AUTOMATED GAS LEAKAGE SECURITY SYSTEM

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Abstract: Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and offices. The main objective of the work is designing microcontroller based toxic gas detecting and alerting system. If toxic gases exceed the normal level then an alarm is generated immediately and an alert message (Email, SMS and calls) is sent to the authorized person through the online and offline databases using the proposed system. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation. This paper presents the growth in the industrial monitoring system's design using Internet of Things (IoT). The requirement of a gas detection system is not only to monitor the surroundings continuously but also needs to prevent the further leakage of gas in the environment to minimize the chances of fire. Thus, user can take immediate action upon leakage occurs to prevent the conditions becoming worst.

Index Terms – **Internet of Things, alert message, microcontroller.**

I. INTRODUCTION

During the last several decades there has been a growing awareness of the expanding risks and consequences of major industrial disasters. This is reflected in official statistics, mass media reports, and the appearance of new public institutions that address the problem. The growth of industrial accident prevention companies and the blossoming of literature on industrial risk assessment are other expressions of the same trend. Industrial disasters are not simply safety problems that need to be resolved: they also have wider significance because they offer important opportunities to learn about the "goodness of fit" between society, technology, and environment and about how that fit can be strengthened or weakened by unexpected events. This is the kind of information that will be invaluable to humanity during an era of deep and far-reaching societal and environmental change. However, if we are to make optimal use of such opportunities it may be necessary to modify the way we think about industrial disasters. It is customary to view industrial disasters as "extreme events" that are different mainly in degree from more mundane disruptions to which industries and society have become adjusted. It is time to make a clear distinction between two types of industrial disasters - "routine" disasters and "surprises". Routine disasters are well understood by experts and susceptible to management using long- established principles and practices. They constitute the great majority of threats to human populations.

Successful management of routine disasters mainly requires that society put into practice the ample stocks of knowledge and experience about them that already exist. Surprises, which confound both expert and lay expectations, are quite different and much less understood. They include disasters like Bhopal and Chernobyl and Minamata events or their consequences or both - that lie outside the realm of previous experience. Because surprises are unprecedented events, it is difficult to design specific anticipatory measures of the kind that have proved successful in reducing routine hazards. Industrial hazards are threats to people and life-support systems that arise from the mass production of goods and services. When these threats exceed human coping capabilities or the absorptive capacities of environmental systems they give rise to industrial disasters. Industrial hazards can occur at any stage in the production process, including extraction, processing, manufacture, transportation, storage, use, and disposal. Losses generally involve the release of damaging substances (e.g. chemicals, radioactivity, and genetic materials) or damaging levels of energy from industrial facilities or equipment into surrounding environments. This usually occurs in the form of explosions, fires, spills, leaks, or wastes.

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and huge global economic impact. The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities. The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the "smart home'', offering more security and energy efficiency. IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of "smart cities'', which help minimize congestion and energy consumption. IoT technology offers the possibility to transform agriculture, industry, and energy production and distribution by increasing the availability of information along the value chain of production using networked sensors.

The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered to be the world's worst industrial disaster. Over 500,000 people were exposed to methyl isocyanate (MIC) gas. The highly toxic substance made its way into and around the small towns located near the plant. Liquid MIC storage.

Dates: 2 Dec 1984 – 3 Dec 1984
Location: Bhopal
Deaths: At least 3,787; over 16,000 claimed
Cause: Methyl isocyanate leak from Union Carbide India Limited plant
Non-fatal injuries: At least 558,125
Location: Madhya Pradesh

The Bhopal disaster was an industrial accident. It happened at a Union Carbide subsidiary pesticide plant in the city of Bhopal, India. On the night of 2-3 December 1984, the plant released approximately 40 tons of toxic methyl isocyanate (MIC) gas, exposing more than 500,000 people to toxic gases.

A mixture of poisonous gases flooded the city, causing great panic as people woke up with a burning sensation in their lungs. Thousands died immediately from the effects of the gas. Many were trampled in the panic that followed. The first official immediate death toll was 3,598 in 1989. Another estimate is that 8,000 died within two weeks, that an additional 8,000 have since died from gas-related diseases.

