IOT – GAS LEAKAGE MONITORING AND ALERTING SYSYTEM

LITERATURE SURVEY

[1] Farnsworth, J.M. Passive Leak Detection Devices and systems for Detecting Gas Leaks. US Patent Pub. No US 2010/0089127 A1, (2010).

The French Aerospace Lab - and ADCIS companies are undertaking a multiyear R&D collaborative project to develop remote sensing technologies and methodologies for gas leak detection, visualization and quantification. The history of gas leak incidents in the Oil and Gas Industry has shown the need for efficient and accurate tools for quantifying the gas leak rate and the extent of the hazardous areas to manage efficiently an emergency situation. Besides, detection and measurement of gaseous hydrocarbon emissions in industrial facilities is a must for obvious environmental reasons. The current generation of infrared imagers detects the presence of gas in the atmosphere but needs improvement for accurate estimation of the size of the gas leak. In this context, a test campaign held on September 2015 in TOTAL's Lacq Pilot platform in France was organised to determine if infrared multispectral or hyperspectral imaging could provide reliable and quantitative data in the event of a release in the range of 1g/s to 50g/s of methane. Several gas spectral imaging systems were installed to observe a methane emission point: hyperspectral cameras in Long-Wavelength InfraRed (LWIR) (7.7-12µm); multispectral cameras in Medium-Wavelength InfraRed (MWIR) (1.5-5.5µm; 3.2-3.4µm and 3-5µm); multispectral cameras in LWIR (8-9.6µm); one Spectro-Radiometer system in MWIR/LWIR (3µm-14µm). The performance of infrared imagers in different wavelengths has been compared for methane emissions. A set of algorithms and software has been developed and successfully tested to measure, compute and visualize in real time a methane plume from the infrared imagers, and with reasonable accuracy for the methane emissions of 1 and 10g/s. For the 50g/s flowrate, quantifications have been under-estimated with this methodology. Further works should allow improving the accuracy of these quantification methodologies. The gas imagers enable to visualize and quantify in real time and in 3D a methane plume. This technology could be applied in different ranges of gas leak flowrates (small leaks in environmental monitoring, medium size leaks in safety monitoring, and major leaks in crisis management). The objective over time is to qualify a system that would economically complement the plant gas detection system and bring valuable information should a gas leak incident happen.

[2] Fraiwan, L.; Lweesy, K.; Bani-Salma, A.; Mani, N, "A wireless home safety gas leakage detection system", Proc. of 1st Middle East Conference on Biomedical Engineering, pp. 11-14, 2011.

A wireless safety device for gas leakage detection is proposed. The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk. The system also can be used for other applications in the industry or plants that depend on LPG and natural gas in their operations. The system design

consists of two main modules: the detection and transmission module, and the receiving module. The detection and transmitting module detects the change of gas concentration using a special sensing circuit built for this purpose. This module checks if a change in concentration of gas(es) has exceeded a certain pre-determined threshold. If the sensor detects a change in gas concentration, it activates and audiovisual alarm and sends a signal to the receiver module. The receiver module acts as a mobile alarm device to allow the mobility within the house premises. The system was tested using LPG and the alarm was activated as a result of change in concentration.

[3] Apeh, S. T., K. B. Erameh, and U. Iruansi. "Design and Development of Kitchen Gas Leakage Detection and Automatic Gas Shut off System." Journal of Emerging Trends in Engineering and Applied Sciences, vol. 5, no. 3, pp. 222-228, 2014.

The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turn off the power supply, while activating the alarm. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas around 2kg so that the user can replace the old cylinder with new in time and automatically books the cylinder using a GSM module.The device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using ARM 7 processor and simulated using keil software. [Padma Priya et al, 2014] This approach does not make provision for kitchen gas that uses gas cylinders not supplied by power utility supply, which the commonest is found in developing countries like Nigeria who have not developed such infrastructure.

In yet another approach, leak detection module consists of MQ-6 gas sensor to detect amount of combustible gas present in the surrounding. As the leakage detects the ARM 7 controller sends the message to LCD which displays "Gas Leakage Detected". The ARM 7 controller checks the concentration of gas is within safe level if it beyond safe level (safety level is programmable) then ARM 7 controller not only immediately activates buzzer but also switch on the exhaust fan so that the gases are sent out and GPS receiver gives altitude location of gas leakage.

[Shinde et al 2012] This system provides for components that can be considered overkill for household kitchen gas detection and response.This work develops a gas detection and response system that detects gas leakage and automatically shuts off supply through the gas valve and sounds an alarm. It is focused on managing cylinder gas supply used in domestic household cooking in the kitchen to minimize accidents due to gas leakages. It does not however protect against explosions resulting from expired gas cylinder use.

[4] Mahalingam, A., R. T. Naayagi, and N. E. Mastorakis. "Design and implementation of an economic gas leakage detector." Recent Researches in Applications of Electrical and Computer Engineering, pp. 20-24, 2012.

Liquid petroleum gas (LPG) is commonly used in homes for central heating, hot-water, gas-fires, cooking, and in mobile heaters for leisure activities such as boats, caravans and barbecues. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG leaks can happen, though rarely, inside a home, commercial premises or in gas powered vehicles. Leakage of this gas can be dangerous as it raises the risk of building fire or an explosion. The casualties caused by this hazard are still common news in the media. Since the LPG as such does not have any odour, gas companies/refineries add an odorant such as ethanethiol, thiophene or a mercaptan so that leaks can be detected easily by most people [1]. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. In such cases, a gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. A number of research papers have been published on gas leakage detection techniques [2-11]. A wireless home safety gas leakage system has been proposed in [2] where the alarm device provides mobility within the house premises.

Leakage detection and identifying its location is the most important task of pipeline operators in the gas industry. Flow monitoring and linear parameter varying (LPV) model based methods are widely used in the gas industry to detect gas leakage. Both these methods continuously measure the pressure at different sections of the pipeline, usually at extreme ends [3-8]. However, the drawback of these techniques is that they are strongly dependent on the noise of pressure/temperature measurements. Reliability issues of gas leakage detectors were addressed in [9]. Gas leakage sounds generated from the cracks in the pipelines were analysed in [10] to locate the leakage. This paper provides a cost effective audio-visual solution for LPG leakage detection in homes and commercial premises and audibly alert the users of those premises in case of a hazardous situation and provide warning signals (beeps) in case of low risk scenarios – in particular, when the appliances may be left unattended in a premises or there is a risk of gas flames blowing out or being forgotten to be lit.