IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11306

AI BASED AUTOMATIC FIRE EXTINGUISHER SYSTEM IN VEHICLE

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Abstract: The integration of Artificial Intelligence (AI) with advanced technologies has significantly enhanced safety measures in various domains, including transportation. In this project, we propose an innovative AI-based automatic fire extinguisher system designed specifically for vehicles. This system employs Arduino Uno microcontroller, GSM module, GPS, and fire sensors to detect and mitigate fire incidents effectively. The primary objective of this system is to detect fire outbreaks in vehicles at an early stage and promptly initiate fire extinguishing procedures to minimize damage and ensure passenger safety. The integration of AI algorithms enhances the system's capability to accurately identify fire hazards while minimizing false alarms.

The system utilizes fire sensors strategically installed within the vehicle's compartments to continuously monitor the surrounding environment for any signs of fire. Upon detecting abnormal temperature rise or smoke indicative of a fire outbreak, the sensors trigger the Arduino Uno microcontroller. The Arduino Uno, functioning as the central processing unit, employs AI algorithms to analyze sensor data and determine the severity of the fire. Based on the analysis, the system activates the appropriate response mechanisms to address the situation effectively. In case of a confirmed fire incident, the system initiates the deployment of the onboard fire extinguisher. The AI algorithms optimize the extinguisher's deployment by considering factors such as fire location, intensity, and vehicle occupants' safety. Additionally, the system utilizes the GPS module to transmit the vehicle's location to emergency services, facilitating swift response and assistance. Furthermore, the integration of the GSM module enables real-time communication capabilities, allowing the system to send alerts and notifications to relevant stakeholders, including vehicle owners, emergency contacts, and authorities. This ensures timely intervention and coordinated efforts to mitigate the fire incident.

Keywords: IOT, smart industrial trolley**.**

I. INTRODUCTION

Our project deals with design and fabrication of automated fire extinguishing system. In present days, there are many fire accident occurs due to short circuits in electric systems. When the fire occurs inside the engine room, there is no alternate option to cut off the fire because we will not able open the bonnet due to increase the oxygen level fire will expend. So we use class b extinguishing material to control the fire.

Electric cars are fully run by the battery so the vehicle use many electrical wire and circuit they battery are produce more heating problem not only the battery vehicle and also the IC engine also have many heating problem wiring and Ets unit will make problem to make fire “Design and Fabrication of automated fire extinguishing system” is our project to detect and cut off the fire inside the car bonnet. The main objective of our project is to avoid fire accident, it will be highly efficient and safe drive.

II. LITERATURE SURVEY

part of research papers/technical reports on a certain leak detection method and other gas related subjects. A.Mahalingam, r. T. Naayagi, n. E. Mastorakis; they introduce design and implementation of an economic gas leakage detector. They gave the formulation of many problems in previous gas leakage detectors. They told that several standards have been formulated for the design of a gas leakage detection system such as IEEE, BS 5730, and IEC.For

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this work, the recommended UK safety standards have been adopted. The proposed alarm system is mainly meant to detect LPG leakage, which is most commonly used in residential and commercial premises. The system detects not only the presence of gas (gas leak), but also the amount of leakage in the air, and accordingly raises an appropriate audio visual alarm. The objective of the system is to detect LPG gases such as propane and butane. The allowed UK level for butane is 600 ppm above which it is considered to be of high level and poses a danger. The proposed system ensures a continuous monitoring of the gas levels. If the gas level increases above the normal threshold level of 400 ppm butane (LPG), the system starts to issue early warning alarms at 100ms interval, which implies low level gas leakage. If the leakage level increases to 575 ppm of butane (LPG), the system activates high severity audio alarms at 50 ms intervals warning the occupants to run to safety.[1]