So, focusing on such cases occurred previously and concerning future consequences, this project is built up. In this paper we are introducing a gas detection system which exceeds the performance of the previously existing systems. In the proposed method we make use of Arduino Uno R3 as a control system. There are many methodologies to detect the leakage of gas over pipelines. But they are not able to serve over long length of the pipeline. So, detection becomes difficult and it needs time to identify the leakage. The existing methodologies may cause severe consequences. To avoid these effects the system methodology should be updated. Then only it's possible to reduce the fire accidents. So, we modified the existing system by extending the number of sensors used in previous designs. This technique works effectively and helps us to identify the leakage easily with the help of IoT. It also allows the user to control and monitor irrespective of the location of the user.

II. LONG TERM HEALTH EFFECTS

Some data about the health effects are still not available. A total of 36 wards were marked by the authorities as being "gas affected," affecting a population of 520,000. Of these, 200,000 were below 15 years of age, and 3,000 were pregnant women. The official immediate death toll was 2,259, and in 1991, 3,928 deaths had been officially certified. The government of Madhya Pradesh confirmed a total of 3,787 deaths related to the gas release. Later, the affected area was expanded to include 700,000 citizens. A government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary partial injuries and approximately 3,900 severely and permanently disabling injuries.

A number of clinical studies are performed. The quality varies, but the different reports support each other's. Studied and reported long term health effects are:

Eyes: Chronic conjunctivitis, scars on cornea, corneal opacities, early cataracts

Respiratory tracts: Obstructive and/or restrictive disease, pulmonary fibrosis, aggravation of TB and chronic bronchitis

Neurological system: Impairment of memory, finer motor skills, numbness etc.

Psychological problems: Post traumatic stress disorder (PTSD)

Children's health: Peri- and neonatal death rates increased. Failure to grow, intellectual impairment etc.

Missing or insufficient fields for research are female reproduction, chromosomal aberrations, cancer, immune deficiency, neurological sequelae, post traumatic stress disorder (PTSD) .

Bhopal gas tragedy was an example of gas leakage accident in India. This was world's worst gas leakage industrial accident . Gas leakage detection is not only important but stopping leakage is equally essential. Our system is identified gas leakage and chemical leakage too.

