International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 1 Volume No.7 January - February – 2023
DOI:10.46647/ijetms.2023.v07i01.039 ISSN: 2581-4621

A Study on Robot Engineering based Fire Evacuation System

[1]Aishwarya A. (1DS20EC400), [1]Avantika P. (1DS20EC403),
[1]Indhudhara G.I. (1DS20EC411), [1]Kavya U. (1DS20EC416),
[2]Dr. Sindhu Sree M. [3]Dr. Pavithra G., [4]Dr. T.C.Manjunath,
[5]Aditya T.G., [6]Sandeep K.V., [7]Rajashekar M. Koyyeda
[8]Dr. Suhasini V.K., [9]Dr. Vijayakumar K.N.
[1]Third year (ECE) students, Dept. of Electronics & Communication Engg., Dayananda Sagar College of Engineering, Bangalore
[2]Assistant Professor, ECE Dept., Dayananda Sagar College of Engineering, Bangalore
[3]Associate Professor, ECE Dept., Dayananda Sagar College of Engineering, Bangalore
[4]Professor & HOD, ECE Dept., Dayananda Sagar College of Engineering, Bangalore
[4]Second year CSE Student, PES University, Bangalore
[6]Assistant Professor, Electronics & Telecommunication Engg. Dept., DSCE, Bangalore
[7]Assistant Professor, EEE Dept., Tatyasaheb Kore Inst. of Engg. & Tech., Kolhapur, Maharashtra
[8]Prof. & Head, Mechanical Engg. Dept., DJ Sanghvi College of Engg., Mumbai
[9]Principal & Prof., Dept. of MCA, Bharati Vidyapeeth's Inst. of Mgmt. & Info. Tech., Mumbai

Abstract
In this paper, we will read research papers on relevant issues to obtain information to help us create a system to rescue individuals who are caught in dangerous situations due to fire. This paper comprises the review of publications linked to fire evacuation and rescue robots. This robot is intended to rescue people trapped in a burning building and transport them to a safer area. Here, we'll path-plan the quickest route from the escapee's location to the exit and dispatch the robot to rescue and take them there. Human interruption has decreased as a result of mechanical technology advancements, and robots are now used for a variety of tasks as well as for the welfare of humans. The firefighters may utilise this firefighting robot in addition to them in emergency scenarios. A robot firefighter should be able to look about a given region, find the flame, and extinguish it. To complete these duties, the robot needs the proper controller. The work given here is a mini-project that is taken up as a part of the curriculum completed by electronics and communication engineering students in the second year of the electronics & communication engineering department at Dayananda Sagar College of Engineering in Bangalore.
Keywords : Fire, Robot, Extinguish, Put-off, Evacuation.

1. Introduction

Video processing that is cognitive is necessary for fire detection. Using multi-sensor fusion technology, path creating algorithms for static obstacles can be developed. Among a new breed of bionic intelligence algorithms are particle swarm algorithms.
Immune optimization and methods, like ant colony optimization, are evolving [1]. Intelligent fire-fighting robots are not particularly widespread due to a variety of problems. Due to the increasing urbanisation, several basement structures and petrochemical businesses are still being built. Sometimes, combating fires puts firefighters' lives in jeopardy [2]. Robots are mechanical devices that are frequently used for dangerous jobs like fighting fires. Robot's compass and ultrasonic sensors allow it to manoeuvre and navigate in a specific area. An algorithm's main job is to locate and extinguish a flame [3].
A wireless sensor placement system was created that integrates target facility information, real-time monitored fire alarms, alerts for disaster relief, and a database. This group also developed an analytical tool for path optimization to inform firefighters of appropriate rescue routes [4]. In locations and industries where there are a lot of dangerous substances, research is being done on novel

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ways to put out flames. Flying drones are one of the most innovative techniques being investigated to put out flames. This type of robot will be greatly sought after due to how useful they are [5].
Anand The ALPHA I (Fire Fighting Robot) was built by Mohan Misra (2008). It detects fire that is controlled by humans at a considerable distance using an RF module. Additionally, this robot has the ability to extinguish fire at an angle of 45 degrees on both the top and bottom [6]. A fire alarm and monitoring system created by S. Bhosale uses GSM to relay information to an uncontrolled station. A wireless firefighting robot has been developed by Swati Deshmukh et al. [7] that can detect and put out fires. In order to assist with both jobs without requiring human assistance, a robot that can both locate and extinguish flames is being created.
Due of its small size and autonomy, the robot can be used to put out fires in restricted spaces that are hazardous and difficult for people to access [8]. A total of 16,858 fire events were reported in 2016 across the country, resulting in 152 fatalities and a loss of 240 crore 43 lacs Taka. In our project, we developed a robot that can use a flame sensor to detect fire and pump water to a designated fire location [9]. The likelihood of major disasters can be considerably decreased through observation, which can also quickly put an end to an unusual event. Techniques for detecting flames at the blob level perform better than those at the pixel or patch level.

Fig. 1 : A fire fighting robot

In CCTV surveillance films, the initial stages of flame recognition using convolutional neural networks were studied [10]. Fire poses the biggest threat to a building's security. Modern building fire alarms are primarily focused on the fire alarm. The entire building's long-distance ZigBee-Wi-Fi fire information transmission system is designed in this study. The technology can keep track of the fire disasters' most frequently hit corners in real time [11]. High rise buildings present fewer fatalities than lowrise structures of the same type. A fire fighting robot is shown in the Fig. 1.
Analyzing how the facility is used is crucial for predicting tenant behaviour and developing an efficient fire safety design. Each variable needs to be investigated in order to provide precise advice regarding various aspects of the evacuation process [12]. In the UK, the Grenfell Tower fire in London caused more than 70 injuries in addition to 80 fatalities. The huge loss of life was believed to be caused in part by a delayed building evacuation. The incident commander might not have had the information essential to decide whether to alter the evacuation plan [13].
A wireless sensor network can tackle the primary issues with real-time detection, data transfer, and communication bandwidth. Thanks to sensors that detect humidity, temperature, and visibility, we will receive all weather information. Only the injured and buried can be saved quickly [14]. To

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develop intelligent behaviour, artificial intelligence (AI) is primarily used in video games. Pathfinding is a technique for helping a player who is being controlled by a computer to determine the shortest path between two spots. Dijkstra's algorithm has served as the foundation for the development of various pathfinding algorithms [15].

Methodology

The control box is located at the back of the car, above the body, and it has an antenna on it for signal reception. The walking mechanism is driven by a pair of driving wheels. Once mounted, the ultrasonic sensor receives this pulse at its I/O pin. PWM signals are sent using the "servo" to control the ultrasonic sensor. This robot uses five relays to control four of its moves, and an extra relay is used to turn on DC motors that spray water when a fire is detected [7]. After identifying the direction, the robot is forced to circle slowly so that the centre sensor may aim at the fire source [5].

Conclusion

In the event of a fire, the fire fighters can remotely control the fire robot to enter the fire scene, manage the robot's movement, and modify the fire arm's condition to quickly extinguish the fire. They do this by using the camera to view the environment and circumstances in which the firing arm operates. When engaging in potentially lethal operations, completing difficult tasks, or approaching accident scenes involving flammable and explosive risks in order to acquire information, process it, and provide feedback, a firefighting robot can step in for people. This robot's functionality is provided by a flame sensor, a gas sensor, an IR sensor, a temperature sensor, and a humidity sensor. The gas sensor detects the presence of combustible gases, the passive infrared sensor confirms the presence of people, and the temperature and humidity sensors send information about the environment's temperature and humidity levels. The flame sensor is used to simultaneously detect the fireplace.

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