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Fire Management System Using AI Technology

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Abstract: Firefighting is an important job but it is very dangerous occupation. Due to that, Robots are designed to find a fire, before it rages out of control. It could be used to work with fire fighters to reduce the risk of injury to victims. This paper presents the Fire Fighting Robot competition that purposely to simulate the real-world operation of an autonomous robot to rescue 10 victims and stop 5 fires in a house within three minutes. The robot development is consisting of three elements which is the hardware, electronic, and programming. The robot has three DC motor, two for driving system and another single DC motor for ball suction subsystem and the fire blowing subsystem. Various sensors are also interfaced with PIC16F877A the robot such as photoelectric sensors, fiber optic sensor and RGB color sensors. LCD display also gives the graphical information of the robot status to the user. For the programming part, C language is used.
Keywords: Artificial Intelligence, Sensors, Fire Fighting Robot, Arduino UNO.

I. INTRODUCTION

The Firefighting Robot is a compact and portable emergency responder robot that assists firemen in fighting high-rise fires, especially in highly dangerous environments where it is not safe for people to enter. Equipped with a thermal imager that is able to detect hot zones in a room autonomously without being impeded by smoke, the scenes captured by the robot's camera are transmitted live to the operator's control unit, allowing firefighters to assess the fire scene from a safe distance while remotely guiding the robot. With the flexibility to discharge foam from its 9-litre on-board foam solution tank or water through its water monitor, the Firefighting Robot can put out small yet potentially lethal fires in a confined space. Therefore, reducing risk exposure, alleviate cognitive loads and allow more bandwidth for firefighters during an emergency to conduct highly demanding tasks such as casualty rescue.

II. LITERATURE SURVEY

1) Firefighting robot Hasimi, Hamiruce Marhaban, Vaishvani FireFighting robot is 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 robot is controlled autonomously using Android application. Robot can transfer video to control room.

2) Fire Fighting Robot using sensors (Khandwala) RutujaJadkar, Rutuja wadeka , Shweta Khatade Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks such as in nuclear power plant, petroleum refineries and gas tanks. QRob is designed to be compact in size than other conventional fire- fighting robot in order to 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. 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.

3) Automation of fire fighting robot with help of Arduino Kiran, Keerthana Krishnan, Megha (IJECS) The proposed vehicle is able to detect presence of fire and extinguishing it automatically by using gas sensor and temperature sensor. Relay circuit is used to control the pump and when it will detect fire then it will communicate with microcontroller (Arduino UNO R3) through Bluetooth module. Communication between the mobile phone and robot will take place through Bluetooth, which will have communication between smartphones and microcontroller. Android controlled robot can be used easily in everyday life. The analysis is also useful to further give information to safety authorities regarding amount of poisonous gases inhaled over a time period by the occupants of the affected area so they can take appropriate actions to undo the harm.

4) J.Reinhart V. Khandwala (2003) was set all discussed about design and the implementation of the firefighting robot. The key design elements of the robot to be discussed include: the assembly and construction of the robot hardware, the processing algorithm based on the sensors response, and the navigation algorithm that will enable the robot to find an efficient path in and out of the house model.

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5) Sahil S.Shah (2013) was all discussed about design a FIRE FIGHTING ROBOT using embedded system. A robot capable of fighting a simulated household fire will be designed and built. It must be able to autonomously navigate through a modeled floor plan while actively scanning for a flame. The robot can even act as a path guider in normal case and as a fire extinguisher in emergency. Robots designed to find a fire, before it rages out of control, can one day work with fire-fighters greatly reducing the risk of injury to victims. The result shows that higher efficiency is indeed achieved using the embedded system.

6) U.Jyostna Sai Prasanna, M.V.D.Prasad (2013) design the fire detection system using four flame sensors in the firefighting robot, and program the fire detection and fighting procedure using sensor based method. The firefighting robot is equipped with four thermistors/flame sensors that continuously monitor the temperature. If the temperature increases beyond the predetermined threshold value, buzzer sounds to intimate the occurrence of fire accident and a warning message will be sent to the respective personnel in the industry and to nearby fire station with the GSM module provided to it Swati A.

7) Saravanan P (2015) discussed about the Design and Implementation of this project is mainly based on control of Semi - Autonomous mobile robot (SA-BOT). The system controls four DC Geared motors which is powered by the Atmega2560 and controlled autonomously by Navigation system which comprises of integrated ultrasonic and infrared sensors. The bot is outfitted with wireless camera which captures the video and transmits it to the base station. The fire detection system comprises of LDR and temperature sensor, if there is a fire, the sensors detects it and the bot will be moved to the source and starts extinguishing it. The Extinguishing System comprises of a BLDC motor with water container. The SABOT can also be operated manually for extreme conditions.

