

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.

1.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.

2.LITERATURE SURVEY

P.H. Chang and Y.H. Kang, et al., "Control Architecture Design for Fire Searching Robot using Task Oriented Design Methodology", SICE-ICASE 2006, Oct. 2006.

Fire detection and extinguishment are the hazardous job that invariably put the life of a fire fighter in danger. By putting a mobile robot to perform this task in a fire-prone area, it can aid to avoid untoward incidents or the loss of lives. This paper describes the development of an Autonomous Fire Fighting Mobile Platform (AFFMP) that is equipped with the basic fighting equipment that can patrol through the hazardous site via a guiding track with the aim of early detection for fire. When the fire source is being identified, the flame will be promptly extinguished

using the fire extinguishing system that is mounted on its platform. The patrolling movement is guided by a set of lines with the use of a conventional line following algorithm but with the addition of a homing algorithm. The tasks for the AFFMP once it navigates out of the patrolling route include the obstacle avoidance, locating for more precise location of fire source using front flame sensor and extinguish the fire flame. To detect for fire source, the input from flame sensors were finely-tuned in relation to the surrounding area, external interference and the mobility of the AFFMP prior the deployment of the platform. Development work done to date on the platform has shown its feasibility of being an autonomous unit to monitor a prescribed area, detect for fire and extinguish the flame. Fire-Fighting is an extremely dangerous task but still often being carried out by human operators, thus putting human life, invaluable as it is, in a very precarious situation. Therefore, it is highly desirable that the execution of routine and basic fire-fighting tasks to be replaced or at least partially assisted by AFFMP. There are several ways of implementation for AFFMP; however, most of them are being deployed based on the need-to-use basis. This project is quite unique in terms of its way of implementation wise, whereby the guiding track will be used to guide the AFFMP to navigate through an area for patrolling purposes and locate for fire source with its continuous monitoring feature for 24 hours per day, 7 days per week. This paper describes the work done to develop an AFFMP that monitors for occurrence of fire in a prescribed area and safely extinguish it promptly. Monitoring is done by patrolling within a guiding track while constantly scanning for fire via the flame sensors. If fire is detected, AFFMP will then attempt to locate for more precise position of the fire source. Once the location is determined, it will move out of its guiding track, approach the fire source and extinguish the flame by using the built-in fire extinguishing sub-system. When the flame is extinguished completely, it then returns to the guiding track to continue the patrolling task. All of the processes occur autonomously without any need of human controls since all processes are fully automated using a microcontroller system, executing the fire-detection algorithm, the autonomous navigation algorithm, the line tracking algorithm and the fire extinguishing sub-system.

Daniel J. Pack; Robert Avanzato; David J. Ahlgren; Igor M. Verner; “Fire-Fighting Mobile

Robotics and Interdisciplinary Design-Comparative Perspectives”, IEEE Transactions on Education, 3 August, 2004, Volume 47, No. 3.

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. 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.

Young-Duk Kim; Yoon-Gu Kim; Seung-Hyun Lee; Jeong-Ho Kang; Jinung An; “Portable Fire Evacuation Guide Robot System”, Intelligent Robots and Systems, IEEE/RSJ International Conference, 11-15 October 2009. Pages: 2789-2794.

Determining and extinguishing the fire is a dangerous job for a fire extinguisher. To this problem the fire fighter reaches the destination quickly and prevent the fire. Due to this fire fighter are constantly at a risk of losing their life. Technologies has come to rescue this issue. This paper gives you the technical solution to this mentioned problem. These robots are designed to use in extreme condition whereas humans' interruption becomes less and robots are using several works. An arduino UNO is microcontroller for needed operation. A vessel of water and apparatus for putting out flames organization with pump is got on the machine made to act like man body and its operation is did from microcontroller 1 out-put through right sign put out from sensor. The complete operation is controlled by Arduino UNO microcontroller.. This advanced firefighting robotic system independently detects and extinguishes fire. In the age of technology, the world is slowly turning towards the automated system and self-travelling vehicles, fire fighters are constantly at a risk of losing their life. Fire spreads rapidly if it is not controlled. In case of a gas leakage there even may be an explosion. So, in order to overcome this issue, safe guard live of our hero, our system comes to the rescue. This firefighting robotic system is powered

by Arduino Uno development board it consists of the HC-SR04 ultra-sonic sensor mounted on a servo motor for obstacles detection and free path navigation, it is also equipped with the fire flame sensor for detecting and approaching fire it also makes use of water tank and spray mechanism for extinguishing the fire. Water spraying nozzle is mounted on servo motor to cover maximum area.

Kuo L. Su; “Automatic Fire Detection System Using Adaptive Fusion Algorithm for Fire Fighting Robot”, Systems, Man, and Cybernetics, IEEE International Conference, 8-11 October 2006, Pages: 966-971.

