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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612

DISASTER PREDICTION AND PREVENTION SYTEM USING IOT

Dr. Princess Maria John, Ph.D. [1], Manoj D[2]

Assistant Professor, Master of Computer Applications, Hindusthan College of Engineering and Technology, Coimbatore, India[1]

II MCA Students, Master of Computer Applications, Hindusthan College of Engineering and Technology, Coimbatore, India[2]

Abstract: Disasters, whether natural or man-made, have devastating effects on human lives, infrastructure, and the environment. Early prediction and effective prevention are paramount to mitigating their impact. This paper presents a novel approach to disaster prediction and prevention leveraging the Internet of Things (IoT) technology. The proposed system integrates various IoT sensors, including weather sensors, seismic sensors, and surrounding sensors, to collect real-time data from the disaster-prone areas. Machine learning algorithms are employed to analyze this data and predict potential disasters such as earthquakes, floods, hurricanes, and forest fires with high accuracy. Furthermore, the system utilizes actuators and automated control mechanisms to implement preventive measures in response to the predicted disasters. These preventive measures may include early warning alerts to the authorities and the affected population, activation of evacuation protocols, deployment of emergency resources, and adaptive infrastructure management. The effectiveness of the proposed system is validated through simulation studies and real-world deployment in disaster-prone regions. The results demonstrate significant improvements in disaster prediction accuracy and timely preventive actions, leading to reduced loss of life and property during disasters. The Disaster Prediction and Prevention System using IoT offers a comprehensive and proactive approach to disaster management, empowering communities and authorities to better prepare for and mitigate the impact of natural and man-made disasters. This project uses an MQ135 gas sensor, LM35 fire sensor LCD display, buzzer, GSM module and Arduino which is used as the brain of this project. A relay is used to cut off of the power supply in the leakage environment. The gas sensor of type MQ135 is used to detect the atmosphere gas which is an extra component, and noticed by the Arduino and an alerting message is send through the GSM to user.

Keywords: Internet of things, MQ135, LM35, Power cut-off, Arduino UNO, GSM module.

I. INTRODUCTION

In recent years, the world has witnessed an increase in the frequency and severity of natural disasters, along with the persistent threat of human-induced calamities. The repercussions of these events, ranging from loss of life and property to disruptions in infrastructure and economy, underscore the critical importance of effective disaster prediction and prevention measures. Leveraging the transformative capabilities of the Internet of Things (IoT), a new paradigm in disaster management is emerging, offering proactive solutions to mitigate risks and enhance resilience. The integration of IoT technologies into disaster prediction and prevention systems heralds a shift from reactive to proactive strategies. By harnessing a network of interconnected sensors, actuators, and data analytics tools, these systems gather real-time information on environmental conditions, infrastructure status, and human activity. This data work as the foundation for predictive modeling and risk assessment, enabling authorities to anticipate potential disasters and take preemptive actions. Moreover, IoT-enabled disaster management systems facilitate rapid response and adaptive interventions during emergencies. Through automated alert systems, communication networks, and decision support mechanisms, timely warnings can be disseminated to vulnerable communities, evacuation routes optimized, and emergency resources mobilized. The dynamic nature of IoT allows for adjustment and continuous monitoring of preventive measures based on evolving risk factors, thereby enhancing the effectiveness of disaster preparedness efforts. In this context, the development of a comprehensive Disaster Prediction and Prevention System using IoT represents a significant advancement in disaster resilience. By leveraging the interconnectedness and data-driven insights afforded by IoT technologies, this system offers a holistic approach to disaster management, integrating prediction, prevention, response, and recovery phases seamlessly. Through interdisciplinary collaboration and technological innovation, we can harness the potential of IoT to build more resilient communities and mitigate the impact of disasters on society and the environment.

