Research on the Marketization of Indoor Air Monitoring in the Internet Period

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Abstract. With the improvement of people's living standards and the popularization of the Internet, indoor activities have become a major feature of contemporary people's lives, which results in the great demand for accurate and intelligent real-time monitoring of indoor environment. However, there are some defects, such as the market of indoor air monitoring in the monitoring industry is small, and the popularization and popularization of monitoring products are low. Therefore, mainly starting from the current market situation of indoor air monitoring, this paper analyses the necessity of promoting the marketization of indoor air monitoring, and studies the related technologies of current indoor air data, such as acquisition, processing and analysis. Then we expounds the operability of popularizing indoor air monitoring system, and put forward for how to develop the room in the Internet era. Opinions and countermeasures in the internal air monitoring.

1. Introduction

At present, indoor air pollution has attracted wide attention. Hundreds of indoor pollutants have been identified. The degree of indoor air pollution is two to five times more serious than that of outdoor air. Low indoor air quality can easily cause respiratory tract damage, cancer and other human diseases, which pose a threat to human health.

China's air monitoring activities are mainly carried out by the relevant environmental agencies of the Bureau of Ecological Environment. In recent years, it has become a consensus to introduce market mechanism into the field of environmental monitoring. In November 2018, the Ministry of Environmental Protection issued “Guidelines on Promoting the Socialization of Environmental Monitoring Services”, which put forward the goal of further promoting the marketization of indoor air monitoring and liberalizing the market for service-oriented environmental monitoring. With the promotion of market-oriented environmental monitoring, the market has become an important force in the industry of indoor environmental monitoring in economically developed areas. However, among the purchasers of indoor environmental monitoring products, the government and enterprises (mostly sewage enterprises) play a major role, which tend to be public welfare, and the individual purchase rate is very low. In addition, the existing operating mode of the testing equipment manufacturers is small, the use of instruments is complex, and the monitoring reports are professional and too difficult to understand. It hinders the full development of indoor environmental monitoring. However, with the development of big data and Internet, indoor air monitoring technology has made innovative progress, which provides media and technical support for further promoting the marketization of indoor air monitoring and processing services. Therefore, solving the contradiction between the demand and supply of indoor air monitoring will give practical significance to the popularization of indoor air monitoring.

2. Market status of indoor air monitoring with Internet involved

Monitoring and control of indoor air environment has been a global hot spot. With the development of economy and technology, indoor air monitoring and control services have gradually become the focus of the development of relevant departments and industries. Now, with the rapid development of Internet, the Internet of Things, big data and AI have been integrated into the meteorological service industry. China Meteorological Network emphasizes that the meteorological big data with the Internet involved can provide various meteorological services, such as internal operational services, scientific research services and public services of meteorological departments.[1] This is in line with the 2015 "Notice of the State Council on the Platform for Action to Promote the Development of Big Data". According to statistics, the number of deaths caused by indoor pollution in China reached 111,000 in 2018, with an average of 304 deaths per day and an economic loss of 10.6 billion US dollars.[2] Therefore, it is urgent to promote Internet indoor air monitoring and processing services. Although in recent years, relevant departments and Internet enterprises have continuously integrated into meteorological public services, such as the combination of Internet and air purifier, the analysis and sharing of meteorological data in various places, the awareness of indoor air environment safety and health and economic opportunities have not been maximally popularized by the public whether in the air purification market, air monitoring market, or government departments, and the consumer demand on the market is not high in utilization. In addition, the high cost of air monitoring equipment, the high professionalism of monitoring procedures and the long time consuming have always been the shortcomings of the air testing industry. According to the unified national air quality standards and industry regulations, there are fewer indoor air testing institutions that are grant to use CMA certificate marks at present, mainly in developed areas, such as Beijing and Shanghai. Moreover, according to the indoor environmental quality testing center, there are 12 service items in this emerging industry, and there are many branches in the project, which leads to insufficient specialization and supply. The market popularization is affected by the small quantity of institutions and low development of service projects. Therefore, the processing and analysis of indoor air monitoring data has not fully reached the market, and the integration of the Internet and it needs to be improved.