This paper focus on improving the security of houses and industries against harmful Gas Leakage and fireflame. This device is very robust and help the user to notifyabout if there is any gas leakage or fire. It alerts the user when a person is not at home or offices directly from the Iotserver. The designed robot can be easily controlled by sending the commands to the micro controller from anywhere from the world. These commands can be observedby using Attention commands and acceptable action is taken. The main aim of this paper is to design a semiautonomous electronic IoT based firefighting robot which can replace the traditional human firefighters and prevent them from the danger of firefighter. The robot sends message to controller and will take emergency precautions to eliminate the danger for firefighters. The device is made more efficient by sending the message via SIM card to user so that the user could be automatically alert when he/she is out of home or office. The key point of the proposed scheme is to optimally direct the power and resources of the distribution systemthrough persistent display of data as IoT-based communication system. At proposed scheme, every home device is interconnected using data acquisition module with an internet protocol (IP) address, which generates an enormous wireless network of working devices. For encouraging improved demand response for the distribution system to take care of energy, IoT-based communication system is utilized. To simply treat energy, optimal load requirement forecast and energy control processes are deal with SMACA system. In addition, the optimal utilization of the available resourcesand flexibility of these networks is provided and prolonged with IoT-based distribution system [1]. Different people use the automation system for different purposes according

to their comfort. Some of them use it for making their life more comfortable like developing automatic door closer, automatic fan speed controller, home automatic system etc, and some of them make the use of automation for making the task easier such as automatic railway crossing gate controller or in metro, the automatic smart card detection system [2],[3],[4]. But the operation of all these systems or devices is not possible without the use of internet of things (IOT). The designs which are developed is based on GSM and GPRS innovation and Public subservience items for communication [5]. It is a Gas or Fire battle Robot which can be used for either prevent our homes or industries, offices etc from fire or from harmful gases. The new and novel thought behind this research is that our robot will move in the area of suffocated fire or harmful gases in our homes or in buildings of other offices, when nobody is at home and offices. This robot will find the presence of fire using infrared sensor LM35 and gas sensor MQ6 and when the flame or fire is observed by the robot, it will battle with detected fire using fans and send the message in a form of signal to a server of IOT. These Gadgets can be used at various places where feasibility of human is very difficult. Wireless network has proclaimed its incoming on vast stage and thus the whole world goes dynamic. It is need to regulate all the things without disturbing the ecosystem. This construction and design of fire or gas battle robot is remotely controlled by using GSM module embedded in Arduino UNO. The employment of "Embedded System in Communication" gave rise to several attention-grabbing applications which assured comfortless and safety to our life. The main object of this paper is to construct a SMS based Fire/Gas battle Robot tools that may replace conventional flame battle device. The tool detects the flame thereby sending message to landlord of the house, this device is made more efficient by SIM card installed in users phone for sending messages so that user got alert during fire [6]. Autonomous Fire Fighter Robot is the robot which autonomously detects and extinguishes the fire, it uses the flame sensor for detection, and the fire extinguisher is used to extinguish the detected fire. The robot can rotate while actively scanning for the fire, this scanning is performed by the sensors placed on the sides, when the fire is detected, the robot can move in the direction of the fire and it stops in front of it and trigger the extinguisher to turn out the fire. The aim of this project is to design a robot which acts as an extinguisher of fire. This

proposed fire fighting robot is expected to produce a small but very powerful and versatile robot. It detects fire in the disaster prone area. We will implement this by using FPGA board. Here, the fire detection robot overcomes the problem of hitting the obstacle by sensing the obstacle and moves into the direction where it is obstacle free. The firefighting robots can save a lot of lives some day, The lives of those affected by the fire disaster as well as lives of those people working as the firefighters, It can be useful in certain types of incidents where the environment will be very dangerous for the humans such as the hazardous materials, the radioactivity or the propane tank which can explode. The robots assisting firefighters are not an often seen sight, there are robotic devices which can already be used for such purposes, these include the bots that can be thrown into the fire site to inspect the situation, as well as the large remote controlled fire extinguishers. The robot is used to fight the fire where the humans cannot enter, It can identify the fire location and it can move automatically, It can turn itself automatically if there are any obstacles, It can take many pictures of the fire place regularly and it sends it to the central system, once the robot detects the fire location etc.

Scott Dearie; Kevin Fisher; Brian Rajala; Steven Wasson; "Design and Construction of a Fully Autonomous Fire Fighting Robot", 2004 IEEE, Pages: 303-310.