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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612

Gas leaks create a variety of incidents, including property damage, human injuries, and so on. Gas leaks can be dangerous to both people and the environment. An explosion can occur even if only a little amount of gas leaks. Major gas explosions occur as a result of poor quality or human negligence. A gas leakage detection system can identify a leak and send out a warning, allowing you to take the necessary precautions to avoid the leak. LPG use causes a slew of issues in both the home and the workplace. So, keeping the project's premise in mind, we devised an alerting system that detects gas leaks and assists in taking the appropriate precaution at the appropriate time.

A microcontroller belongs to ATmega238. The board includes several pins ie. input (14), output (6) pins, power jack, reset button, ICSP header, and a USB connection. A USB connection is used for connecting the board to the computer for further operation. 5V is enough for the operation, but 7V-12V is recommended. The power supply for Arduino board is done with AC-DC transfomer, USB port or a battery. Arduino UNO can detect the surroundings from the inputs, which are different types of sensor and outputs are in the form of turning on/off lights, controlling motors, etc. The board is programmed using the Arduino IDE and integrated development environment. An applications of Arduino Uno are developing of automation systems, designing of basic circuit designs, etc.

II. RELATED WORK

In [1], rapid progress in many industries, technology is impacting human life in multiple ways, but we still need to adapt that technology in order to make human life simpler to live were discussed. Because LPG output in our country is insufficient, it is impossible to distribute LPG to every residence through pipeline. An advance booking of cylinder through online/IVRS, which makes struggle for people who are not aware or have a hectic schedule to reserve LPG cylinder in advance. The main threat for LPG consumers is that they don't aware of LPG completion. which extends the booking procedure even further. Another major difficulty with LPG cylinder consumers is that they don't aware of the situation of LPG completion. Which leads to delays in booking. We currently have an IVRS system in which the customer must go through a series of steps, which involves Automatic voice with selecting options. Because, peoples are unable to book and the landlines are busy due to high volume of call and some issue. The research proposes a system that can completely automate the booking of LPG cylinders, removing the need for human intervention. The device weighs the cylinder and send message to authorized Agent. when it surpasses a particular threshold, allowing them to deliver cylinder on time. The automatic cylinder booking, they created a function dedicated to the user's safety, which continuously monitors LPG gas leakage and alerts the user to the problem in order to avoid significant consequences.

One of the most important industries to keep human’s in existence on earth are food industries were discussed in [2]. The product‘s quantity and quality can be improved and profits also can be increased by using automatically machine. Market available automatic machine is complicated and difficult to clean up due to installment of cylinder piston. To make things simple and easier cylinder piston is replaced with a new water measuring system using ultrasonic is developed. An additional tank is used to measure the desired water level named measuring tank. Water flow is controlled between storage tank to measuring tank to 4 measuring tank and to nozzle. Cost of the machine will be too low and implemented to boost production and profit in small average company also.

In [3], Derailment, collision, injuries to environmental damage, train passengers & property damage can all be caused by obstacles in the train's right of way, train’s smoke, and flooding in track, so there’s a need to investigate various methods for prevent or to decrease frequency and hardness of these accidents to mitigate these accidents. The goal is to replicate Proteus program that detects impediments in trains' right-of-way, floods on railway tracks, and train smoke. The Arduino code is then recreated in Proteus to detect impediments on the route, as well as train fires and floods on the railway track. The findings show of new inventive technology can improve resiliency of railway’s safety system. We can drastically reduce accidents by adding these properties into real-time apps.

In [4], discusses how gas leaks in industrial areas generate a slew of health problems. To avoid a tragedy, the atmosphere in the workplace should be maintained and checkes on a routine basis for maintaining a clean air environment. The lack of science based strategy for identifying and assessing atmospheric quality of air and harmful gas has hampered air control. However, the construction of a gas leakage monitoring system is required. For the construction of the system, combustible gas sensors (MQ9) are utilised to detect methane and carbon monoxide. The sensor can detect gas concentration based on sensor voltage output and operated in alarm system, autonomous control & monitoring system utilizing by microcontroller. Data readings will be delivered through zigbee from sensor to monitoring system, which will display the lab view and GUI. If a leak occurs, the user must act quickly; otherwise, the gas supply/system will cut-off automatically within particular time to prevent the situation from worsening.

