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Institute of Engineering & Technology

MID TERM REPORT

On

SMART KITCHEN

Submitted by

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PROBLEM STATEMENT

The problem in smart kitchen is classifying the leakage in the kitchen, rise in temperature and humidity.

OBJECTIVE

Kitchen is a place where meals are prepared and in hotels and restaurants where more than dozens of people cooks food some critical conditions may arrive like leakage of gas or unhandled rise of temperature due to some technical failure. In our day-to-day life there is serious threat about leakage which leads to suffocation when inhaled, when ignited leads to explosion and causes a number of deaths. According to business standard more than 260 lives were lost due to gas leakage alone in 2017-18 which may tend to increase if both factors are considered.

Latest technology like IOT can be used in prevents life loss where embedded devices along with sensors can used for monitoring temperature and gas leakage and alerting user via email or any other medium.

The objective of this project is about designing a LPG leakage monitoring system along with temperature detection to avoid disasters and hazards which is proposed for home safety. In this project gas leakage of LPG and temperature inside kitchen is monitored by the help of gas detection app which receives real-time data from nodemcu attached with gas sensor and humidity and temperature sensor.

INTRODUCTION TO INTERNET OF THINGS

What is IOT?

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems.

Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things.

In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers.

There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to address these concerns have begun.

History

The main concept of a network of smart devices was discussed as early as 1982, with a modified Coca-Cola vending machine at Carnegie Mellon University becoming the first Internet-connected appliance able to report its inventory and whether newly loaded drinks were cold or not.

Mark Weiser's 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as Ubicomp and Precoma produced the contemporary vision of the IoT.

Applications

1. Consumer Application

a. Smart home

1. IoT devices are a part of the larger concept of home automation, which can include lighting, heating and air conditioning, media and security systems.

2. Long-term benefits could include energy savings by automatically ensuring lights and electronics are turned off.

3. A smart home or automated home could be based on a platform or hubs that control smart devices and appliances.

4. For instance, using Apple's Home Kit, manufacturers can have their home products and accessories controlled by an application in iOS devices such as the iPhone and the Apple Watch.

5. This could be a dedicated app or iOS native applications such as Siri.

b. Elder care

1. One key application of a smart home is to provide assistance for those with disabilities and elderly individuals.

2. These home systems use assistive technology to accommodate an owner's specific disabilities.

3. Voice control can assist users with sight and mobility limitations while alert systems can be connected directly to cochlear implants worn by hearing-impaired users.

2. Commercial Application

a. Medical and healthcare

1. The Internet of medical things (IoMT) is an application of the IoT for medical and health related purposes, data collection and analysis for research, and monitoring.

2. The IoMT has been referenced as "Smart Healthcare”, as the technology for creating a digitized healthcare system, connecting available medical resources and healthcare services.

3. IoT devices can be used to enable remote health monitoring and emergency notification systems.

4. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of

monitoring specialized implants, such as pacemakers, Fitbit electronic wristbands, or advanced hearing aids.

b. Transportation

1. The IoT can assist in the integration of communications, control, and information processing across various transportation systems.

2. Application of the IoT extends to all aspects of transportation systems (i.e. the vehicle, the infrastructure, and the driver or user).

3. Dynamic interaction between these components of a transport system enables inter- and intra-vehicular communication,smart traffic control, smart parking, electronic toll collection systems, logistics and fleet management, vehicle control, safety, and road assistance. In Logistics and Fleet Management, for example an IoT platform can continuously monitor the location and conditions of cargo and assets via wireless sensors and send specific alerts when management exceptions occur (delays, damages, thefts, etc.).

c. Building and home automation

IoT devices can be used to monitor and control the mechanical, electrical and electronic systems used in various types of buildings (e.g., public and private, industrial, institutions, or residential) in home automation and building automation systems. In this context, three main areas are being covered in literature:-

1. The integration of the Internet with building energy management systems in order to create energy efficient and IOT-driven "smart buildings".

2. The possible means of real-time monitoring for reducing energy consumption [60] and monitoring occupant behaviors.
3. The integration of smart devices in the built environment and how they might to know how to be used in future applications.

d. Agriculture

1. There are numerous IoT applications in farming such as collecting data on temperature, rainfall, humidity, wind speed, pest infestation, and soil content.

