



# MICROCONTROLLER BASED FIRE MONITORING SYSTEM IN PETROCHEMICAL INDUSTRIES

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*Abstract:* The Internet of Things pertains to connecting currently unconnected things and people. It is the new era in transforming the existed systems to amend the cost effective quality of services for the society. To support Smart city vision, Urban IoT design plans exploit added value services for citizen as well as administration of the city with the most advanced communication technologies. To make emergency response real time, IoT enhances the way first responders and provides emergency managers with the necessary up-to-date information and communication to make use those assets. IoT mitigates many of the challenges to emergency response including present problems like a weak communication network and information lag. In this paper it is proposed that an emergency response system for fire hazards is designed by using IoT standardized structure. To implement this proposed scheme a low-cost Espressif wi-fi module, Flame detection sensor, Smoke detection sensor, Flammable gas detection sensor are used. The sensors detects the hazard and alerts the local emergency rescue organizations like fire departments and police by sending the hazard location to the cloud-service through which all are connected. The overall network utilizes a light weighted data oriented publish-subscribe message protocol MQTT services for fast and reliable communication. Thus, an intelligent integrated system is designed with the help of IoT.

*Index Terms* – Microcontroller, IOT, Sensors, Wi-fi

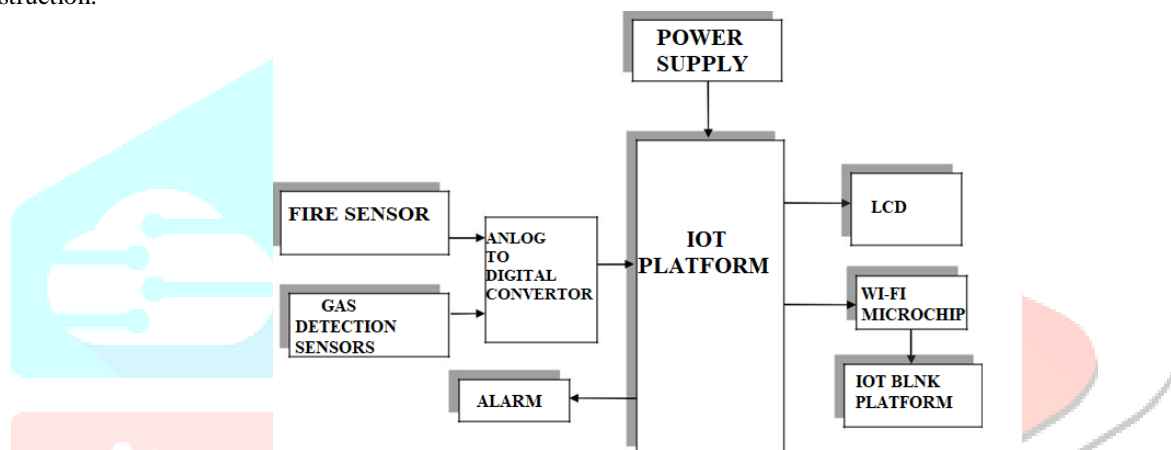
## I. INTRODUCTION

In IoT the devices can communicate with each other and independently configure themselves in a network of multiple Internet connected devices. To unleash smart cities development agenda, many existing systems with the specific application domain to serve a greater good in urban areas adopting this modern IoT technology. After adopting this emerging technology, machine to machine communication transforms the existing human-to-human or human-machine forms of communication. The proposed system is capable of detecting smoke, different flammable gases and fire. This system is capable of providing hazard location coordinates to the nearby fire department. This fire hazard sensing system with systematic IoT framework emphasis an application innovation to the public safety and livelihood service sector. The fire hazard sensing system with IoT standardized design method. The smoke detection sensor MQ-2 is used to detect the smoke, the Flame detection sensor is used to sense the flame, the flammable gas sensor MQ-5 is used to detect the gases like LPG/LNG and the GPS module is to obtain device location. These sensors along with Wi-Fi micro-controller are connected to a MQTT broker via Internet through which it communicate hazard status to the nearest fire-fighting organizations. The LPG or propane which is flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, vehicles because of its desirable properties which include high calorific value, which produce the less smoke, produces less soot, and does not cause much harm to the environment. Natural gas is another widely used fuel in homes. Both gases burns to produce clean energy, however there is a serious problem about their leakage in the air. The gases being heavier than air do not disperse easily and may lead to suffocation when inhaled also