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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612

In [5], an accident prevention system of car accident identification, which will enhance the chance of minimising the number of daily road accidents. Simultaneously, if accident occurs, the system detect the scene, also automatically notify the person who can 5 able to respond quickly. An Arduino-based system was built using the GPS and the GSM technologies. When car collides with something, the speed is measured through an accelerometer and tilting amount. If a car speed exceeds the speed limit set by the road. Furthermore, if an accident occurs, the GPS locate location. By using GSM the SMS will send to the user. The system is not very expensive and simple to use.

III. METHODOLOGY

Identifying Hazard Profiles: Begin by identifying the types of disasters that are prevalent or likely to occur in the target area. This could include natural disasters such as earthquakes, floods, hurricanes, or wildfires, as well as human-induced disasters like industrial accidents or pandemics.

Data Collection and Acquisition: Gather relevant data sources that can provide insights into the conditions conducive to each type of disaster. This may include historical records, weather data, geological surveys, satellite imagery, sensor networks, social media feeds, and demographic information.

Data Preprocessing and Integration: Cleanse, preprocess, and integrate the collected data to create a unified dataset. This may involve removing outliers, filling in missing values, and harmonizing data formats to ensure compatibility and consistency.

Feature Engineering: Identify relevant features or variables from the integrated dataset that are indicative of impending disasters. This could involve extracting meaningful patterns, trends, or correlations through statistical analysis, spatial analysis, and domain expertise.

Model Development: Develop predictive models using machine learning techniques and advanced analytics. This may include regression models, time series analysis, classification algorithms, or ensemble methods tailored to the specific characteristics of each disaster type.

Model Evaluation: Assess the performance of the predictive models using appropriate metrics such as accuracy, precision, recall, and F1-score. Validate the models using cross-validation techniques and test datasets to ensure robustness and generalizability.

Real-Time Monitoring and Alerting: Implement a real-world monitoring system that continuously collects and analyzes the incoming data readings from IoT devices and other sources. Develop algorithms to detect early warning signs and trigger alerts when predefined thresholds or risk levels are exceeded.

Decision Support System: Integrate the predictive models and real-time monitoring system into a decision support system that provides actionable insights to emergency responders, policymakers, and the public. This could include interactive dashboards, visualization tools, and communication channels for disseminating information and coordinating response efforts.

Training and Capacity Building: Provide training and capacity building programs to stakeholders involved in operating and utilizing the disaster prediction and prevention system. This includes emergency response teams, government agencies, community leaders, and the general public.

Continuous Improvement and Adaptation: Monitor the performance of the system over time and iterate on the methodology based on feedback, new data, and evolving disaster scenarios. Incorporate lessons learned from past incidents to enhance the effectiveness and resilience of the system.

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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612