2. This data can be used to automate farming techniques, take informed decisions to improve quality and quantity, minimize risk and waste, and reduce effort required to manage crops. For example, farmers can now monitor soil temperature and moisture from afar, and even apply IoT-acquired data to precision fertilization programs.

3. Infrastructure Application

Monitoring and controlling operations of sustainable urban and rural infrastructures like bridges, railway tracks and on- and offshore wind-farms is a key application of the IoT.

The IoT infrastructure can be used for monitoring any events or changes in structural conditions that can compromise safety and increase risk.
The IoT can benefit the construction industry by cost saving, time reduction, better quality workday, paperless workflow and increase in productivity.

It can help in taking faster decisions and save money with Real-Time Data Analytics.

It can also be used for scheduling repair and maintenance activities in an efficient manner, by coordinating tasks between different service providers and users of these facilities.

a. Environmental monitoring

1. Environmental monitoring applications of the IoT typically use sensors to assist in environmental protection by monitoring air or water quality, atmospheric or soil conditions, and can even include areas like monitoring the movements of wildlife and their habitats.

2. Development of resource-constrained devices connected to the Internet also means that other applications like earthquake or tsunami early-warning systems can also be used by emergency services to provide more effective aid.

3. IoT devices in this application typically span a large geographic area and can also be mobile.

4. It has been argued that the standardization IoT brings to wireless sensing will revolutionize this area.

INTRODUCTION OF SMART KITCHEN

Introduction

The applications of Information communication technology have brought a sea change in human life. The present-day society is moving towards the adaptation of the digital environment.

The earlier ‘internet of computers’ transformed into ‘internet of people’ by introduction of social websites. The next wave is mobile computing. The different generations of internet connection have made it possible for faster accessibility accompanied by better quality. The further advancement of this technology is the ‘Internet of Things’ through which, the interoperability and intelligence can be achieved. This is possible through communication between certain devices that are connected through the internet, wireless sensor networks and smart phones. These devices in the system are able to perceive, process and deliver the product as per the programming. technologies such as sensors, Cloud Computing, Networking Technology and Nanotechnology have been used. The applications of IoT can be observed in number of areas in various kitchens. Kitchen is the unique place, called the main hub or the heart of the home or hotel industries. It is the place where one of the basic needs i.e. food is prepared. It is the common centre of social activities of all the family members who share their feelings or emotions. It is equipped with all basic amenities.

Smart Kitchen is a technologically advanced system that incorporates interactive services. It is a built-in system which consists of a dangerous item like electric stove, Gas cylinders, Fridge, oil and etc. The reader and tags to provide all the necessary information regarding he safety level of all the items in kitchen. In this project the different technologies, and applications involved in IoT, in different fields and a special mention regarding its role in Smart Kitchen has been discussed and involved.

Scope

When things like household appliances are connected to a network, they can work together in cooperation to provide the ideal service as a whole, not as a collection of independently working devices. This is useful for many of the real-world applications and services, and one would for example apply it to build a smart residence; windows can be closed automatically when the air conditioner is turned on, or can be opened for oxygen when the gas oven is turned on. The idea of IoT is especially valuable for persons with disabilities, asIoT technologies can support human activities at larger scale like building or society, as the devices can mutually cooperate to act as a total system. So far, much work has been done on realizing the IoT.