3. The necessity of promoting marketization of indoor air monitoring with the Internet involved

The necessity of marketization is mainly embodied in the impact of air environment on human body, the impact of marketization of indoor environmental monitoring on policy and environmental protection, and the impact of marketization on industry and economic development.

3.1 Impact of air environment on human body

People know much earlier about the hazards of outdoor air pollution than indoor air pollution. With the development of economy, Internet technology is becoming more and more popular and information transmission is faster and faster. At the same time, more and more chemical products are entering residential houses and buildings are becoming more and more dense. Now the diffusion speed of polluted air is not as fast as before. People's awareness of indoor air environmental protection is increasing.[3]

In developing countries, as people burn biomass to generate energy to maintain their own lives, a large number of pollutants produced threaten human life and health. In the interior, we have to face the VOC gas composition in kitchen lampblack, formaldehyde produced by room decoration, powder produced by printers and dust hidden in corners, etc. Most people think that we will not be polluted by air when we close doors and windows, but actually it is in indoor pollution.[4] In fact, compared with outdoor, indoor air has a long and deep contact with human body, so indoor polluted air is more harmful to human body. At the same time, there are many indoor pollution sources and the influencing factors are very complex. These air pollutants can cause human diseases. The most direct impact will be headache, chest tightness and other physical discomfort. However, people are not

aware of indoor air monitoring and management, and the market of indoor environmental monitoring and processing services is not optimistic. Therefore, we should further promote the marketization of indoor environmental monitoring and change the indoor air quality.

3.2 Impact of marketization of indoor environmental monitoring on policy and environmental protection

With the support of Internet technology, monitoring equipment and software have been popularized, specific to the users' houses, offices, factories and so on, which have health prompting effect on newly decorated households and guiding effect on the air quality and pollution control of factories and their vicinity. It can also use the function of the Internet to form one or more regional point-to-surface distributions. The data of these atmospheric information are fed back to the meteorological bureau and relevant scientific research institutes, which promotes the short-and medium-term weather numerical model, makes the prediction resolution higher and pays attention to the differences among small regions, so that it can forecast the weather conditions in small regions, improve the accuracy of weather forecast in meteorological bureau and speed up the development of academic research in atmospheric science; it can also become a source of information media, provide the national environment specific pollution parameters for the Bureau of Ecology and Environment, formulate corresponding policies and guidelines to control air pollution, improve air quality index, and protect nature. Therefore, promoting the marketization of indoor environmental monitoring can make the policy more scientific and beautify the environment.

3.3 Impact of marketization on current industry and economic development

To sum up, the current situation of air monitoring market is not optimistic. Promoting the marketization of indoor environmental monitoring can make use of market regulation. Manufacturers will invest in production and expand the indoor monitoring market under the attraction of profits to meet the needs of consumers and strive to achieve a balance between supply and demand. In order to ensure and increase the competitiveness or market share of their products in the market, manufacturers will improve their own products to provide more diversified services to meet consumer demand and promote supply-side structural reform. With the continuous improvement of production efficiency, the price of products becomes civilian, so more and more consumers can afford indoor monitoring instruments.

The annual loss caused by indoor air pollution in China is more than 10 billion US dollars. Air pollution reduces our economic efficiency. Moreover, China emphasizes that the economy should be transformed and upgraded to achieve high output and low pollution. Therefore, a set of perfect and convenient indoor environment monitoring system can help the country to find air pollution enterprises accurately, supervise enterprises and reduce air pollutants emissions, so as to achieve low-pollution production.

4. Maneuverability of marketization of indoor air monitoring

The indoor environment monitoring system is composed of data acquisition system, cloud computing platform database processing, indoor environment monitoring and data analysis system V1.0 software.[5]

4.1 Collection and processing of indoor environment data

MCU plays an important role in data acquisition of indoor environment system. In indoor environment monitoring system, MCU can integrate CPU, ROM, RAM, timer, interrupt system and so on, and use the obtained micro-computer system to realize various control operations.[6] STM32 MCU is connected with temperature sensor, humidity sensor, PM2.5 sensor, CO2 sensor and formaldehyde sensor in the form of independent keys to collect indoor environment gas parameter data. The collected indoor environment gas parameter data are stored in the cloud server database through WIFI wireless sensor network, so that the cloud computing platform can process the indoor environment monitoring data by using two-level data fusion of neural network and D-S

(Dempster-Shafer) evidence theory and store the data as Cloud Data.[7] Finally, the processed data are transferred from the database to the mobile phone software of indoor environment monitoring and data analysis system V1.0, as shown in Figure 1.

