An Intelligent Exploitation System for Underground mine

ZHANG Yuan Sheng[1, 2, a *], YANG Xiao Cong[1, 2, b]

[1] Beijing General Research Institute of Mining and Metallurgy, Beijing, China

[2] Beijing Key Laboratory of Nonferrous Intelligent Mining Technology, Beijing, China

[a]zysdicky@126.com, [b]yxcong@126.com

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Abstract. With depth increasing, mining environment of underground metal mine become severely, for the purpose of obtaining higher efficiency and safety in mining process, based on the framework of EPC system network to establish a completed efficient intelligent system for underground metal mine exploitation is meaningful. The system consists of information accessing, information organizing and managing, and intelligent application three levels, was given in the paper. By means of this system, it can accelerate technology upgrading in tradition mining industry.

Introduction

Deep mining is an upcoming direction of mining industry. However, the depth deeper, the safety weaker, so higher safety and efficiency is needed in mining process of underground metal mines. Currently ,some underground mines have established computer-aided mining system, remote monitoring system and other useful systems for production, but due to no unified programming and managing, interoperability and normative, there exists a lot of repetitive construction, meanwhile the portability of current system is very poor.

So this paper researched a completed efficient intelligent system for underground metal mine exploitation basing on the framework of EPC (Electronic Product Code) system network.

The Structure of Intelligent Exploitation system

The system consists of three levels, information accessing level, information organizing and managing level, and intelligent application level. Firstly, massive underground information accessing is realized by the use of commonality device of receiving information and middleware software, underground efficient and integrated radio-communication system and underground people and vehicle highly precision positioning system; secondly, the information can be organized and managed by database software, and then the visual exhibition is realized by using three-dimensional visual software; lastly, dispatch and operation system with intelligent and productive properties , safety evaluation system and intelligent mining device realize intelligent and meticulous mining pattern.

Information Accessing

An EPC system can be described by the following elements: sensor nodes, Industrial Ethernet/Wireless Netware, PML server, ONS server and savant middleware system. The structure [1] was shown in Fig.2, EPC Tags was equipped in object, when they went through EPC Readers, EPC can be obtained, and then the data were managed and processed by Savant middleware system, and transported by Industrial Ethernet/Wireless Netware to ONS server, where an IP address was analyzed and returned to Savant, with this IP Savant can find the PML server and retrieve all the message of this EPC.

Based on the structure of this kind of EPC system, an information accessing system can be achieved. We can install EPC Tags in all mining equipment, and meanwhile set up lots of EPC Readers in Tunnel as shown in Fig.3, and build other parts of the system on ground data center, and the Savant middle software is embedded in information organizing and managing system.

With this system we can obtain real-time position of equipment in tunnel, which contribute to the production dispatch system. And also by the Industrial Ethernet/Wireless Netware, we can set up sensor networks which used to get kinds of surrounding messages for safety production [2, 3].