Prof. M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi, M.Gunasekaran; they told in their research paper on "GSM based LPG leakage detection and controlling system" the leakage of LPG gas is detected by the MQ-6 gas sensor. Its analog output is given to the microcontroller. It consists of predefined instruction set. Based on this, the exhaust fan is switched on. So, the concentration of gas inside the room gets decreased. Then, the stepper motor is rotated thus closing the knob of the cylinder. Because of this process, the leakage of gas is stopped. The relay is switched to off the power supply of the house. The buzzer produces an alarm to indicate the gas leakage. Then, the user is alerted by SMS through the GSM module. They proposed their methodology that the system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle for closing the valve. We are increasing the security for human by means of a relay which will shut down the electric power to the house. Also by using GSM, we are sending an alert message to the users and a buzzer is provided for alerting the neighbors about the leakage.[2]

B. B. Did paye, Prof. S. K. Nanda; in this paper they told about their research on leakage detection and review of"Automated unified system for LPG using microcontroller and GSM module". Their paper proposed an advance and innovative approach for LPG leakage detection,prevention and automatic booking for refill. In advance, the system provides the automatic controlling of LPG regulator also if leakage is detected the system will automatically turn off the main switch of power supply. Hence it helps to avoid the explosion and blast.[3]

Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree; in this research paper they told about gas leakage detection and control. In this paper, the gas leakage resulting into fatal inferno has become a serious problem in household and other areas where household gas is handled and used. It alerts the subscriber through the alarm and the status display besides turning off the gas supply valve as a primary safety measure.[4]

Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare,in the year 2014 planned a framework, They gave security issues against hoodlums, spillage and fire mishaps. In those cases their framework sends SMS to the crisis number gave to it.[5]

P.Meenakshi Vidya, S.Abinaya, G.Geetha Rajeswari, N.Guna,"Automatic LPG detection and hazard controlling " published in April 2014 proposed the leakage detection and real time gas monitoring system. In this system, the gas leakage is detected and controlled by means of exhaust fan. The level of LPG in cylinder is also continuously monitored.[6]

Ch. Manohar Raju and N. Sushma Rani, 2008, they introduce an android based automatic gas detection and indication robot. They proposed prototype depicts a mini mobile robot which is capable to detect gas leakage in hazardous places. Whenever there is an occurrence of gas leakage in a particular place the robot immediately read and sends the data to android mobile through wireless communication like Bluetooth. We develop an android application for android based smartphones which can receive data from robot directly through Bluetooth. The application warns with an indication whenever there is an occurrence of gas leakage and we can also control the robot movements via Bluetooth by using text commands as well as voice commands. The previous mobile robots are based on heterogeneous technologies like GSM, GPS, internet based etc., but the main disadvantage of those prototypes were the absence of communication in particular areas. So, with the rapid developments and tremendous changes in technology we have lots of techniques to eradicate previous problems. Wireless communication protocols play a vital role in present trends. Bluetooth, WI-Fi, Zigbee etc., we use one of the best feature of smartphone, i.e., the Bluetooth technology to control and monitor parameters driven by a robot.

They introduce a robot and mobile application for In the meantime, the system prototype has imposingly demonstrated its use and capability in intensive series of tests. The drive unit, the navigation system and, therefore, the complementary sensor systems performed superbly throughout the tests.

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The robot facilitates independent gas detection and leak localization in sites that are otherwise troublesome to access. Moreover, it helps to avoid mistreatment of human inspectors in probably dangerous environments. However, before ready-ing in industrial settings, more development is needed (e.g., in explosion protection, package development, etc.), and in fact leg a problems should be processed before ready-ing in business settings. Still, it is certain that an autonomous, mobile gas detection and leak localization robot is possible today and can significantly enhance safety.[7]

Pal-Stefan Murvaya, Ioan Sileaa, 2008, they told in their survey on gas leak detection and localization techniques various ways to detect the gas leakage. They introduce some old or new technique to detect the gas. The proposed techniques in this paper are nontechnical methods, hardware based methods which include acoustic methods, optical methods and active methods. In their survey they told a wide variety of leak detecting techniques is available for gas pipelines. Some techniques have been improved since their first proposal and some new ones were designed as a result of advances in sensor manufacturing and computing power. However, each detection method comes with its advantages and disadvantages. Leak detection techniques in each category share some advantages and disadvantages. For example, all external techniques which involve detection done from outside the pipeline by visual observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long. Methods based on the mathematical model of the pipe have good results at high flow rates while at low flow rates a mass balance based detection system would be more suitable. This disadvantage is prone to disappear for some of these techniques due to forthcoming technological advancements.[8]