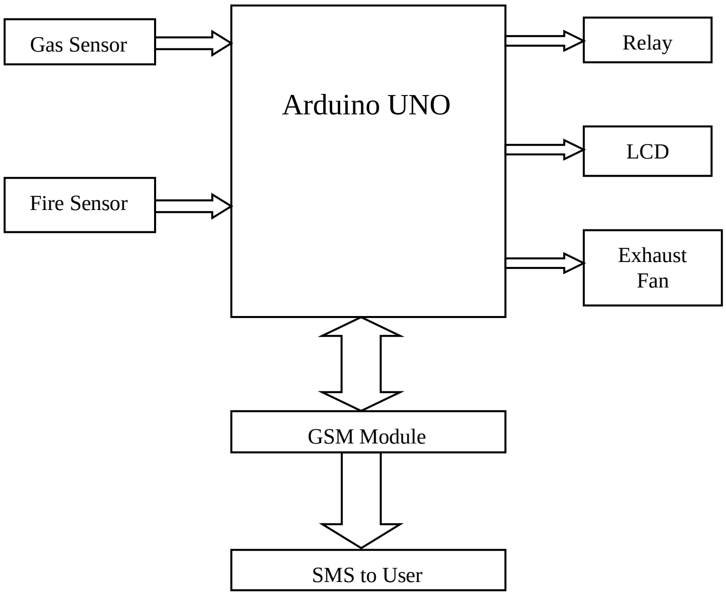


Fig.3.1 Architecture of The system

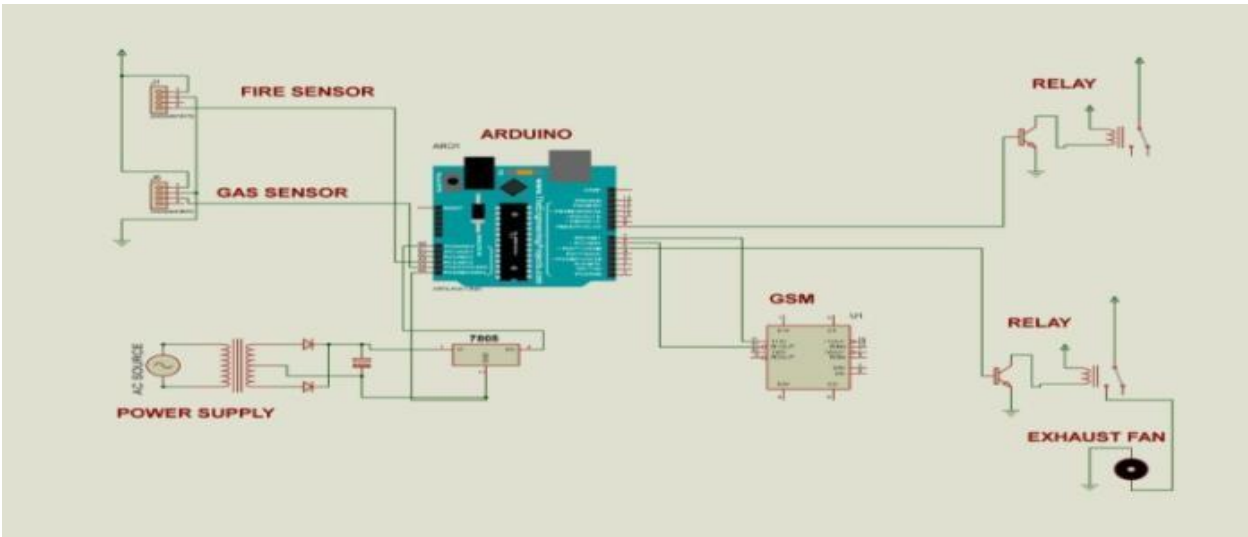


Fig 3.2 Circuit diagram

IV. IMPLEMENTATION

The Arduino programming language is used in the proposed system. In the beginning of the code, there is a declare of two variables such as temp and gas. Liquidcrystal and softwareserial are the two libraries included in the programming. The liquidcrystal library is used to control the LCD by the Arduino board based on a compatible chipset. The other library softwareserial which allows serial communication with the digital pins except the pins 0 and 1 of the Arduino. The serial communication on pins 0 and 1 has built-in support. The multiple software serial ports rates up to 115200 bps are possible. For devices that require that protocol, a parameter enables inverted signalling When a sketch starts, the setup() method is invoked. It may be used to set up variables, pin modes, and start accessing libraries, among other things. After each powerup or reset of the Arduino board, the setup() method will only execute once. It begins with a curly - opening bracket and ends with a closing bracket. When you upload, power up, or reset Arduino, the Void setup function is only called once. Three items must be defined in the void setup such as serial.begin and pinmode. Serial.begin is a built-in function that takes one parameter and returns a value like Serial.begin (9600) or Serial.begin (115200).

