

The Wireless Electronic Noses and Mobile Devices Interoperation Based on Internet of Things Technology

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Abstract. According to the recent researches on multimodal interfaces, the olfactory content can be an important factor for immersive user experience. The olfactory content is an additional element to enhance visual, audio contents by providing the emotional effects. But the olfactory content has not been used widely because olfactory systems should be connected with main contents system. Therefore the wireless connectivity is very important issue for olfactory content system. In this paper, we describe the wireless electronic noses and mobile devices interoperation based on Internet of Things technology. And furthermore, we will extend our research to develop the scent emission system for olfactory content display.

Keywords: Olfactory content, Electronic nose, Internet of Things

1 Introduction

Recently, the researches on the multimodal interfaces make progress and the interest of the olfactory content is growing. The olfactory content is an ambient content with symbolic significance. There are two main research and development areas, the electronic nose and the scent emission in olfactory content technology. Various type of wireless e-Nose sensor nodes have been developed by engineers and researchers in the last ten years[1]. An electronic nose was used for beef quality detection with the advantages possessed by the concept of the Internet of Things and Cloud Computing[2]. The livestock farm odors are monitored by electronic nose network system automatically[3]. A wireless device for monitoring air quality was developed based on gas sensors and ZigBee wireless network[4]. A portable electronic tongue system was developed for taste analyzing using Bluetooth[5].

Despite of various researches and developments, the olfactory devices are not used. The existing systems were not light-weight and they needed the gateway to consisted with legacy network system. Therefore the wireless connectivity and the lightening method are important issues for olfactory content system. In this paper, we describe the wireless electronic nose of single microcontroller based Wi-Fi communication system and mobile device integration based on IoT(Internet of Things) technology.

2 The architecture of olfactory content system based on Internet of Things technology

The visual and audio senses are important to recognize the surroundings and enjoy life. The olfactory sense often used as secondary role to support main senses. Likewise, the almost multimedia systems provide the visual and audio media as main contents and the olfactory content are not used standalone but can be used as additional content. If the olfactory system does not satisfy the easy-to-use, wireless connectivity and light weight, it is not adopted to interact with main contents system. Figure 1 represents the architecture of olfactory content system based on Internet of Things technology. The olfactory devices are classified as electronic nose or scent emitter. The olfactory devices are deployed in the internet based IP network. The mobile devices are connected with olfactory devices by IP communication. They can use the mobile network and communicated through internet. Database server system collects the data of olfactory devices. The sensing data of electronic noses and status of olfactory devices are stored in the DB server. The service provider controls the olfactory devices and DB server. If the service provider commands the olfactory devices to sense data or to emit scent, the olfactory devices receive the command and process the functions.

To connect with IP network, existing electronic noses used the additional module with dedicated microcontroller for wireless communication or used the network gateway to convert with IP network. Both solutions are easy to implement the wireless electronic noses for developers or researchers but they make the system be too heavy and expensive. We suggest the single microcontroller based Wi-Fi system as olfactory content system to process olfactory content and communication function simultaneously. It is light-weighted system and easy to be deployed in internet. All the devices in IP network interoperated with our olfactory devices.