Zhao Yang, Mingliang Liu, Min Shao, and Yingjie Ji, 2011, in this paper they told about their research on leakage detection and analysis of leakage point in the gas pipeline system. In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30 seconds. This module communicates with SCADA. Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature.

Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature. Then all the parameters of the gas in the pipeline system can be acquired.

Leakage Detection: The leakage detection is carried out by comparing the data acquired through the SCADA system with that by the Transient Simulation Model. This model could provide leakage point judgment and prompt warning based on transient simulation and volume balance.[9]

Falohun A.S., Oke A.O., and Abolaji B.M. 2016, in this paper they proposed their dangerous gas detection using an integrated circuit and MQ-9. In this basically, they used an embedded design which includes typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction device. The amount and type of detectors and the type of fire alarm system that one chooses for property protection will depend on the owner's property protection goals, the value of the property and the requirements of the owner's insurance company.

Generally, heat detection will be used in all areas that are not considered high value. Here again, one of the most common mistakes in fire alarm generally, heat detection will be used in all areas that are not considered high value. Here again, one of the most common mistakes in fire alarm system application is to provide partial protection of a building and expect high performance from the installed systems of any kind.system application is to provide partial protection of a building and expect high performance from the installed systems of any kind.[10]

Hina Ruqsar , Chandana R , Nandini R , Dr. T P Surekha, have proposed a system that along with monitoring and detection of gas leakage, real time data is made available through real time feed over internet They have used Xively IOT platform to provide real time sensor data over the internet.[11]

III. OBJECTIVE

- ✓ To achieve high safety.
- ✓ To reduce man power.
- ✓ To increase the efficiency of the vehicle.
- ✓ To reduce the work load.
- ✓ To reduce the fatigue of workers.
- ✓ To high responsibility.
- ✓ Less maintenance cost.

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IV. SCOPE

World progressing at faster rate which demands efficient working equipment's such as user friendly machinery and hence the three way dumper may be used more than the two way or one way. The work can be modified further more on following basis:-Electronic sensors can be used to make the operations easy. Oil pump can be used instead of Pneumatic cylinder. Capacity can be increased. Four wheel steering can be adopted for more movement ability.

V. COMPONENTS DETAILS

Arduino Uno:
- ✓ Utilize Arduino Uno as the central processing unit to control the entire system.
- ✓ Interface with other modules such as GSM, GPS, and fire sensor.
- ✓ Implement algorithms for real-time fire detection, decision-making, and extinguisher activation.

Fire Sensor:
- ✓ Choose appropriate fire sensors like flame sensors or temperature sensors capable of detecting fire in the vehicle.
- ✓ Integrate the sensor with Arduino Uno to detect the presence of fire or abnormal temperature rise.
- ✓ Calibrate the sensor to differentiate between normal heat sources and actual fire hazards.

GSM Module:
- ✓ Use GSM module for remote communication and alerting.
- ✓ Send SMS or make calls to the vehicle owner or emergency services upon fire detection.
- ✓ Implement two-way communication for remote control and status monitoring.

GPS:
- ✓ Incorporate GPS for real-time tracking of the vehicle's location.
- ✓ Include the GPS data in alert messages to provide precise location information during emergencies.
- ✓ Enable features like geo-fencing to trigger specific actions based on the vehicle's location.

AI Algorithm:
- ✓ Develop an AI algorithm for fire detection, which could involve machine learning or rule-based approaches.
- ✓ Train the algorithm on a dataset containing various fire scenarios to improve accuracy.
- ✓ Optimize the algorithm for real-time performance and resource efficiency, considering the constraints of Arduino Uno.