BOARDS AND SENSORS

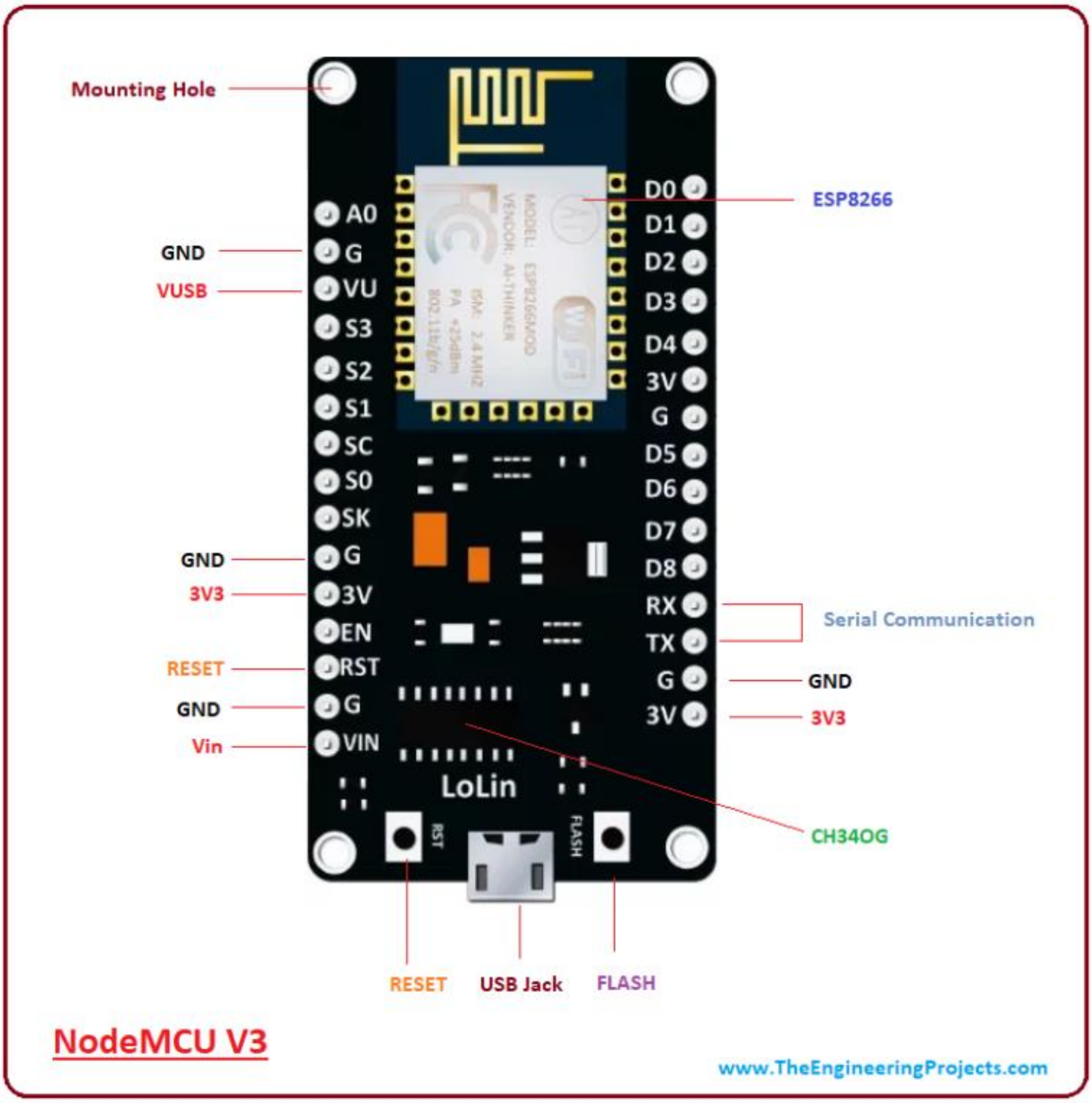
1. NodeMCU

NodeMCU is an open-source platform (any hardware or software on which we can run our program) and development kit developed for ESP8266 Wi-Fi SoC from Espressif Systems and the hardware is based on the ESP-12 module. MCU stands for Micro Controller unit means a computer on a single chip. Their firmware coded in LUA scripting language. It is a single-board microcontroller. Their memory is 128kBytes and storage 4Mbytes. They powered by USB. NodeMCU started on 13 October 2014 which developed by Huang R and their team afterward the other independent groups contributes on 30 Jan 2015. NodeMCU produced and in 2016 there are more than 40 different modules are produced.

There are two versions of the module. There are a few differences between the two versions. There is a slight difference in the antenna design of the different versions of NodeMCU. There are extra six pins in the 2nd version of NodeMCU namely MTDO, MTDI, SD_3, MTMS, MTCK, SD_2.

NodeMCU uses XTOS operating system. This board has a storage capacity of RAM support up to 16mb of external flash storage and 128k Bytes memory.

The energy consumption of NodeMCU is very less and it supports Wi-Fi. It has a drawback that we need to learn another programming language Lua. There are following two IDE's used for writing code for NodeMCU named ESPlorer IDE (can code only in Lua language) and Arduino IDE (can code in C/C++).