III. PROPOSED SYSTEM

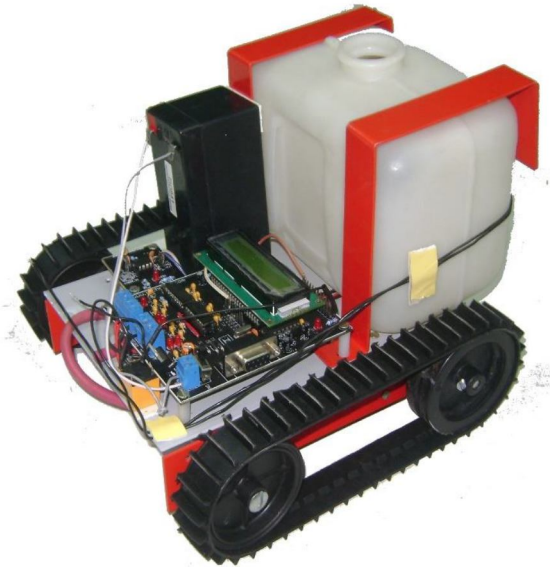
In this research paper , we have planned to achieve the following objectives

The main objective of fire fighting robot is to extinguish the fire with safety precautions. Firefighting robot consists of many sensors which has respective applications like identifying toxic gases, identifying nearby obstacles, finding temperature etc. Manpower is not required.

The Fire Fighting Robot can be used to fight fires in hazardous location, which firefighters cannot go easily and safely. The firefighting robot can be used for domestic as well as commercial purpose. To save people who get trapped in the fire.

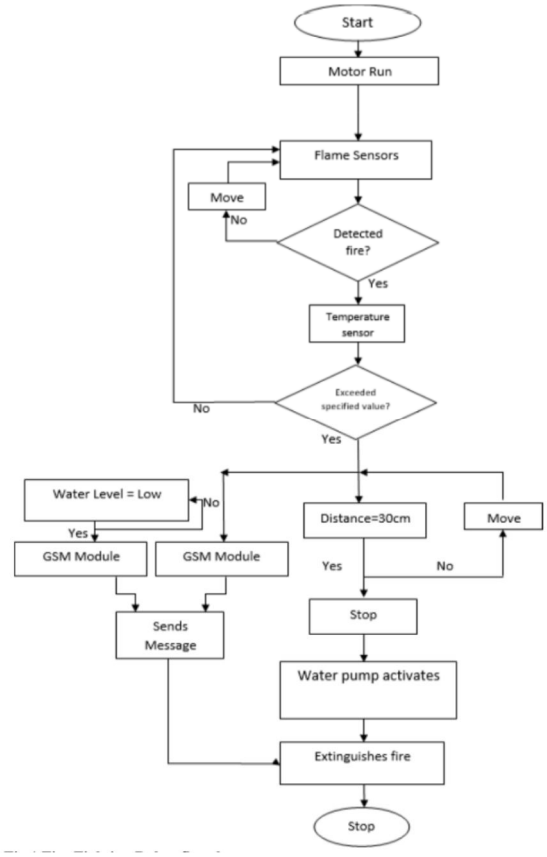
The system is to be further implemented and improved by using Machine Learning techniques and Artificial Intelligence, CNN which would give the best and more effective results with the detection of the fire accidents with the magnified image.

Figure1. Prototype of the robot



The above picture is the prototype of our fire fighting robot. We are going to further develop our project to real time commercial use which will be a full time robot for the fire fighter department.

Figure 2. Flowchart of the model



We are going to modify the existing system of firefighting robot to a newer version, by adding the following Infrared camera, automated version within a certain range Infrared cameras is used to detect any living beings in the fire accident area.

IV. RESULT

In this project, an autonomous Firefighting Robot has been implemented which is capable of detecting flames & smokes and extinguishing them successfully. This robot can move forward, move left & right flawlessly. The motors and Arduino code work together to control the movement of the robot. If any of the flame sensors or smoke sensor are triggered, then buzzer will start to buzz & warning about the danger environment will be displayed on the Virtual Terminal & safe environment will be shown in case of no such detection. The motor will start to rotate & move the robot to the danger point upon receiving a signal about the danger environment & start to pump the water with the help of servo motor. This process will be continued until the fire or smoke has been extinguished completely. Then it will display about the safe environment. After successfully building the project, the simulation was run and the desired output was obtained. Proper snapshots of the results were attached. Thus, an autonomous firefighting robot has been built to achieve the objectives of this project successfully