Extinguisher Activation Mechanism:
- ✓ Interface with a suitable fire extinguisher mechanism compatible with the vehicle.
- ✓ Implement a reliable activation mechanism triggered by Arduino upon fire detection.
- ✓ Ensure safety measures to prevent accidental discharge and ensure proper functionality during emergencies.

Power Supply:
- ✓ Design a power supply system capable of supplying power to all components efficiently.
- ✓ Incorporate backup power sources like batteries to ensure continuous operation during vehicle power failure or accidents.

Integration and Testing:
- ✓ Integrate all components seamlessly and conduct thorough testing under various conditions, including fire simulations.
- ✓ Perform field testing to validate the system's reliability, accuracy, and response time.
- ✓ Iterate on the design based on feedback and test results to improve performance and usability.

Regulatory Compliance:
- ✓ Ensure compliance with relevant regulations and standards for vehicle safety systems.
- ✓ Consider certification requirements for automotive applications to ensure legal compliance and market acceptance.

User Interface:
- ✓ Develop a user-friendly interface for system configuration, monitoring, and manual control.
- ✓ Include indicators or alarms to notify passengers about the system's status and actions during emergencies.

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VI. WORKING PRINCIPLE

Fire Detection:

The fire sensor continuously monitors the vehicle's interior for any signs of fire or excessive heat. When it detects a fire, it sends a signal to the Arduino Uno.

Location Tracking:

The GPS module is used to track the vehicle's current location. This information will be crucial for emergency services or the vehicle owner to locate the vehicle in case of a fire.

Alert System:

Upon detecting a fire, the Arduino Uno triggers the GSM module to send an alert message to predefined emergency contacts. This message can include the vehicle's current GPS coordinates for easier identification.

Fire Suppression:

Once the fire is detected and alerts have been sent, the Arduino Uno activates the relay module, which in turn triggers the fire extinguisher system installed in the vehicle. The fire extinguisher is discharged to suppress the fire.

VII. MERITS

Real-time Detection: The fire sensor continuously monitors the vehicle's environment for any signs of fire or excessive heat. This real-time detection enables rapid response to any potential fire hazards.

AI-based Decision Making: By integrating artificial intelligence algorithms, the system can analyze data from various sensors to accurately identify fire risks. This allows for more intelligent decision-making in triggering the fire extinguishing mechanism.

Quick Response Time: Upon detecting a fire threat, the system can automatically activate the fire extinguisher without requiring human intervention. This swift response can help prevent small fires from escalating into larger, more dangerous incidents.

Reduced Damage: By promptly extinguishing fires, the system minimizes the extent of damage to the vehicle and its occupants. This can potentially save lives and reduce repair costs.

Remote Monitoring and Control: Integration with a GSM module enables remote monitoring and control of the system. Vehicle owners or authorities can receive alerts in case of a fire emergency and take appropriate actions, such as remotely activating the fire extinguisher or notifying emergency services.

Location Tracking: Incorporating GPS functionality allows for precise tracking of the vehicle's location. In the event of a fire, this information can be crucial for emergency responders to quickly locate and assist the vehicle.

Enhanced Safety: Overall, the implementation of an AI-based automatic fire extinguisher system significantly enhances the safety of both the vehicle and its occupants. It provides peace of mind to drivers and passengers, knowing that there is an advanced system in place to mitigate fire risks effectively.

Scalability and Customization: The modular nature of Arduino-based systems allows for scalability and customization according to specific vehicle requirements.