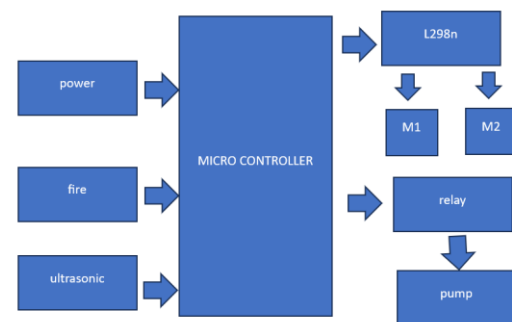
Fire Incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. The Victim of Fire Incident can also suffer from prolonged psychological and trauma. Fire fighters are primarily tasked to handle fire incidents, but they are often 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 extinguishment operations, technological innovations can be utilized to assist firefighting. Therefore, this paper presents the design of a firefighting robot dubbed that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger. It is designed to be compact in size than other conventional fire-fighting robot to

ease small location entry for deeper reach of extinguishing fire in narrow space. It 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 It demonstrating capabilities of identifying fire locations automatically and ability to extinguish fire remotely at distance. Firefighting is the act of extinguishing destructive fires. A firefighter must be able to stop fire quickly and safely extinguish the fire, preventing further damage and rescue victims to a safer location from the hazard. Technology has finally bridged the gap between Firefighting and machines allowing for a more efficient and effective method of firefighting. Robots were designed to find a fire before it rages out of control. The robots could one day work with fire fighters in reducing the risk of injury to victims. Our team was always more interested in security-related projects. We determined that our idea would be security-related, but we also wanted to create something unique, both in terms of the market and for a social cause. As a result, we devised the concept of a fire-fighting robot. One of the most crucial factors in a fire tragedy is the number of lives lost in the process of saving another's life. Because of explosive materials, smoke, and high temperatures, it is sometimes hard for firefighting workers to reach the scene of a fire. Many disastrous outcomes can be avoided if the fire is detected quickly. A single spark can start a huge conflagration. Because of an inadequate fire management system, not only industrial workers' lives are in danger, but also the lives of domestic workers. Many lives can be lost in a fire, and many more can be permanently injured. However, employing correct firefighting techniques, this can be prevented. We plan to construct a Fire Extinguishing Robot that can detect and move a little flame to extinguish it. With the use of flame sensors, it will automatically identify a fire. It navigates itself to the fire source and extinguishes the fire using the built-in fire extinguishing system once it recognizes the location of the fire breakout. It employs flame sensors for fire detection. When a fire is detected, the fire extinguishing system will be engaged. When the water pump detects a fire, it will begin ejecting water. The primary function of this system is to provide fire surveillance in order to prevent severe fire accidents and reduce human life loss. progress to location-dependent services and requests in wireless arrangements endures to need the progress

of extra precise and reliable positioning and pursuing systems. 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.

3.METHODOLOGY

BLOCK DIAGRAM



POWER SUPPLY

A regulated power supply converts unregulated AC (Alternating Current) into a consistent DC (Direct Current). It ensures reliable results regardless of fluctuations in input. A regulated DC power supply, commonly referred to as a linear power supply, is an embedded circuit composed of multiple blocks.

- Definition of a Regulated Power Supply: A regulated power supply provides a stable DC output by transforming variable AC input.
- Overview of Components: A regulated power supply consists of several key components: a transformer, rectifier, filter, and regulator. Each of these elements plays an essential role in ensuring a stable DC output.
- Rectification Explained: This process entails the conversion of alternating current (AC) to direct current (DC) through the use of diodes, often employing full wave rectification to optimize

efficiency.

- **Filter Function:** Various filters, including capacitor and LC types, are employed to smooth the DC output, thereby minimizing ripple and ensuring a stable voltage.
- **Regulation Mechanism:** Adjustments are made by regulators to stabilize output voltage, safeguarding against fluctuations in input or variations in load, which is crucial for ensuring a dependable power supply.

SENSORS

Sensors are employed for the detection of various phenomena and devices, among other applications. An apparatus that delivers a functional output based on a defined measurement. The sensor measures a physical parameter and transforms it into a signal that can be processed (such as electrical, mechanical, or optical), enabling the detection of specific physical quantities in various devices or materials. The sensor produces a signal that is transformed into a format understandable to humans, such as variations in characteristics, resistance, capacitance, impedance, and so forth.

What is HC-SR04 Ultrasonic Sensor:

The HC-SR04 ultrasonic sensor comprises both a transmitter and a receiver. This sensor is utilized to determine the distance to the target. The duration required for the transmission and reception of the waves will determine the distance separating the sensor from an object. This sensor employs sound waves through non-contact technology. This sensor enables the measurement of the required distance to the target without causing any damage, delivering precise information. The sensor operates within a range of 2 centimeters to 400 centimeters. The HC-SR04 is an ultrasonic sensor that employs sonar technology to measure the distance between the sensor and an object. This system offers an exceptional array of non-contact detection capabilities, ensuring high accuracy and consistent readings. The system comprises two components: an ultrasonic transmitter and a receiver. This sensor finds utility across numerous applications, including the measurement of direction and speed, burglar alarms, medical devices, sonar, humidifiers, wireless charging, non-destructive testing, and ultrasonography.



Fig: HCSR04-ultrasonic-sensor

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.

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