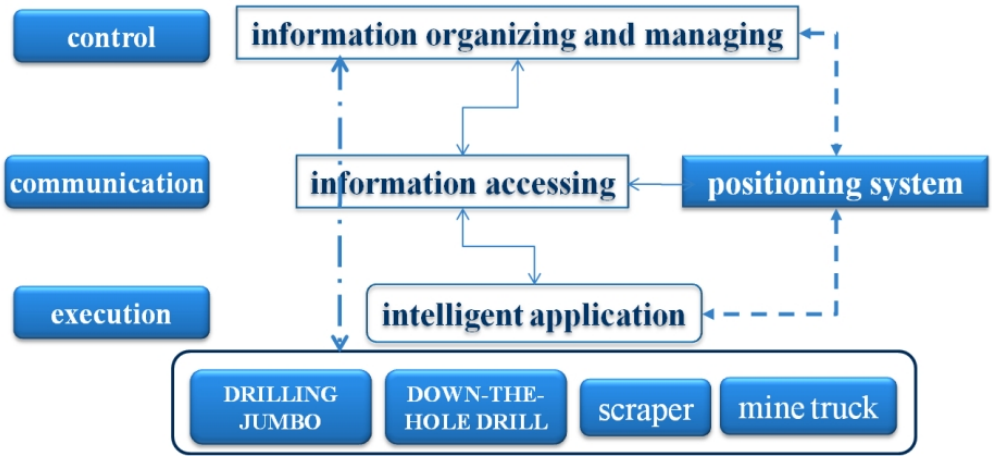

Fig. 1 The architecture of platform

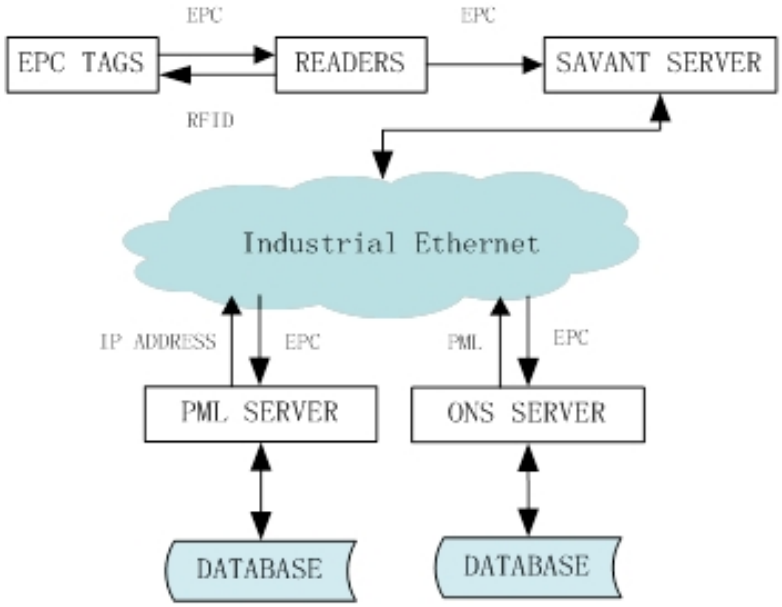

Fig.2 The workflow of EPC system

Information Organizing and Managing

After the data are obtained by information accessing system, all of them can be organized and managed by visual exhibition and database software.

And with the support of data, we can build 3D (Three-dimensional) simulation platform, in which the tunnel and equipment can be all modeled and shown in 3D mode, and also the ore body, stratum and other geological structure are presented in this platform, and based on this model, the mining plan and blasting program can be designed conveniently[4-6].

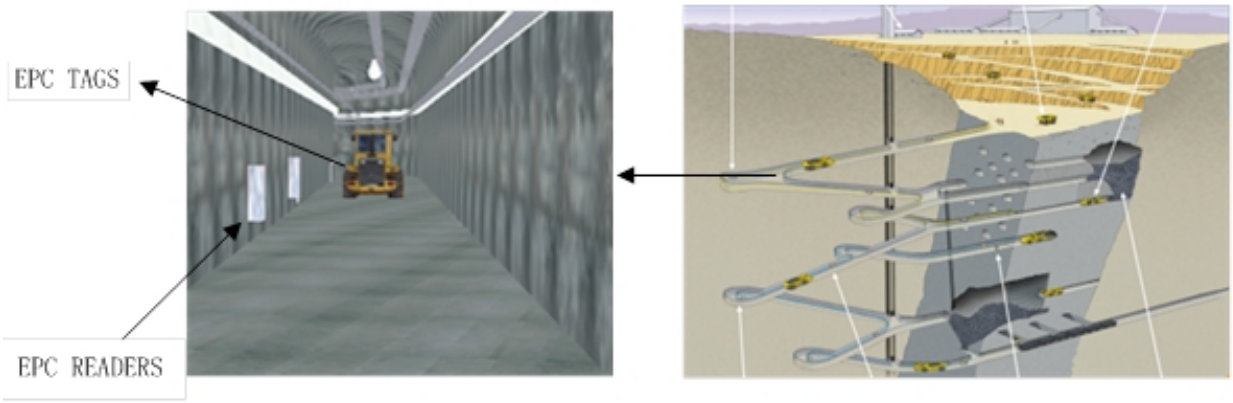

Fig.3 The model of information accessing system based on EPC

Application

According to the 3D simulation platform and the real-time data from underground [7-15], lots of work may be realized. Intelligent mining dispatch and control system can be established, how many mine trucks and scrapers a stope needed, the output of mine in one day, and all other mining activities are computed and arranged by the platform intelligently. We can also carry out mining stability analysis and safety protection work conveniently. Some typical usages are shown in Fig.5.

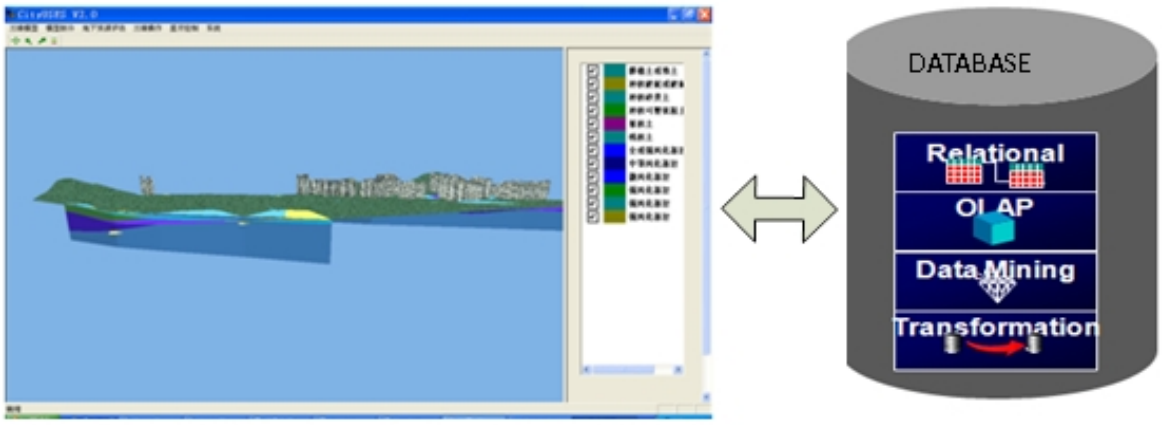

Fig. 4 The structure of Information organizing and managing

Fig.5 Examples of application

Summary

Intelligent mining is the direction of mining area, there are many key techniques need to be overcome. The system formed by Information accessing, information organizing and managing, and intelligent application given an initial ideas and experiment, lots of work need to be researched further in future work.

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