Additional sensors or functionalities can be easily integrated as needed, making the system adaptable to different vehicle types and usage scenarios. 8..BLOCK

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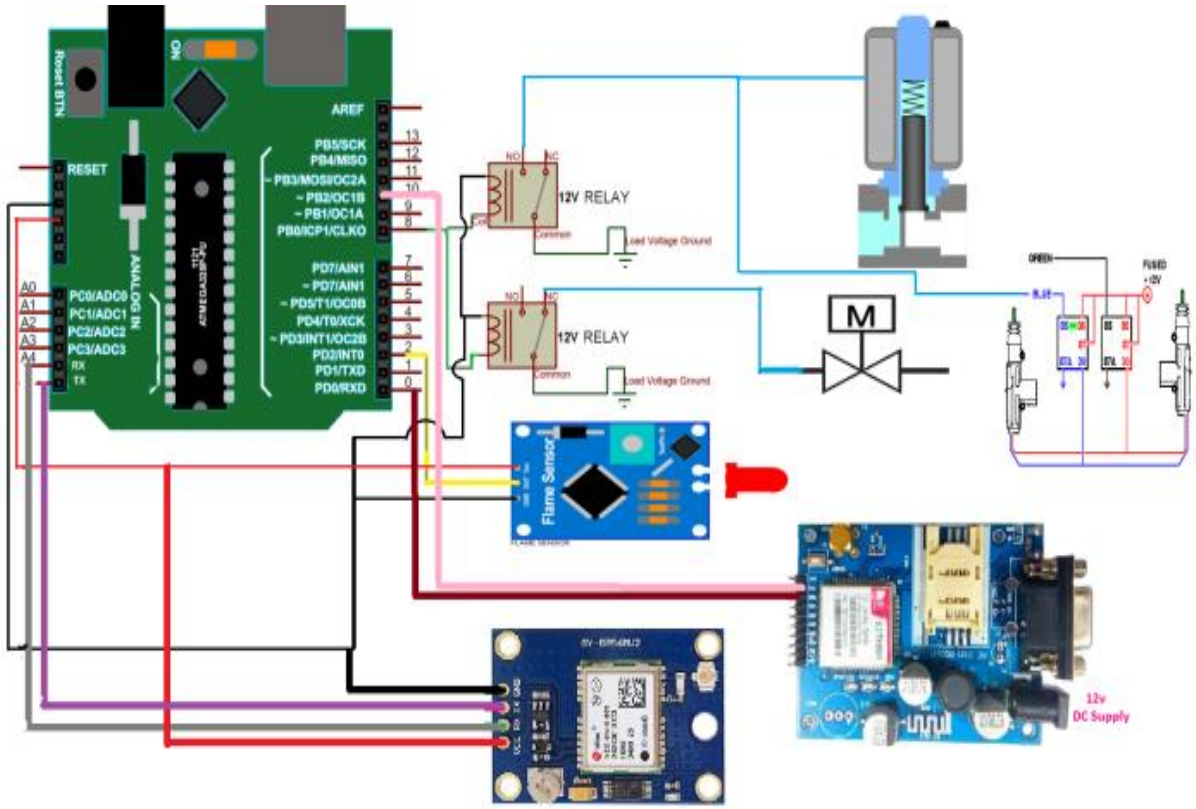
VIII. DRAWING



IX. CONCLUSION

Early Detection of Fire: The incorporation of fire sensors enables the system to detect fire incidents promptly. These sensors can detect even small flames or increases in temperature, allowing for rapid response to potential fire hazards.

Real-Time Monitoring: With the inclusion of GPS and GSM modules, the system can provide real-time monitoring and alerts to relevant stakeholders, including vehicle owners, emergency services, and fleet managers. This ensures that appropriate actions can be taken swiftly in the event of a fire.

Automated Fire Suppression: Upon detecting a fire, the system can automatically trigger the deployment of fire extinguishing agents, such as foam or dry chemical, to suppress the fire. This automated response helps to mitigate the spread of fire and reduce the risk of damage or injury.

Integration with Vehicle Systems: By leveraging the capabilities of Arduino Uno, the system can be seamlessly integrated with existing vehicle systems, enabling efficient communication and coordination with other onboard technologies.

Enhanced Safety: Overall, the implementation of this AI-based fire extinguisher system enhances the safety of occupants, vehicles, and surrounding environments. It provides an additional layer of protection against fire-related incidents, thereby reducing the likelihood of catastrophic accidents and potential loss of life.

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