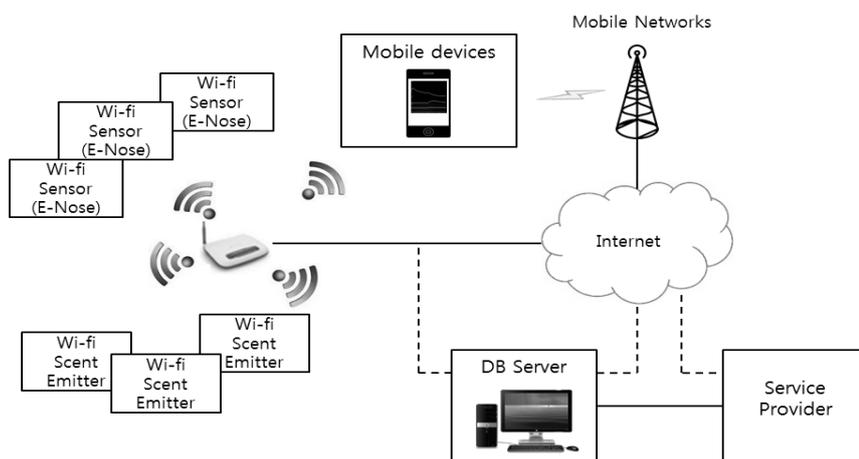


Fig. 1. The Architecture of olfactory content system based on IoT technology

3 The prototype of wireless electronic noses and mobile devices interoperation based on Internet of Things technology

To implement the wireless electronic nose of single microcontroller based Wi-Fi system, the microcontroller is not dedicated for specific function. It should process the Wi-Fi communication and data acquisition by analog to digital conversion of gas sensing data, simultaneously. The hardware of wireless electronic nose includes the RF(Radio Frequency) antenna for wireless communication and ADC(Analog to Digital Converter) peripheral device to recognize the gas sensing value. The gas sensors in the electronic nose are TGS sensors and they can be replaced with other products.

Because the sensor devices are configured as servers in general IoT technology, the wireless electronic nose is also configured as UDP server. The light weight protocol for IoT olfactory content is designed and implemented in the electronic nose and the mobile application. The protocol defines the message formats and sequences to discover olfactory devices, identify devices, set device parameters and collect the sensing data. The device discovery is needed for users to find the olfactory devices in the network. The mobile application shows the olfactory devices lists of the ListView format. Users can request to start and stop sensing data. The request message is delivered to the wireless electronic nose by IoT olfactory content protocol. The electronic nose receives the command and parses the message. As the user's command, the wireless electronic nose responds the sensing data.

The single microcontroller based wireless electronic nose is simple to use and connect to any devices in the IP based network directly. The contents providers and IoT service users can access the olfactory device by simple protocol on UDP. We will make the olfactory device compact based on this prototype.

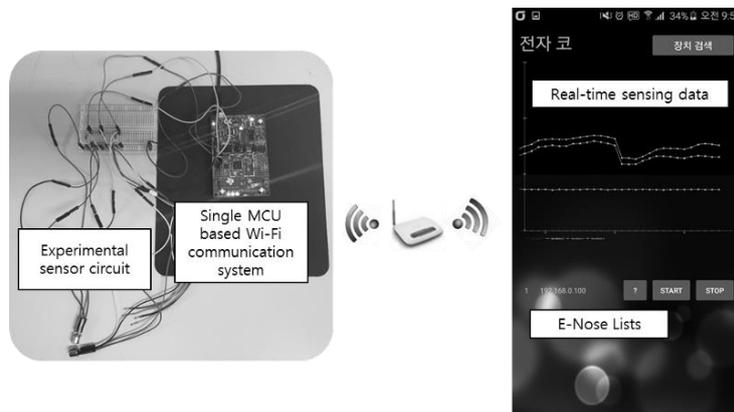


Fig. 2. Experimental circuit of wireless electronic nose and mobile application

4 Conclusions

The olfactory content is an important factor for enhancing emotion in the multimedia technology. However, it has not used because the systems were difficult to configure and not be applied the easy point to utilized. If IoT technology is combining, olfactory content can be utilized as an important content when wireless connectivity is complemented. We design the olfactory devices of a single microcontroller based Wi-Fi communication system to improve the weight and the wireless connectivity of the olfactory system. The prototype of system is implemented with experimental circuit configuration of the electronic nose using gas sensors. The mobile application processes various functions to discover the olfactory devices, identify devices and collect the sensing information to represent in graph real-time.

We will make the compact electronic nose with the PCB and sensor chamber based on the prototype system. The scent emitter will also be implemented with single microcontroller Wi-Fi system. It will provide scent media with multimedia contents system and applied in various IoT spaces by user's preferences.

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