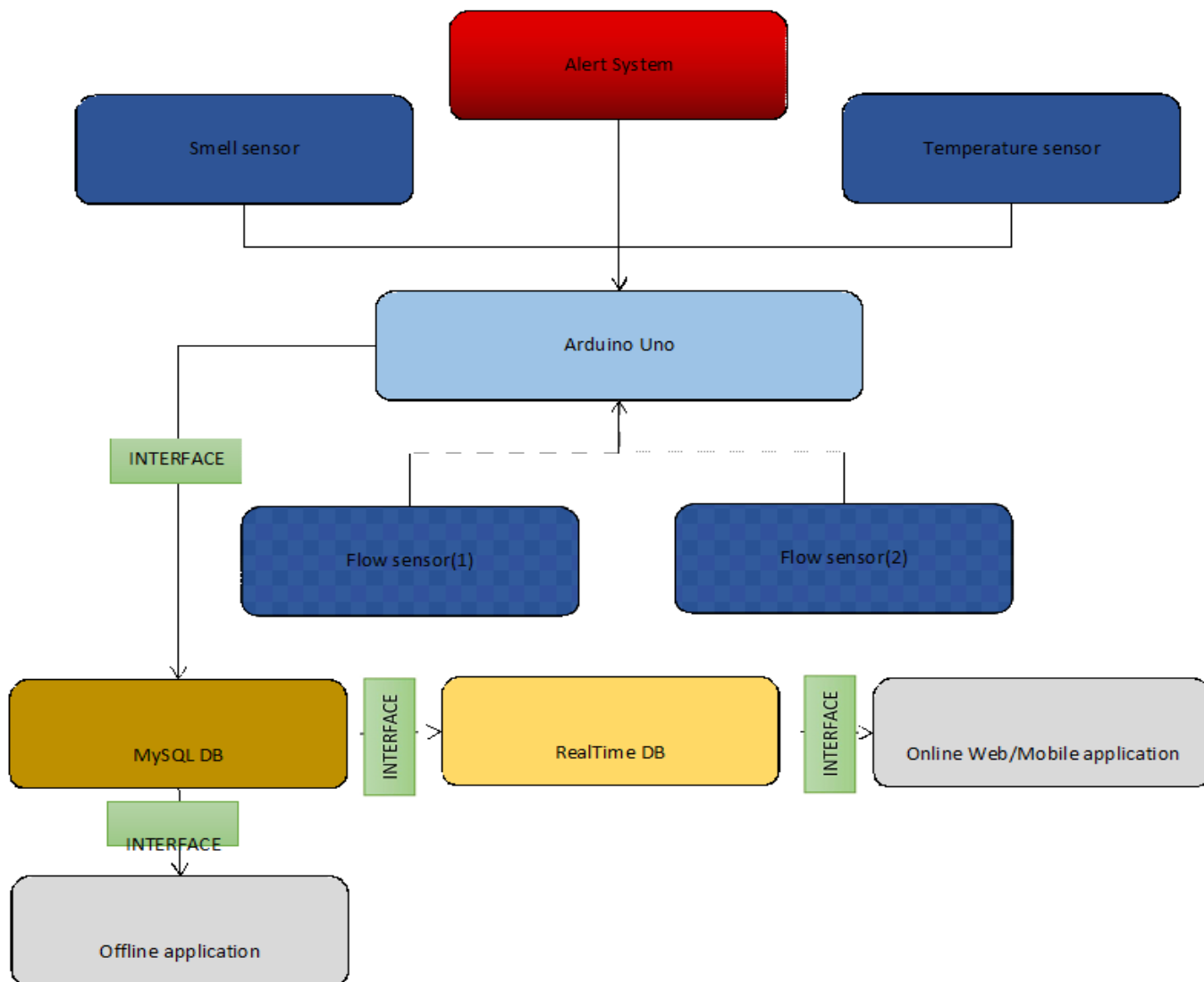### III. METHODOLOGY USED

SYSTEM BLOCK-DIAGRAM

Fig (1) System Block Diagram

The functionality of system is divided into three main steps. The Fig (1) shows the block diagram of gas leakage security system. In the initial step the alert message and alarm is alarming by the alert system. Alert system has two kind of sensor. One is smell sensor and another is temperature sensor. If any leakage is occurred in pipe then the smell sensor detect them and pass the message to the system. Pipe temperature is increase then temperature sensor pass message to the system. Both sensors are sensed and passed message to the Arduino Uno. Once the message came from sensors the alarm is start alarming and one message passed to the owner's registered phone. One message also passed to fire station and police station too. When fire is detected one phone call is went to the fire station too. Arduino Uno interfaced to database. Database interfaced to Real-time database and online web server and mobile application. Database direct interfaced to offline application too. If we don't have internet connectivity then also all the data are available and save offline too.

IoT Devices Used:

▪ GAS SENSOR:

Gas sensor has high sensitivity to ammonia gas, sulfide, benzene series steam, also can monitor smoke and other toxic gases well. It can detect kinds of toxic gases and is a kind of low-cost sensor for kinds of applications. It has good sensitivity to toxic gas in wide range, and has advantages such as long lifespan, low cost and simple drive circuit. MQ-135 gas sensor is widely used in domestic gas alarm, industrial gas alarm and portable gas detector. MQ-135 gas sensor made with SnO_2 which has lower conductivity in clean air.

Fig (2) Gas Sensor

- BUZZER:

Buzzer or a beeper is an audio signaling device which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig (3) Buzzer

- HEAT SENSORS:

A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature.

Fig (4) Heat Sensor

IV. TECHNOLOGIES USED:

In software engineering, there may be many layers between the hardware and end user. The front is an abstraction, simplifying the underlying component by providing a user-friendly interface, while the back usually handles data storage and business logic. The terms front end and back end refer to the separation of concerns between the presentation layer (front end), and the data access layer (back end) of a piece of software, or the physical infrastructure or hardware. In the client–server model, the client is usually considered the front end and the server is usually considered the back end, even when some presentation work is done on the server itself.