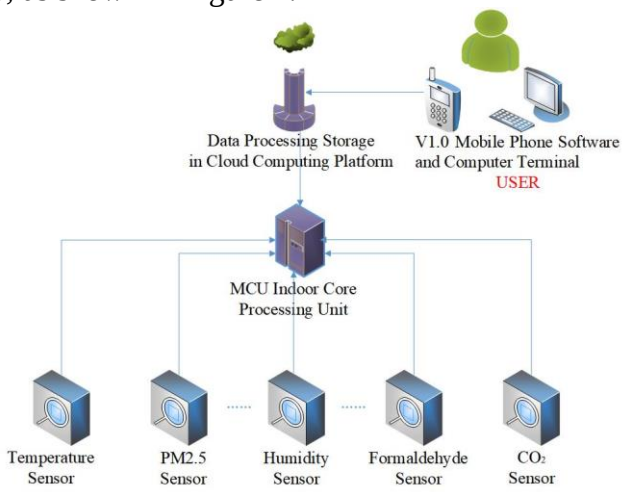

Fig. 1. Work-flow diagram of indoor environment monitoring system

4.2 Analysis of indoor environmental monitoring data

The indoor environment monitoring and data analysis system V1.0 is a software that connects and runs on Android mobile phones. By registering and login, users can access the real-time monitoring data of indoor temperature, humidity, PM2.5, CO2 and formaldehyde content, which are acquired by the cloud computing platform and processed by the sensors in the MCU, as shown in Figure 2. The software has the functions of displaying indoor and outdoor environment monitoring data, inquiring historical data and real-time data, inquiring real-time environmental quality grade, inquiring weather status, diagnosing and analyzing data, warm health tips, such as "Raining, please bring umbrella", indoor environment pollution and other popular science knowledge. In addition, combined with indoor air quality standards, the comfort and pollution of indoor environmental conditions are diagnosed and analyzed, and suggestions are given.

In the information age of the 20th century, the changes brought about by technological innovation have been affecting human life. With the advent of WIFI and the coming 5G era, digitalization and intellectualization are gradually deepening in the fields of economy, scientific research, national defense and other fields, and people's lives are becoming more convenient. Indoor environment monitoring system composed of sensors, MCU, cloud computing platform, indoor environment monitoring and data analysis system V1.0 software and Internet can update, store and analyze real-time indoor environment monitoring data. Through the Internet and other means to achieve data storage and utilization, it can meet people's health and comfort needs of modern home life.

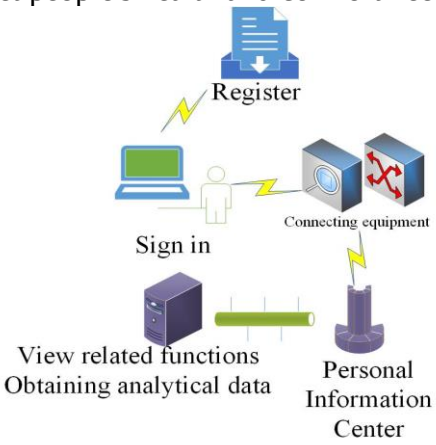

Fig. 2. Basic flow chart of software operation of indoor environmental monitoring and data analysis system V1.0

5. Conclusion

In the Internet era, the injection of technology gene will strengthen the coverage and marketization of indoor environmental monitoring. Combining with various expanding technologies in the Internet era, we can explore the construction of a new integrated indoor air monitoring system, and then promote the management and governance of relevant departments and industries, so as to provide reference for the development of indoor environmental monitoring field.

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