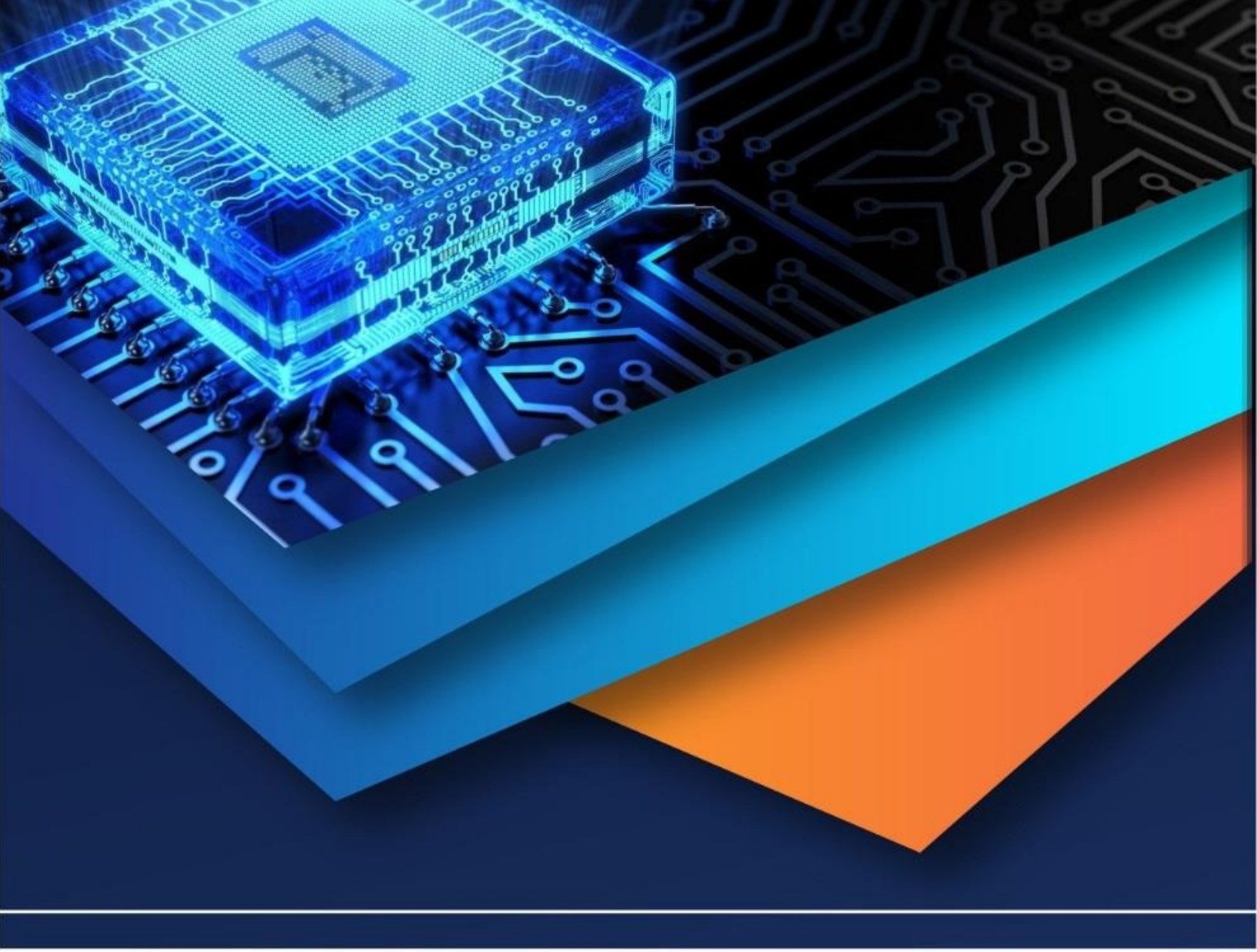
V. CONCLUSION

The proposed system serves for two main purpose, it detects the fire accidents and send the signal to the fire management system in form of alert message and it a cost effective solutions for the detections of fire accidents. It can detect the fire in heavy climatic conditions with high accuracy and the thermal vision camera gives the clear image of the fire and the degree Celsius of it, which makes the fire management system find the way on which direction to travel along with message. The proposed system serves for two main purpose, it detects the fire accidents and send the signal to the fire management system in form of alert message and it a cost effective solutions for the detections of fire accidents. It can detect the fire in heavy climatic conditions with high accuracy and the thermal vision camera gives the clear image of the fire and the degree Celsius of it, which makes the fire management system find the way on which direction to travel along with message.

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