- FRONTEND:

➢ Firebase

Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014. As of October 2018, the Firebase platform has 18 products, which are used by 1.5 million apps. Firebase provides a real-time database and back-end as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. The company provides client libraries that enable integration with Android, iOS, JavaScript, Java, Objective-C, Swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js. The REST API uses the Server-Sent Events protocol, which is an API for creating HTTP connections for receiving push notifications from a server. Developers using the real-time database can secure their data by using the company's server-side-enforced security rules. The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in real-time.

➢ jQuery

jQuery is a JavaScript library designed to simplify HTML DOM tree traversal and manipulation, as well as event handling, CSS animation, and Ajax. It is free, open-source software using the permissive MIT License. As of May 2019, jQuery is used by 73% of the 10 million most popular websites. Web analysis indicates that it is the most widely deployed JavaScript library by a large margin, having 3 to 4 times more usage than any other JavaScript library. jQuery's syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and develop Ajax applications. jQuery also provides capabilities for developers to create plug-ins on top of the JavaScript library. This enables developers to create abstractions for low-level interaction and animation, advanced effects and high-level, theme able widgets. The modular approach to the jQuery library allows the creation of powerful dynamic web pages and Web applications. The purpose of jQuery is to make it much easier to use JavaScript on your website. jQuery takes a lot of common tasks that require many lines of JavaScript code to accomplish and wraps them into methods that you can call with a single line of code. jQuery also simplifies a lot of the complicated things from JavaScript.

➢ JavaScript

JavaScript (js) is a light-weight object-oriented programming language which is used by several websites for scripting the webpages. It is an interpreted, full-fledged programming language that enables dynamic interactivity on websites when applied to an HTML document. It was introduced in the year 1995 for adding programs to the webpages in the Netscape Navigator browser. Since then, it has been adopted by all other graphical web browsers. With JavaScript, users can build modern web applications to interact directly without reloading the page every time. The traditional website uses js to provide several forms of interactivity and simplicity.

Although, JavaScript has no connectivity with Java programming language. The name was suggested and provided in the times when Java was gaining popularity in the market. In addition to web browsers, databases such as CouchDB and MongoDB uses JavaScript as their scripting and query language. JavaScript is a text-based programming language used both on the client-side and server-side that allows you to make web pages interactive. Where HTML and CSS are languages that give structure and style to web pages, JavaScript gives web pages interactive elements that engage a user.

➢ KendoUI

Kendo UI is a comprehensive HTML5 user interface framework for building interactive and high-performance websites and applications. Kendo UI for jQuery provides AngularJS and Bootstrap integration. its a "Javascript framework for building modern interactive web applications". These days people expect rich interactive and fluent websites and in order to achieve that a developer must make good use of the available client-side technologies which Kendo UI does for you. Kendo UI is basically a collection of scripts, styles and images. When you install it you simply have a lot of javascript files, stylesheets, images, etc. in your project. Kendo UI leverages many of the existing technologies to make the rich immersive web application.

➢ Arduino Uno R3

The *Arduino Uno R3* is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins. Programs can be loaded on to it from the easy-to-use *Arduino* computer program. The main advantage of this board is if we make a mistake, we can change the microcontroller on the board. The programming of this board can easily be loaded by using an Arduino computer program. This board has huge support from the Arduino community, which will make a very simple way to start working in embedded electronics, and many more applications. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases. The Uno-board is the primary in a sequence of USB-Arduino boards, & the reference model designed for the Arduino platform.

➢ Popper
➢ Sweet alert

Popper and sweet alert are alert boxes. Alert messaging (or alert notification) is machine-to-person communication that is important or time sensitive. Alerting makes it possible for people to keep up with the information that matters most to them. Alerts are typically delivered through a notification system and the most common application of the service is machine-to-person communication. Very basic services provide notification services via email or SMS. More advanced systems (for example AOL) provides users with the choice of selecting a preferred delivery channel such as e-mail, Short Message Service (SMS), instant messaging (IM), via voice through voice portals, desktop alerts and more. Our system is using emails, sms and call services getting accessed via offline and online database.

➢ Nexmo

Nexmo is sms alert service which is used while sending sms. Nexmo connects your apps directly to carriers around the world. Integrates sms and voice messages using one simple api.. use nexmo variety to register users, verify transactions and implements two factors authentications. Nexmo is the tool in the voice and sms category of a tech stack. Voice and sms services are triggered by java script at the time of alert whenever the event of security happens.