There is a total of 30 pins in NodeMCU. 4 power pins one for Vin and three other pins for supplying 3.3V for supplying voltage to the external peripheral devices connected to the board. 4 ground pins in NodeMCU. It has I2C pins stands for Inter-Integrated circuit which consists of two pins one for SDA (Serial Data used for data exchange) and another is SCL (Serial Clock which provides clock frequency of 100 kHz). There are two modes supported in this board namely master mode and slave mode. This circuitry consists of one 10-bit ADC Channel (Analog to digital converter). This micro-controller consists of 16 GPIO pins pronounced as General-purpose Input/output Pin. It has a UART interface which is used to load code serially. There are SPI pins. SDIO stands for a Secured digital Input/output interface. It consists of PWM Pins or 4 Pulse Width Modulation channels used for operating digital motor and LED. Control Pins includes EN pin (chip enable) when this pin is high, the ESP8266 chip is enabled, the RST pin (Reset pin) for reset the pin and WAKE pin used for activating the chip from deep-sleep. There is SPI, I2C and I2S interface present in the board which is used to handle all types of sensors and peripheral devices.

History

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to the NodeMCU project, enabling NodeMCU.

Overview

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Ten silica Xtensa LX106 core, widely used in IoT applications (see related projects).

Pins

NodeMCU provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

I/O index	ESP8266 pin
0 [*]	GPIO16
1	GPIO5
2	GPIO4

3	GPIO0
4	GPIO2
5	GPIO14
6	GPIO12
7	GPIO13
8	GPIO15
9	GPIO3
10	GPIO1
11	GPIO9
12	GPIO10

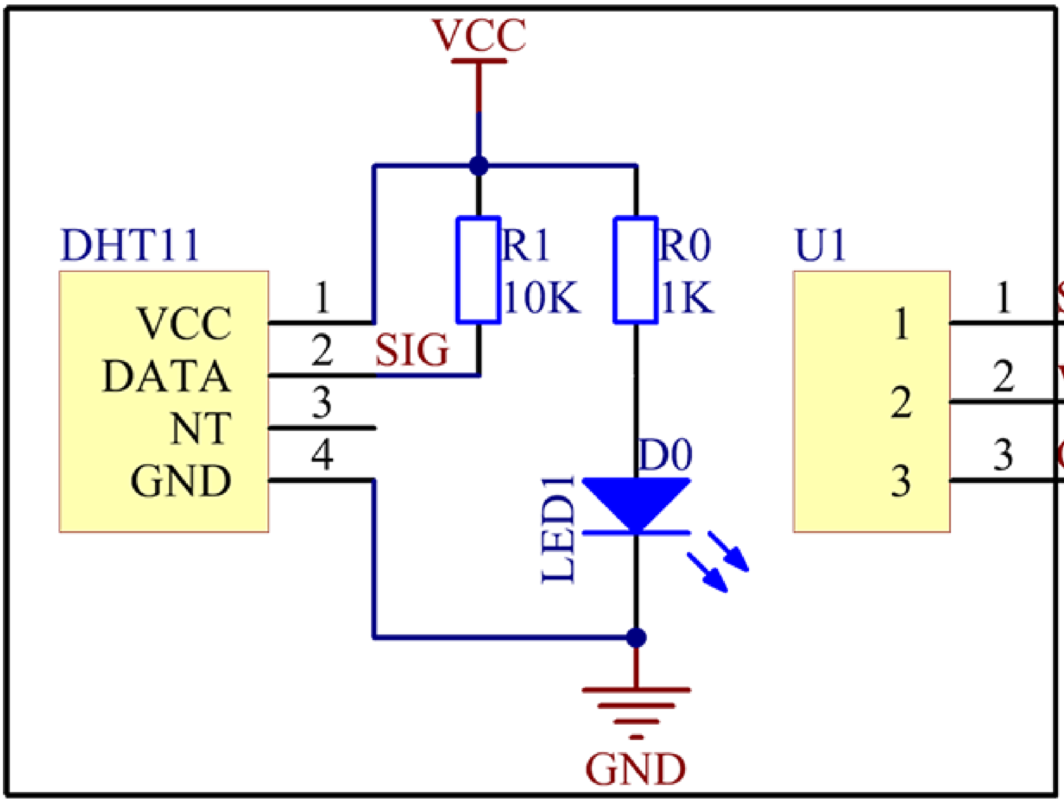
2. DHT11 Sensor

Introduction

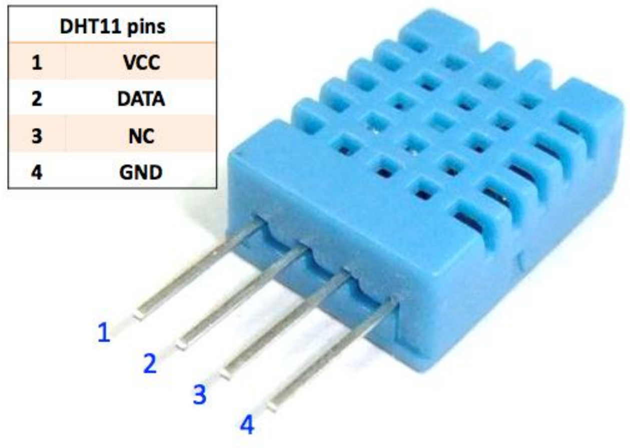
The digital temperature and humidity sensor DHT11 are a composite sensor that contains a calibrated digital signal output of temperature and humidity. The technology of a dedicated digital modules collection and the temperature and humidity sensing technology are applied to ensure that the product has high reliability and excellent long-term stability.

