Based on ZigBee and GIS technology to explore the real-time dynamic monitoring system of urban atmospheric environment

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Abstract. Good ecological Environment and Atmospheric Environment is an important part of human healthy growth and survival. With the acceleration of the urbanization process, bringing people a lot of material and spiritual enjoyment, but also increased water, soil and atmospheric environment and other serious pollution problems. Under the influence of greenhouse effect, global warming further aggravates the harm to people's physical and mental health. In this paper, based on ZigBee and GIS technology, the content of real-time dynamic monitoring of urban atmospheric environment is deeply analyzed, and the positioning and targeted warning of pollution sources of solid pollution particles and pollution gases in the city are carried out to further prevent the spread of pollution accidents.

1. Development background and status quo of environmental monitoring technology
As one of the technical contents with far-reaching influence on the development of the times, environmental monitoring technology has been officially appeared in the public field of vision since 1950s. In the four different stages of environmental monitoring technology change, from chemical analysis to pollution source monitoring, from automatic monitoring to remote sensing geographic information measurement and control, environmental monitoring has changed from passive to active, from artificial to intelligent. Nowadays, the DHT11 type temperature and humidity sensor, which is used in ZigBee technology, can realize the above technology very well, see figure 1 for more details.
Although great achievements and progress have been made in monitoring technology, in the process of its application in China, such as fig. 2, the comparison of atmospheric monitoring data in China shows that only first-tier cities or municipalities directly under the Central Government have promulgated and implemented the relevant regulations and methods of environmental monitoring. At the same time, the traditional methods of on-line monitoring of environmental data can not match the present situation of the development of our country. Therefore, it is necessary to establish a set of comprehensive environmental monitoring information system with many functions and characteristics, such as automation and networking [1].

### Tab 1. Atmospheric monitoring data in China

| Time  | Moran I | Z   | Time  | Moran I | Z   |
|-------|---------|-----|-------|---------|-----|
| 2018.1 | 0.52    | 37.07 | 2019.1 | 0.62    | 52.01 |
| 2018.2 | 0.46    | 32.51 | 2019.2 | 0.40    | 28.87 |
| 2018.3 | 0.49    | 34.73 | 2019.3 | 0.48    | 16.67 |
| 2018.4 | 0.35    | 25.49 | 2019.4 | 0.45    | 37.71 |
| 2018.5 | 0.65    | 45.77 | 2019.5 | 0.65    | 39.83 |

2. Existing problems of urban atmospheric environmental monitoring system

At present, the technical means of our country only collect and transmit the different data of polluted atmosphere in the human living environment. It is impossible to make effective mining and in-depth analysis of the data. At the same time, the data acquisition and analysis method based on computer control improves the data storage space of environmental monitoring to a certain extent, but the analysis of the data processing results does not produce practical effect and significance.

Therefore, according to the problems and disadvantages of the above technology, based on ZigBee and GIS technology, ZigBee technology, as shown in figure 3, can deeply mine and analyze the data on the basis of timely collection and efficient transmission of environmental data information, and provide better technical service support for the environment according to the servers and software supporting the terminal and mobile phone. Provide more efficient and convenient technical support to the public.

![Fig 2. Zig Bee network components](image)

Generally speaking, its function not only includes the network monitoring and monitoring point service of the data monitoring center, but also can be divided into two types: application and perception in different system layering. Figure 4. The application layer is based on the framework of B / S in the
urban atmospheric environment to monitor the environmental problems. Through the targeted control and management of different nodes in the wireless sensor network, and then through the difference of spatial dynamic changes, the possible pollution accidents can be warned in time. It further improves the intuitive control and monitoring of environmental quality.

| Synchronization head | Physical head | Physical layer net charge |
|----------------------|---------------|---------------------------|
| Lead code            | Frame locator | The length of the frame   |
| 4 bytes              | 1 bytes       | reserved                  |

The sensing layer is a hardware sensor network system in the process of monitoring the urban atmospheric environment. Figure 5 shows that on the basis of ZigBee technology, wireless transmission is carried out through GPRS and ad hoc network technology. Because the city has certain regional space in the whole spatial layout, in the process of setting up the perceptual layer system, it is necessary to divide the population, area and function of the regional space. Figure 6 shows and transmits and interacts between the router and the coordinator through the sensor subnet in ZigBee, so as to further achieve the purpose of environmental monitoring [2].

![Fig 3 board composition of Zigbee communication core functions](image-url)
3. Research on the specific application mode of ZigBee and GIS technology
The design and construction of the real-time dynamic monitoring system for urban atmospheric environment based on ZigBee and GIS, the specific content is the targeted division and optimization of the application system. In short, based on the system division of the application layer and the sensing layer, in order to further save the economic cost, the related laying method of the static environmental monitoring point is adopted[3].

First of all, as shown in figure 7, according to the street direction of the city, and for the polluted areas and iconic buildings in the city and other related nodes, as the dense area of node collection. Then the tree network structure diagram is formed. In the process of setting up the nodes of each sub-network, under the action of the router and the coordinator, the collected data is transmitted through the connection of the sensor, and finally the functions of data storage, statistics and publication are completed.

In order to monitor and collect the atmospheric environment more intuitively and concretely, the wireless sensor network nodes are arranged in the sensing layer on the basis of the basic division of the geographical space area and through the different functional areas. The spatial data of each area of the city are monitored and collected in real time, and the analysis is carried out on the basis of centralized statistics. Finally, the display and layout of the thematic content map are formed in the space. As shown in figure 8, the system is designed by ZIGBEE technology, and the results are as follows.
Therefore, in the process of developing and designing the application layer of the system, in order to match with the perceptual layer, the content of GIS is also collected. In the process of research and development of general application layer system technology, ESRI ArcGIS Sever9.3 and other related technologies are often used to serve and develop the global positioning of geographical system, and Java and other related program technologies are used as the main body of language application and development, so as to realize the real-time and dynamic monitoring of the environmental pollution on which people depend for their survival in urban life, and to provide reliable and real reason for the content of environmental control in the later stage. On data support [4].

4. Data content division of urban environment dynamic system

In the monitoring of urban environment dynamic system, the data content of the system is more complex. From the category attribute, it can be divided into four parts: basic geographical space, dynamic real-time monitoring, environmental governance, comprehensive analysis, etc. [5] As shown in Fig. 9, the basic data analysis of urban environment dynamics shows that the basic data is based on the application of geospatial data, while controlling the state of node information of different regional network layout in the city, the spatial geographic information content of the whole city is analyzed.
Figure 10, urban environment dynamic real-time monitoring diagram, we can see that dynamic real-time monitoring is based on the collection of environmental database, the operation status of different network nodes in the environmental database is monitored and managed, and the good condition statistics and analysis are carried out.

Environmental governance is to evaluate the network operation and the layout of relevant nodes for the prediction of environmental conditions and the analysis of the management mode; The comprehensive analysis system is based on the analysis of the above environmental secretary system, through the status and situation of network nodes in different urban functional areas to sort out, count and divide, and then get the most scientific and reasonable adjustment mode method[6].

5. Conclusion
The process of urbanization is accelerating, and the pollution and destruction of ecological environment have become an important factor affecting human survival and development. Therefore, only by continuously improving the dynamic monitoring technology of the urban air monitoring system, can the monitoring and prevention of atmospheric environmental pollution be improved while the resource input cost is constantly reduced. Based on the operating principles of ZigBee and GIS technology, this paper realizes the data transmission and interaction of different system layers in the monitoring system through the node layout of the global positioning system, and improves the visualization in the monitoring process. Therefore, in the future development of the industry, its technical principles and data theory has a high promotion value and role.

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