➢ .NET Windows Form

.net form is used to display offline data which is coming from MySQL database and the windows form will read that and simply display the data. Windows Forms is a set of managed libraries in .NET Framework designed to develop rich client applications. It is a graphical API to display data and manage user interactions with easier deployment and better security in client applications.

Windows Forms offers an extensive client library providing interface to access native Windows graphical interface elements and graphics from managed code. It is built with event-driven architecture like Windows clients and hence, its applications wait for user input for its execution. Every control in Windows Forms application is a concrete instance of a class. The layout of a control in the GUI and its behavior are managed using methods and accessors. Windows Forms provides a variety of controls, such as textboxes, buttons, and web pages along with options to create custom controls. It also contains classes for creating brushes, fonts, icons, and other graphic objects (like line and circle).

Windows Forms Designer is a tool, in Visual Studio.NET, used to insert controls in a form and arrange them as per desired layout, with provision for adding code to handle their events, which implement user interactions. Tabular data that is bound to XML, database, etc. can be displayed using DataGrid View control in the form of rows and cells. Application settings is another feature of Windows Forms to create, store, and maintain runtime state information in an XML form that can be used to retrieve the user-preferred settings, such as toolbar positions and most-recently used lists. These settings can be reused in a future application.

➢ HTML

Hypertext Markup Language is the standard markup language for documents designed to be displayed in a web browser. Hypertext Markup Language (HTML) is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript. Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page. HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items.

▪ Backend:

➢ PHP – Webservices

Webservices are used to allow user to access data from different sources like Android app, IOS app, website, etc. from a centralized database. PHP is a popular general-purpose scripting language that is especially suited to web development. PHP originally stood for Personal Home Page, but it now stands for the recursive initialism PHP: Hypertext Preprocessor. PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side. PHP is well suited for web development. Therefore, it is used to develop web applications (an application that executes on the server and generates the dynamic page.). PHP is an interpreted language, i.e., there is no need for compilation. PHP is faster than other scripting languages, for example, ASP and JSP. PHP is a server-side scripting language, which is used to manage the dynamic content of the website. PHP can be embedded into HTML.PHP is an object-oriented language. PHP is an open-source scripting language.

➤   MySQL

MySQL is an Oracle-backed open source relational database management system (RDBMS) based on Structured Query Language (SQL). MySQL runs on virtually all platforms, including Linux, UNIX and Windows. Although it can be used in a wide range of applications, MySQL is most often associated with web applications and online publishing. MySQL is used for a wide range of purposes, including data warehousing, e-commerce and logging applications, mainly used for the purpose of a web database. MySQL is based on a client-server model. The core of MySQL is MySQL server, which handles all of the database instructions (or commands). MySQL server is available as a separate program for use in a client-server networked environment and as a library that can be embedded (or linked) into seperate applications.

MySQL operates along with several utility programs which support the administration of MySQL databases. Commands are sent to MySQLServer via the MySQL client, which is installed on a computer. MySQL was originally developed to handle large databases quickly. Although MySQL is typically installed on only one machine, it is able to send the database to multiple locations, as users are able to access it via different MySQL client interfaces. These interfaces send SQL statements to the server and then display the results.

➤   Apache(server)

Apache Web Server is an open-source web server creation, deployment and management software. Initially developed by a group of software programmers, it is now maintained by the Apache Software Foundation. It is fast, reliable and secure. Here in project apache is the PHP's server. It is providing Local Host and all the services of PHP are running on Apache. Apache Web Server is designed to create web servers that can host one or more HTTP-based websites. Notable features include the ability to support multiple programming languages, server-side scripting, an authentication mechanism and database support. Apache Web Server can be enhanced by manipulating the code base or adding multiple extensions/add-ons. It is also widely used by web hosting companies for the purpose of providing shared/virtual hosting, as by default, Apache Web Server supports and distinguishes between different hosts that reside on the same machine.