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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612

The number 9600 denotes the baud rate, which is the amount of bits per second. The serial.begin instruction establishes a serial connection between the Arduino and the PC. The pinMode function, like serial, is a builtin feature. To begin, pinMode in void setup routines specifies whether the Arduino pins are used as either input or output. The loop function has no arguments. Until the Arduino is turned off, the code within Void loops functions repeats itself. Whatever we write in these twisted brasses will be repeated many times. It begins with a curly opening bracket and ends with a closing bracket. Whatever is within will begin at the top of the first line, immediately after the brackets are opened, and stop just before the brackets are closed. Whatever you type into this code will be repeated several times. If gas level raises more than normal level, this part of code will be executed.

The gas sensor will be detected the gas level and a single were passed through the Arduino board and the user will receive an alert message is sent via GSM module. When the gas leakage occurs, relay module will turn off the current supply and turn on the exhausting fan automatically. Likewise the gas leakage, the fire occurrence is also detected by the fire sensor and the alert message is passed through the GSM. The fire is measured in term of Fahrenheit which is 1.8 times greater then the Celsius. The alerting message sent to the user's mobile through the SMS, the mobile number is declared in this part of the code.

Sample Source Code

```
if(gas>700)
{
digitalWrite(9, HIGH);digitalWrite(10, LOW);
lcd.clear();        lcd.setCursor(0,0);
lcd.print("Alert : Gas Leak");        delay(1000);
lcd.setCursor(0,1);
lcd.print("SMS Sending...");
delay(1000);
send_sms_gas();        lcd.clear();
lcd.setCursor(0,0);
lcd.print("SMS Sent...");        delay(1000);lcd.clear();
delay(2000);
}
else if(temp>73)


{
 digitalWrite(9, LOW);
digitalWrite(10, LOW);
lcd.clear();        lcd.setCursor(0,0);        lcd.print("Alert
: Fire");        delay(1000);        lcd.setCursor(0,1);
lcd.print("SMS Sending...");        delay(1000);
send_sms_fire();        delay(6000);
lcd.clear();lcd.setCursor(0,0);        lcd.print("SMS
Sent...  ");        delay(1000);lcd.clear();
delay(1000);
```

```
void send_sms_fire()
  {
Serial.println("AT");
delay(500);
Serial.println("ATE0");
delay(500);
Serial.println("AT+CMGS=\"9442093608\"");
delay(500);



Serial.print("Warning: Fire occurance. ");
Serial.print(temp);
Serial.println((char)26);
delay(3000);
  }
```

V. RESULT ANALYSIS

There are generally, over 85% LPG customers in the country in which generally 40% of the gas related accidents occur because of gas leakage. So the real concern is spillage of LPG. Various guidelines are also executed for the gas spillage identification system. This current project gives an alert framework which is basically required to distinguish a Gas leakage in the houses and commercial premises using IoT Technology.

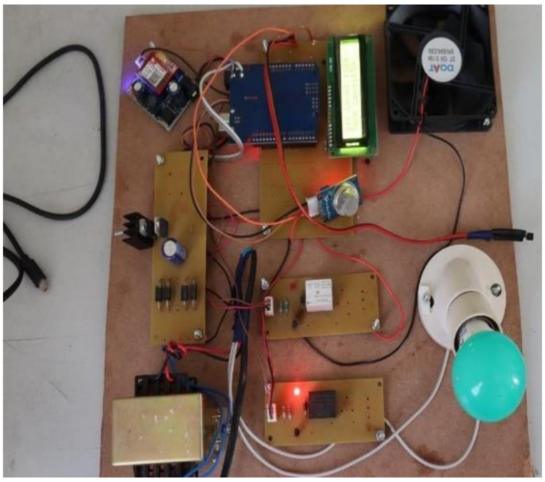
Proportional message is passed on by this methods to LCD screen with the assistance of the GSM module. It is efficient to communicate messages to the users about the LPG spill and can quickly turn off the supply of LPG. With the utilization of MQ Sensor as an extra component, user can recognize liquor smell.