when gas leakage into the air may lead to explosion. Due to the explosion of LPG the number of deaths has been increased in recent years. To avoid this problem there is a need for a system to detect and also prevent leakage of LPG. Gas leak detection is the process of identifying potentially hazardous gas leaks by means of various sensors. These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected. Liquefied petroleum gas is being used for the past decades as industrial fuel and for domestic purpose. It has a characteristic of smokeless burning in the air. The main constituents of LPG are propane and butane and depending on the applications their proportions vary. Gas leakage detection in residential houses has become one of the fundamental issues in the recent times. Accidents mainly occur due to the negligence and technical fault. Electronic and press media have reported many accidents which were caused mainly because of gas leakage in residential houses and industries. A better system needs to be developed to reduce the accidents because of gas leakage. The gas is generally stored in metallic cylinders as its boiling point is lower than ambient temperature. Gas is molecularly heavy than other gases present in the air.

So whenever the gas is leaked it settles closest to the ground level. And unless you provide a powerful exhaust system it cannot be forcefully disposed into open atmosphere. Now-a-days LPG leakage detection in homes, restaurants has been a common issue and the detection systems find applications in the market. Presently they are using load cell to measure the weight of the cylinder. When they find it become empty, consumer will order for a new cylinder. There may be a delay in providing the cylinder for few reasons like we may inform the service provider at the last moment when the gas is empty or there may be a delay in informing the gas provider. So in this system we will use a pressure sensor to measure the amount of gas present in the cylinder and also book the gas automatically when it reaches to a certain level. LPG is generally odourless and cannot be detected by human sense of smell because of its odourless nature. A pungent chemical is added to it purposely so that humans can detect the gas. There are few disadvantages anyhow. Firstly, it requires human presence in the vicinity. Secondly, by the time gas leakage is detected, its concentration in the vicinity may exceed the threshold level and may lead to explosion with the spark like light switch. So in order to monitor its presence, sensing systems are deployed in the premises to detect the leakage and avoid accidents. Many sensors are available in the market which can warn the gas leakage. They make use of transmitters, controllers and other accessories but the cost of these kind of sensing systems is high and has technical complexity and also inaccurate with delays. Therefore, there is a need for the development of lower complexity, low cost and fast response systems.

## II. PROPED METHOD

A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks. They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams. Block diagrams are typically used for higher level, less detailed descriptions that are intended to clarify overall concepts without concern for the details of implementation. Contrast this with the schematic diagrams and layout diagrams used in electrical engineering, which show the implementation details of electrical components and physical construction.