➤   Python (Serial Input)

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently whereas other languages use punctuation, and it has fewer syntactical constructions than other languages. It supports functional and structured programming methods as well as OOP. It can be used as a scripting language or can be compiled to byte-code for building large applications. It provides very high-level dynamic data types and supports dynamic type checking. It supports automatic garbage collection. It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

➤   C#

C# is a general-purpose, multi-paradigm programming language encompassing strong typing, lexically scoped, imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. C# is one of the programming languages designed for the Common Language Infrastructure (CLI). C# is intended to be suitable for writing applications for both hosted and embedded systems, ranging from the very large that use sophisticated operating systems, down to the very small having dedicated functions. It provide support for software engineering principles such as strong type checking, array bounds checking, detection of attempts to use uninitialized variables, and automatic garbage collection. Software robustness, durability, and programmer productivity are important.

V. RESULTS

The prototype of the gas and chemical detection system has been shown in fig . This system has been tested by taking a small amount of mixer of air and water near to the sensor Smell sensor and temperature sensor detect the leakage and send signal to the microcontroller. After that microcontroller send an active signal to other externally connected devices. As a results alarm rings and a message is send to owner's registered contact number and a fire station. One call has been connected to fire station too.
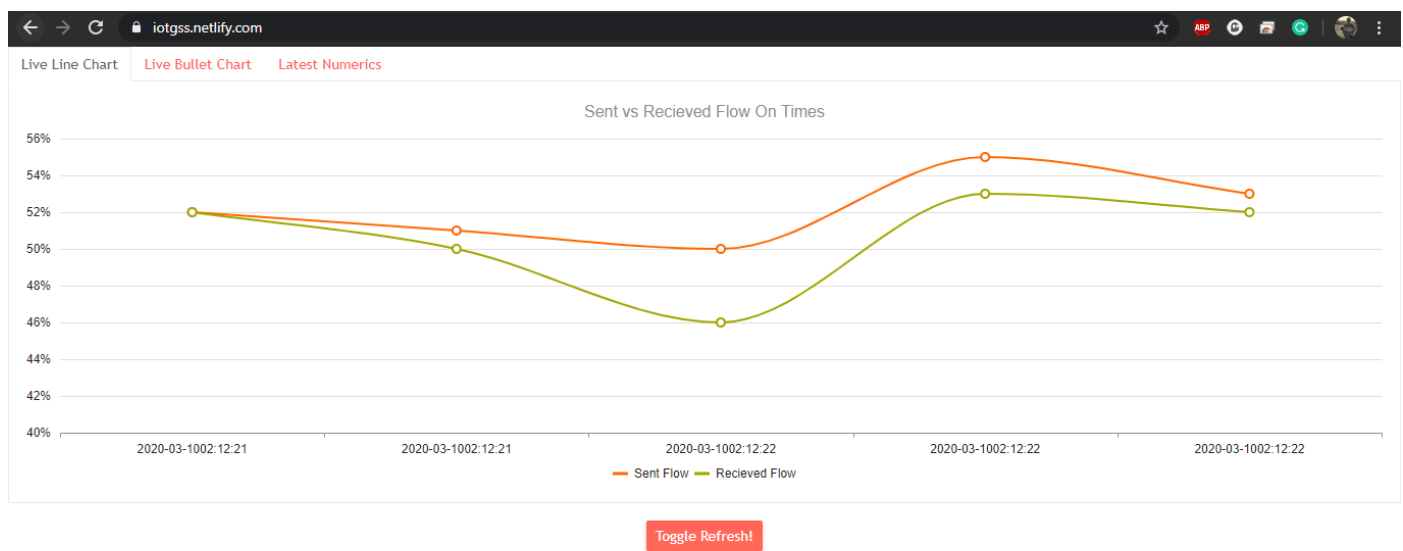
Fig (5) Graphical Representation

Whenever gas or liquid leakage has been occur in the system at that we will see one flow in the graph. Fig (5) shows the leakage in the graph.

