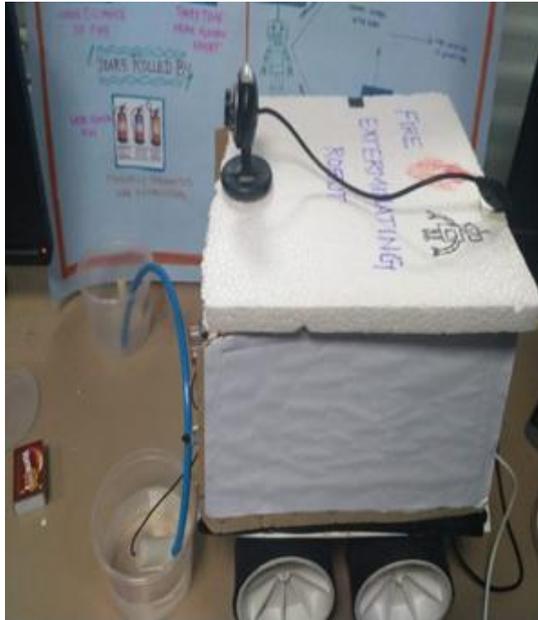
1. MANUAL CONTROL THROUGH WEB PAGE



Web page



Heading towards the fire



Fire extinguished

2. **AUTOMATIC MODE**



Obstacle detection



Obstacle avoided

VI. FUTURE ENHANCEMENTS

In future, the proposed idea can be extended by using various sprinklers to put off the fire automatically based on the type of fire occurred. It can also be enhanced to send alerts to the user or owner of the place about the reason for the fire accident based on the gas from the fire using gas detectors. By implementing the above mentioned ideas the system becomes fully automated and the user also is alerted by the robot about the fire place.

REFERENCES

1. https://www.researchgate.net/publication/241635505_Automatic_fire_extinguisher_robot
2. http://www.arresearchpublication.com/images/shortpdf/1484974622_K1067ijeee.pdf
3. http://www.ijirset.com/upload/2016/january/129_set_JAN%202016.pdf
4. <https://ieeexplore.ieee.org/document/7905275>
5. Periasamy JK, B.Latha.(2019) 'Efficient hash function based duplication detection algorithm for data Deduplication deduction and reduction. Concurrency Computat Pract Exper. <https://doi.org/10.1002/cpe.5213>
6. Periasamy JK, B. Latha (2019) 'An enhanced secure content de-duplication identification and perevention (ESCDIP) algorithm in cloud environment, Neural Comput & Applic.'. <https://doi.org/10.1007/s00521-019-04060-9>.
7. Periasamy J.K , B.Latha (2018), 'Secure and duplication detection in cloud using cryptographic hashing method' in International Journal of Engineering & Technology, VOL.7.pp.105-108.. DOI: 10.14419/ijet.v7i1.7.9585.