

Development of Electronic Nose and Program for Monitoring Air Pollutions and Alarm in Industrial Area

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Abstract—This article presents the development of electronic nose and program for monitoring air pollutions and alarm in industrial area. The design of electronic nose depends on physical connectivity of the sensors, relating to the data management, computing management and information management. Therefore, the sampling, filtering and sensors module, signal transducers and acquisition, data preprocessing, feature extraction and feature classification are applied in the design of an electronic nose. There are 4 sensors are investigated to use as electronic nose in this experiment which consist of TGS2620, TGS2620, TGS2442 and TGS832. These sensors are operated with LabVIEW program. The experiment results show that these sensors can classify and sensitive to the different gas such as Methanol n-Propanol, Hexane and Dichloromethane. The PCA is also used to classify group of gas sensor. The system also performs the warning and alarm system when the gas is leak.

Index Terms—Electronic nose, gas sensor, monitoring industrial area.

I. INTRODUCTION

The analysis of air pollution is a commonly required task in our daily life. Since conventional air pollution tools are too expensive and difficult to use, electronic gas sensor systems, called electronic nose (E-nose), have been used in many applications, e.g., in the field of environmental monitoring, industrial monitoring, process and quality control systems [1]. A drawback of the existing electronic nose system is that they ordinarily work offline [2], [3]. The design of electronic nose depends on physical connectivity of the sensors, relating to the data management, computing management, information management, and knowledge discovery management associated with the sensors and the data they generate and how they can be addressed within an open computing environment [4]. Therefore, the sensor data are collected and recorded using an electronic nose system, and then, statistics software is utilized to extract qualitative or quantitative information. Sensors for use in electronic noses need partial selectivity, mimicking the responses of the olfactory receptors in the biological nose. In the design of an electronic nose, sampling, filtering and sensors module, signal transducers and acquisition, data preprocessing, feature extraction and feature classification are applied.

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Electronic nose design is used, which provides rapid responses, ease of operation and sufficient detection limits [5]. Data quality objectives (DQOs) of environment must be considered as part of technology development and a focus should be made on the most urgent problems. It depends on sensors' sensitivity and selectivity [6]. Sensitivity is used to refer either to the lowest level of chemical concentration that can be detected or to the smallest increment of concentration that can be detected in the sensing environment. While selectivity refers to the ratio of the sensor's ability to detect what is of interest over the sensor's ability to detect what is not of interest as interferes.

Many researchers have been proposed interesting works in electronic nose system such as [7] Independent Component Analysis (ICA) algorithm based on intelligent electronic nose in the mixed gas of feature extraction. ICA algorithm is equivalent to the human brain, with analysis, separation of raw data, which aims to separate the constituents of the gas mixture for quick identification. Electronic Nose to rely on independent component analysis as a multi-channel observation signal processing methods, able to break out the method by optimizing the multi-channel signals in a number of separate components, in the electronic nose signal processing, ICA method can effectively remove because the response to superimposed generated error message. In [8] E-nose has been developed to replace human olfactory and it has been proven useful for food freshness identification and environmental classification [9]. E-nose system should be implemented with wireless system so that signal from isolated locations can be expediently combined and processed at a database server. Leilie Pan and Simon X. Yang [10] developed environment monitoring from various workplaces based on 2.4-GHz wireless LAN. The wireless LAN utilized MPR2400 embedded module including a microprocessor, radio and battery. However, embedded module MPR2400 is expensive and requires two AA batteries, which are not necessary. Moreover, the reported electronic nose did not used gas reference for odor measurement, resulting poor odor sensing capability.

This work focuses to design the electronic nose and program development for the air pollutions monitoring and alarming for industrial factory. There are many types of sensor which had been used in this research such as solvent vapor, air contaminate, CO and Halogen. The next section will explain the design system of the gas sensor system. The Electronic nose is also briefly in Section III. The experiment and results are described in Section IV. Finally, the conclusion is also followed.