Research on New Methods and Technologies of Engineering and Environmental Geophysical Exploration Based on Internet of Things

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Abstract. After years of development, geophysical exploration in macro programming environment through the Internet of things has become a basic international model and has been widely valued and studied. Because of its special advantages in practice, the research of new geophysical methods and technologies has been introduced into the education of computer, law, economics, engineering and other disciplines. With the development of network technology, geophysical exploration of engineering and environment has been combined with network technology, forming problem-oriented research in network environment. In the continuous exploration, there is a stable inertia and activity process between the various elements, which can effectively find problems and solve problems. Therefore, through the Internet of things, this effective bridge combines engineering and environment with "new geophysical methods and technologies" to explore and develop new fields.

Keywords: Internet of Things, Engineering and Environment, New Geophysical Methods and Technologies

1. Development status of Internet of things combined with environmental and engineering geophysical exploration at home and abroad

The so-called combination of the Internet of things and environmental and Engineering Geophysical Methods refers to the introduction of automation and information technology in the traditional environmental protection industry to realize the scientific management of engineering and environmental protection. Its purpose is to use the integrated application of sensors, infrared detection, radio frequency identification and other device technology to collect real-time information of pollution source ecology, and build an all-round, multi-level and full coverage ecological environment monitoring network, so as to promote pollution reduction and environmental risk prevention, and cultivate strategic new industries of environmental protection. With the rapid development of China's national economy, the application field of geophysical methods is constantly expanding. And it provides an effective technical means to solve many engineering detection problems, and has the characteristics of fast, convenient and economic. Therefore, with the need of China's economic development, the application field of geophysical technology is also expanding, which naturally extends from the traditional land exploration to the water exploration (Figure 1).
Figure 1. network diagram of combination of Internet of things with engineering and environment.

Countries around the world have begun to pay attention to how to make full use of various information and communication technologies in the field of environment and engineering to perceive, analyze and integrate all kinds of engineering and environmental geophysical information to make intelligent response to various needs, so as to make decisions more in line with the needs of development. With the Internet of things as the technology core, "smart environmental protection" has emerged, which has promoted the rapid development of new geophysical methods and technologies\[2\]. China has also invested a lot of manpower, material and financial resources, and has issued a series of policies to accelerate the development of geophysical exploration of engineering and environment.

2. New geophysical methods and technologies in metal mineral engineering through Internet of things

2.1. High precision gravity exploration technology in metallic minerals

The development of gravity exploration technology has a history of several decades. It is a traditional method of geophysical exploration. Before the 1980s, it was called the first generation of gravity exploration. The observation accuracy of gravimeter is medium and low. Since the 1980s, the second generation of gravity exploration has entered. The high-tech content of gravity observation instruments has increased. Through the use of the Internet of things, the GPS three-dimensional positioning technology has been adopted to solve the positioning problems in the Gobi and other areas in the middle and high mountains. It can directly measure the gravity difference, with automatic reading, automatic recording, automatic correction and other automatic functions\[3\]. There are mature 2D and 3D forward and inversion methods and computer programs at home and abroad. The selection of geological exploration method is related to many factors, such as different types of deposits, formation reasons of minerals and construction conditions, geological conditions of mining areas, and of course, the most important is construction conditions, which will have a very important impact on the selection of survey methods. Therefore, we should adopt different survey methods in different prospecting stages.

2.2. A new magnetic geophysical exploration technology in metal minerals combined with Internet of things

Magnetic method is one of the earliest geophysical methods, the most mature theory, the highest efficiency and the lowest cost. It is also one of the most widely used methods in mineral exploration. It is a basic geophysical exploration work. Since the 1980s, magnetic exploration has entered a new stage of high-precision magnetic exploration technology using Internet of things. Since the founding of the people's Republic of China, China's metal magnetic prospecting work has roughly experienced
three stages of development: starting, developing and improving.

In each stage, important progress and remarkable achievements have been made in theory, method, technology and geological prospecting. The early 1950s is the initial stage: the imported instruments belong to medium and low precision magnetometers, such as suspension magnetometer and edge magnetometer. From the end of 1950's to the end of 1970's, China has developed and developed some low and medium precision instruments such as hanging wire magnetometer, saturation magnetometer, single component magnetometer and three component magnetometer. In terms of magnetic survey interpretation methods and technologies, this paper summarizes the theory and semi quantitative interpretation methods of magnetic anomaly interpretation under oblique magnetization conditions in China; through the management of Internet of things, attention should be paid to the research of low slow magnetic anomaly, complex magnetic anomaly and residual magnetic anomaly; however, manual calculation is the main method\(^4\). At present, through the flexible application of the Internet of things, it is linked with the development of Linshu minerals, resulting in a new method of engineering geophysical exploration. Through the electronic measurement of the survey ground, the data can be directly calculated through the Internet of things, which saves the manual calculation steps, reduces the time consumption and improves the accuracy rate (Figure 2).

![Figure 2. data processing chart of new magnetic geophysical method.](image)

3. New geophysical methods and technologies for amphibious engineering through Internet of things

3.1. Marine scientific investigation

Transient electromagnetic method based on Internet of things can play a great role in marine scientific investigation. The fluctuation and buried depth of marine bedrock in Wanshan island and Guishan Island, and the division of Quaternary lithology. The instruments and technical parameters of these two islands are the same as those of Lingdingyang project. In the scientific investigation mission of Wanshan island and Guishan Island, special attention has been paid to the mixed layer equivalent phenomenon in the inversion of electrical sounding curve through the Internet of things, so as to ensure the accuracy of interpretation\(^5\). The amount of 3D forward modeling of transient electromagnetic field is huge. It is necessary to improve the calculation speed of forward modeling important topics. The improvement of calculation speed will directly affect the research of transient electromagnetic inversion technology. Therefore, it is an important aspect to improve the 3D forward modeling speed of TEM. We can use computer technology such as GPU parallel computing, or choose a more optimized forward calculation method.
3.2. Dam foundation detection of reservoir and power station
The application of the Internet of things geophysical exploration technology based on transient electromagnetic method in dam foundation detection of reservoirs and power stations has also achieved ideal income of nearly one million yuan. Through a large number of engineering practice and results verification, the theory, application conditions, method technology, data processing and result interpretation of transient electromagnetic method have been developed. Further planning and design of field work program and technology, as far as possible to reduce the impact of other interference factors. stay in the future experiments, we can choose ships without strong interference, or lengthen the length of data transmission line of the instrument to avoid the influence of ship interference, or adopt more advanced wireless transmission mode to connect transmission wire frame and instrument equipment (Figure 3).

![Figure 3. Amphibious engineering and environmental geophysical methods.](image)

4. Conclusion
As mentioned above, in recent years, geophysical exploration through the Internet of things has undertaken a wide range of engineering and environmental fields, including those on the sea, on rivers and on land, as well as on both water and land, that is, amphibious. Therefore, the traditional ground geophysical exploration methods and technologies are not competent, and there is no domestic and foreign experience to learn from [6]. In this paper, by using the flexibility of transient electromagnetic method, a set of new geophysical exploration methods and technologies suitable for various engineering tasks of water, land and amphibious are established through continuous exploration and accumulation of various types of engineering tasks. At the same time, there are also new geophysical methods for metal minerals, such as gravity survey and magnetic method. These methods not only make engineering and environmental geophysical exploration simple and feasible through the Internet of things, but also can provide new ideas for geophysical exploration.

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