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 6, June 2024

DOI: 10.17148/IARJSET.2024.11612



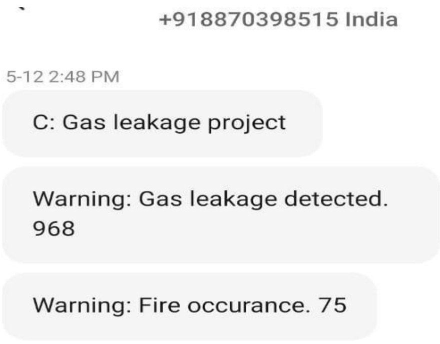


Fig 5.1 Prototype

Fig 5.2 Alert message

Fig 5.3 LCD Display

VI. CONCLUSION

The conclusion of a disaster prediction and prevention system utilizing IoT technology underscores its potential to revolutionize disaster management. By amalgamating real-time data from various IoT devices such as sensors, drones, and satellites, this system can offer invaluable insights into impending disasters, enabling proactive measures to mitigate their impact. The integration of advanced analytics and machine learning algorithms enhances the accuracy of predictive models, empowering authorities to anticipate disasters with greater precision. This foresight allows for timely evacuation plans, resource allocation, and infrastructure reinforcement, thereby minimizing casualties and damage. Furthermore, the scalability and versatility of IoT technology facilitate its deployment in diverse geographical regions and across various types of disasters, from natural calamities like hurricanes and earthquakes to human-induced emergencies like industrial accidents or pandemics.

However, challenges such as data privacy, interoperability, and cybersecurity must be diligently addressed to ensure the reliability and integrity of the system. Additionally, collaboration between governments, industries, and communities is crucial for the successful implementation and sustainability of such a system. In essence, a well-designed disaster prediction and prevention system leveraging IoT holds immense promise in enhancing resilience and saving lives in the face of calamities. Continued research, innovation, and collaboration are imperative to harness its full potential and safeguard communities against the ever-present threat of disasters.

DOI: 10.17148/IARJSET.2024.11612

REFERENCES

[1]. R. Naresh Naik et.al., “Arduino Based LPG gas Monitoring and Automatic Cylinder booking with Alert System”, Journal of Electronics and Communication Engineering (IOSR-JECE), vol 11, Jul.-Aug .2016, PP 06-12.

[2]. M.H. Muhammadsidik and S.A.Che Ghani, “Volume Measuring System Using Arduino for Automatic Liquid Filling Machine”, International Journal of Applied Engineering Research vol 12, No 24, 2017, pp. 14505-14509.

[3]. Adoh Lucky Ugochukwu et.al., “The Prevention of Railway Accident using Arduino Based Safety System”, International Journal of Engineering Research & Technology (IJERT), vol 8, September 2019.

[4]. Huan Hui Yan and Yusnita Rahayu, “A Design and Development of the Gas Leakage Monitoring System using Arduino and ZigBee”, International Conference on Electrical Engineering, Computer Science and Informatics, 20-21, August 2014.

[5]. Md. Sadad Mahamud et.al., “An Arduino Based Accident Prevention And Identification System For Vehicles”, IEEE Region 10 Humanitarian Technology Conference, 21 – 23, Dec 2017.

[6]. Juhi Chaudhary and Anurag Mishra, “Detection of Gas Leakage and Automatic Alert System using Arduino”, 2 nd international conference on advanced computing and software engineering, 2019.

[7]. Shiji Kitagami et.al., “Proposal of a Distributed Cooperative IoT System for the Flood Disaster Prevention and Its Field Trial Evaluation”, International Journal of Internet of Things, 9-16, 2016.

[8]. M. N. Mohammed et.al., “Novel covid-19 detection and diagnosis system using IoT based smart helmet”, International Journal of Psychosocial Rehabilitation, Vol. 24, 2020.

[9]. Chang-Su Ryu, “ IoT-based Intelligent for the Fire Emergency Response Systems”, International Journal of Smart Home, Vol. 9, No. 3, 2015.