Fig (6) Heat Index

In the Fig (6) we have seen heat index. Whenever temperature is increased it will reflect in the graph too.
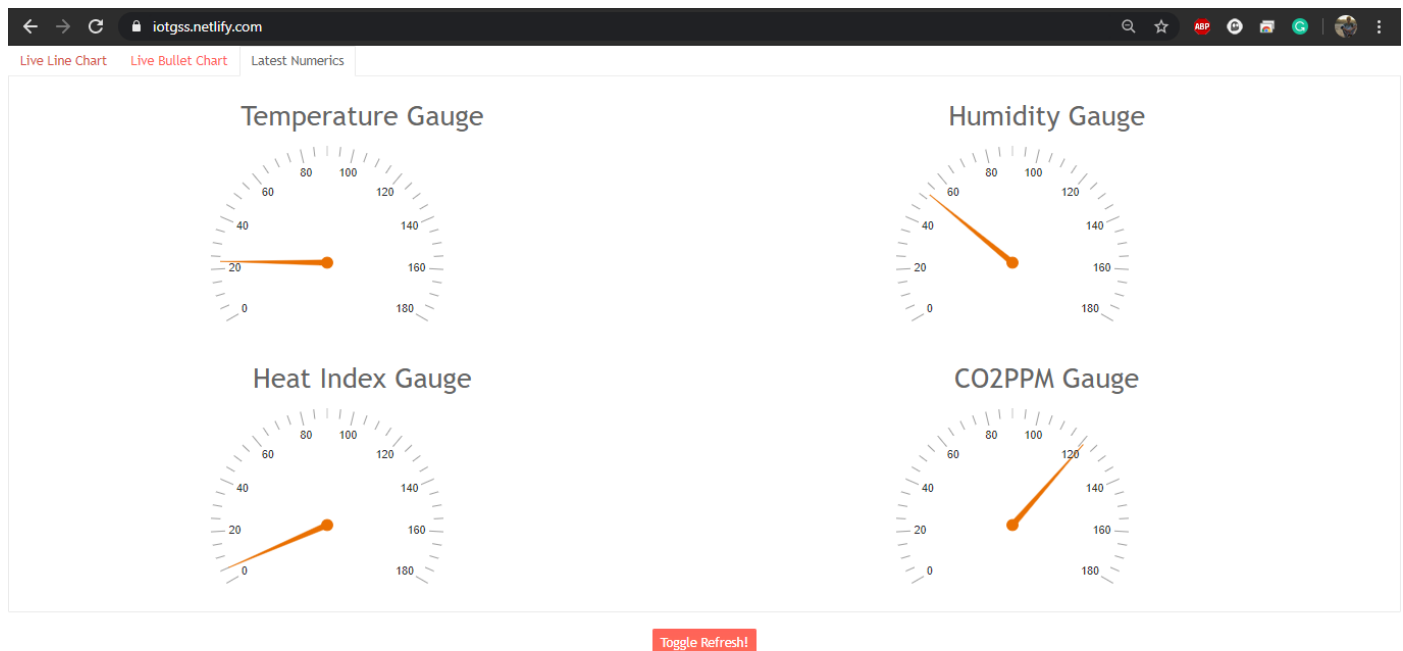
Fig (7) Temperature Gauge

In the above figure (7) we have seen temperature meter. We have seen increased temperature in the device.

Fig (8) Prototype model of proposed system

VI. CONCLUSION

In this system we have describe a new approach for gas and chemical leakage detection system at online as well as offline. The leakage is detected with the help of sensors. Sensors send a signal to microcontroller. In the next step microcontroller sends an active signal to other externally connected devices. The efficiency and memory of the microcontroller can be increased if AT89C51. We have also used some high range sensors for accuracy.

REFERENCES

[1] http://indiatoday.intoday.in/gallery/bhopal-gas-tragedy-in- pics/1/3261.html

[2] Envis Nigh Major Industrial disaster in India Article -2014 Research Gate, National Institute of Occupational health

[3] http://en.wikipedia.org/wiki/Bhopal_disaster

[4] Osney Mead 2004. Amnesty International Publication by Alden Press.

[5] Gupta, Anil K., Nair, Sreeja S. and Shard (2009). Chemical Disaster Management (Proceeding Vol tional Institute of Disaster Management, New Delhi. Pages 76. -ume of National Workshop on Preparation of National Action Plan). Ministry of Environment and Forests, Govt. of India and National Institute of Disaster Management,

[6] John stuart May 14, 2015 Sensor management system an IoT network , Patent Application Publication by Walley US.

[7] David W , Jul 25,2017 System & Method for Internet of Things Security & Management ,United state patent by Kravitz.