The sensor includes a resistive sense of wet component and an NTC temperature measurement device, and is connected with a high-performance 8-bit microcontroller.

The schematic diagram of the Humiture Sensor Module is as shown following:



Only three pins are available for use: VCC, GND, and DATA. The communication process begins with the DATA line sending start signals to DHT11, and DHT11 receives the signals and returns an answer signal. Then the host receives the answer signal and begins to receive 40-bit humiture data (8-bit humidity integer + 8-bit humidity decimal + 8-bit temperature integer + 8-bit temperature decimal + 8-bit checksum).



Features

1. A humiture sensor module to test temperature and humidity, which uses the sensor DHT11.
2. Humidity measurement range: 20 - 90%RH.
3. Temperature measurement range: 0 - 60℃.
4. Output digital signals indicating temperature and humidity.
5. Working voltage: DC 5V; PCB size: 2.0 x 2.0 cm.
6. Humidity measurement accuracy: ±5%RH.
7. Temperature measurement accuracy: ±2℃.

Applications

1. DHT11 Relative Humidity and Temperature Sensor can be used in many applications like:
2. HVAC (Heating, Ventilation and Air Conditioning) Systems.
3. Weather Stations.
4. Medical Equipment for measuring humidity.
5. Home Automation Systems.
6. Automotive and other weather control applications.

Overview

This tutorial covers the low cost DHT temperature & humidity sensors. These sensors are very basic and slow, but are great for hobbyists who want to do some basic data logging. The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a very basic chip inside that does some analog to digital conversion and spits out a digital signal with the temperature and humidity. The digital signal is fairly easy to read using any microcontroller.

3. MQ-6 Sensor

Introduction

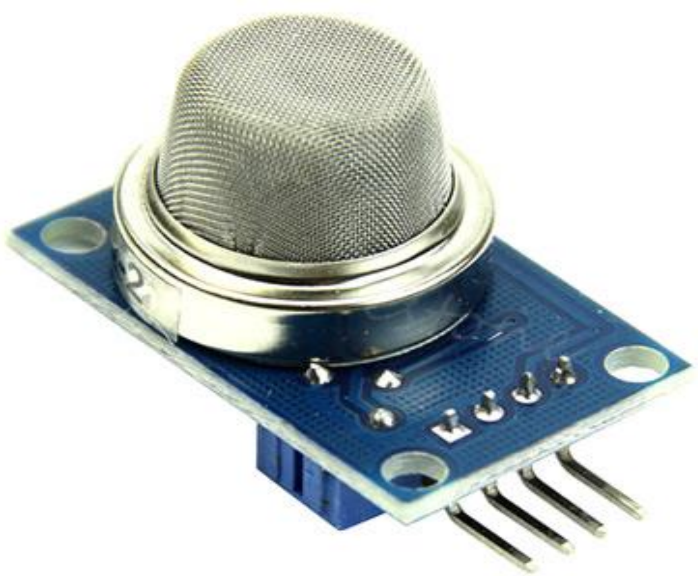
A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting.

Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. Additionally, a visual identification can be done using a thermal camera These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected. Exposure to toxic gases can also occur in operations such as painting, fumigation, fuel filling, construction, excavation of contaminated soils, landfill operations, entering confined spaces, etc. Common sensors include combustible gas sensors, photoionization detectors, infrared point sensors, ultrasonic sensors, electrochemical gas sensors, and metal-oxide-semiconductor sensors (MOS sensors). More recently, infrared imaging sensors have come into use. All of these sensors are used for a wide range of applications and can be found in industrial plants, refineries, pharmaceutical manufacturing, fumigation facilities, paper pulp mills, aircraft and shipbuilding facilities, hazmat operations, waste-water treatment facilities, vehicles, indoor air quality testing and homes.

Applications

1. Detect or measure Gases like LPG, and butane.
2. Air quality monitor.
3. Gas leak alarm.
4. Safety standard maintenance.
5. Maintaining environment standards in hospitals



History

Gas leak detection methods became a concern after the effects of harmful gases on human health were discovered. Before modern electronic sensors, early detection methods relied on less precise detectors. Through the 19th and early 20th centuries, coal miners would bring canaries down to the tunnels with them as an early detection system against life-threatening gases such as carbon dioxide, carbon monoxide and methane. The canary, normally a very songful bird, would stop singing and eventually die if not removed from these gases, signaling the miners to exit the mine quickly.

The first gas detector in the industrial age was the flame safety lamp (or Davy lamp) was invented by Sir Humphry Davy (of England) in 1815 to detect the presence of methane (firedamp) in underground coal mines. The flame safety lamp consisted of an oil flame adjusted to specific height in fresh air. To prevent ignition with the lamps flame was contained within a glass sleeve with a mesh flame arrestor. The flames height varied depending on the presence of methane (higher) or the lack of oxygen (lower). To this day, in certain parts of the world flame safety lamps are still in service.

The modern era of gas detection started in 1926–1927 with the development of the catalytic combustion (LEL) sensor by Dr.Oliver Johnson. Dr Johnson was an employee of Standard Oil Company in California (now Chevron), he begun research and development on a method to detect combustible mixtures in air to help prevent explosions in fuel storage tanks. A demonstration model was developed in 1926 and denoted as the Model A. The first practical "electric vapor indicator" meter begun production in 1927 with the release of the Model B.

SMART KITCHEN

The world's first gas detection company, Johnson-Williams Instruments (or J-W Instruments) was formed in 1928 in Palo Alto, CA by Dr Oliver Johnston and Phil Williams. J-W Instruments is recognized as the first electronics company in Silicon Valley. Over the next 40 years J-W Instruments pioneered many "firsts" in the modern age of gas detection, including making instruments smaller and more portable, development of a portable oxygen detector as well as the first combination instrument that could detect both combustible gases/vapors as well as oxygen.

Before the development of electronic household carbon monoxide detectors in the 1980s and 1990s, carbon monoxide presence was detected with a chemically infused paper that turned brown when exposed to the gas. Since then, many electronic technologies and devices have been developed to detect, monitor, and alert the leak of a wide array of gases.

As the cost and performance of electronic gas sensors improved, they have been incorporated into a wider range of systems. Their use in automobiles was initially for engine emissions control, but now gas sensors may also be used to ensure passenger comfort and safety. Carbon dioxide sensors are being installed into buildings as part of demand-controlled ventilation systems. Sophisticated gas sensor systems are being researched for use in medical diagnostic, monitoring, and treatment systems, well beyond their initial use in operating rooms. Gas monitors and alarms for carbon monoxide and other harmful gases are increasingly available for office and domestic use, and are becoming legally required in some jurisdictions.

Originally, detectors were produced to detect a single gas. Modern units may detect several toxic or combustible gases, or even a combination. Newer gas analyzers can break up the component signals from a complex aroma to identify several gases simultaneously.

Metal-oxide-semiconductor sensors (MOS sensors) were introduced in the 1990s. The earliest known MOS gas sensor was demonstrated by G. Sberveglieri, G. Faglia, S. Groppelli, P. Nelli and A. Camanzi in 1990. MOS sensors have since become important environmental gas detectors.

arity accordingly.