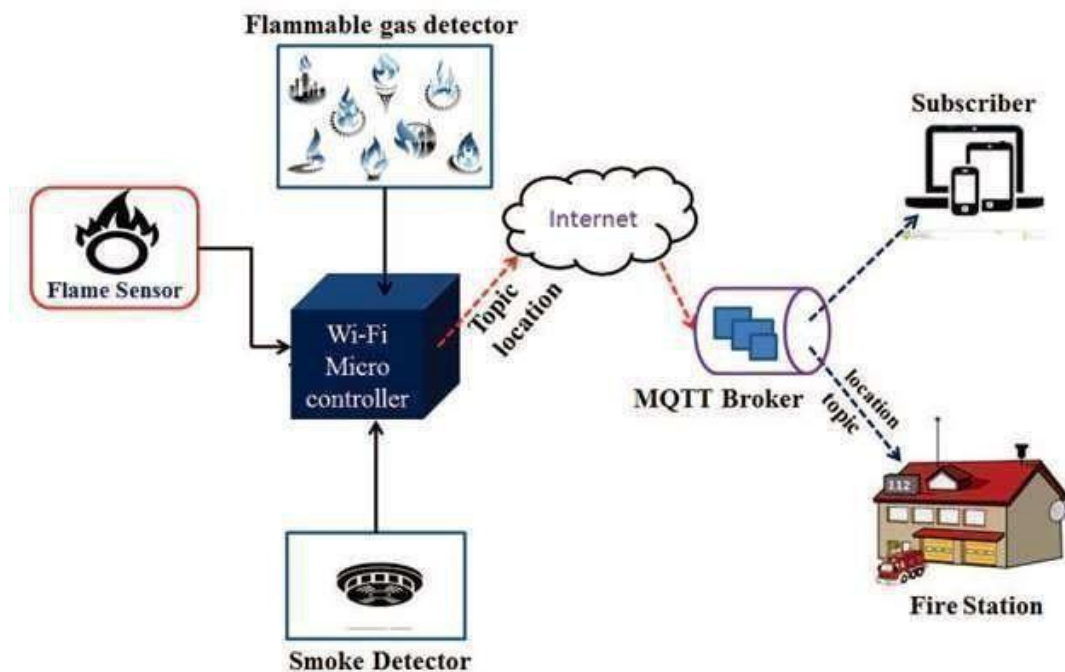


## III. WORKING PRINCIPLE

The Wi-Fi micro-controller board is powered up by using USB cable. Different sensors for different measurements are used and interfaced to the micro-controller board. Flame sensor output pins which are connected to analog read general purpose I/O interface pins respectively. The gas sensor are connected to pins of the board respectively. And GPS module has both transmitter and receiver pins which are connected pins of Wi-fi Microchip board respectively. After that, the logic is structured as required to operate the whole system as desired. For the desired system programming part is done in open source software.

## IV. SYSTEM ARCHITECTURE

A system architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. A system architecture can consist of system components and the sub-systems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture, collectively these are called architecture description languages Wi-fi microchip is the most advanced Espressif Wi-Fi micro-controller board. It is integrated with built in antenna switches, power amplifier and RF balun. Its compact design includes Flash memory and it has ESP32SoC and PCB antenna for better RF performance. Wi-fi microchip is well known for its hybrid functionality which consists of Bluetooth and Wi-Fi. It supports WPA/WPA and WEP for security aspects.



For industrial environments it can give more reliability because it can adopt to environmental changes. It's operating temperature range is  $-40^{\circ}\text{C}$  to  $+120^{\circ}\text{C}$ . It can be interfaced with other devices using I2C/UART or SPI/SIDO interfaces. It has some built in sensors like Hall sensor, Ultra low noise analog amplifier and touch interface. As compared to other Espressif models its performance is better. Its receiver sensitivity up to  $-98\text{dBm}$  and transmit power range up to  $19.20\text{dBm}$ . Wi-fi Microchip is mainly designed for Low power applications like IoT based electronic industrial appliances.

## V. RESULT

The receiving end of the system are RF transceiver, a voltage conversion, a voltage conversion unit, a USB interface and a PC. The RF transceiver service the purpose of receiving the signal that are transmitted by the portable or the fixed device through the zigbee network to the receiving end at the control room. The voltage conversion units is used for the conversion of the incoming signal into voltage that is compatible with an output device is any piece of computer hardware equipment used to communicate. If the smoke caused due to fire is detected at the initial stage then the fire can be controlled. And we can avoid a huge damage which is caused due to the Fire. This fire alarm circuit using PIC microcontroller project will help in smoke detection at early stage by giving a smart alert with the help of buzzer connected to the project. Smoke alarm is implemented using this Buzzer. By using this paper we can avoid an industrial based accident. In case of any fire accident which lead to destroy the major equipment in industries, which lead to major loss in finance and component also. This paper helps to avoid the losses of the industries.

## VI. CONCLUSION

In this paper, It is mentioned that Internet of Things is an emerging technology which helps in providing smart solutions in Smart city development aspect. In providing a quality public safety and security services it is very important to adopt leveraged data driven emergency response systems with urban IoT design standards. A smart emergency response system for fire hazards is designed and implemented with required IoT standards which prioritize the immediate rescue operations by pushing relevant information to the public safetymanagements.

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