

Research on Condition Monitoring Platform for Mineral Processing Equipment Based on Industrial Cloud

Quan Xu^{1,2}, Yajie Li¹, and Yangang Chu^{1*}

(1. State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University, Shenyang 110819, China;
2. Ubiquitous Network Health Services System Engineering Research Center of the Ministry of Education, Nanjing University of Posts and Telecommunications, Nanjing 210003, China)

Abstract—For different mineral processing enterprises, the development process of condition monitoring system of mineral processing equipment is often very similar, but due to the independence of developers and the lack of information exchange, a lot of code is often written repeatedly when developing a new monitoring system, resulting in higher development costs and lower development efficiency. In addition, the existing monitoring system for mineral processing equipment lacks the collection of equipment operating status data in different mineral processing plants, making it difficult to mine the rules of equipment operating status data. Fault diagnosis algorithms are often designed for specific environments and are not suitable for other environments; monitoring systems are more centralized in the local central monitoring room, it is difficult to achieve mobile monitoring and remote monitoring. In order to solve the above problems, a design on condition monitoring platform for mineral processing equipment based on industrial cloud is proposed. First of all, the platform for monitoring system developers to provide a series of common data acquisition, transmission, collection, analysis and processing and monitoring services to facilitate the rapid development of monitoring system. Secondly, IOT, industrial cloud and big data technology are used to collect data of equipment operating status of different mineral processing plant and optimize the fault diagnosis algorithm to improve the application range of fault diagnosis algorithm.

Key words: Industrial cloud, mineral processing, equipment condition monitoring.

I. INTRODUCTION

The main production equipment of the mineral processing is expensive and the equipment type is relatively fixed, which plays an important role in the strategy of sustainable development of mineral processing enterprises. The existing condition monitoring system of mineral processing equipment is concentrated in the local central monitoring room, lack of remote and mobile monitoring of equipment, and fault diagnosis algorithms are often designed for specific environment, it is difficult to apply to the equipment condition diagnosis in other environments, secondly, it is difficult to find out the rules of them from lack of in-depth analysis of the data of the operating status data of the equipment. In addition, the development of condition monitoring system of mineral processing equipment often repeatedly write a large number of

*Corresponding author: Yangang Chu (yangangchu@163.com)

This work was supported in part by the Open research fund of Ubiquitous Network Health Services System Engineering Research Center of the Ministry of Education under Grant 2017SHS02 and 2017SHS01.

code from lack of common standard service interfaces, which leads to low development efficiency. In recent years, with the advent of the new information technologies, such as IoT, cloud computing, mobile computing and big data, it is possible to build a monitoring platform of equipment condition with universal standard service interface for data collection, transmission, storage, analysis, processing and condition monitoring functions.

This paper presents a monitoring platform for mineral processing equipment based on industrial cloud. This platform provides the service interface of data acquisition, transmission, collection and data analysis and processing, and realizes the component and modularization of remote and mobile monitoring functions, so as to developers can build new equipment condition monitoring system quickly by using this platform, thereby reducing development cost and improving development efficiency. In addition, the platform uses the collected data to continuously optimize the fault diagnosis service, so as to improve the efficiency of fault diagnosis and ensure the production and operation of the equipment effectively.

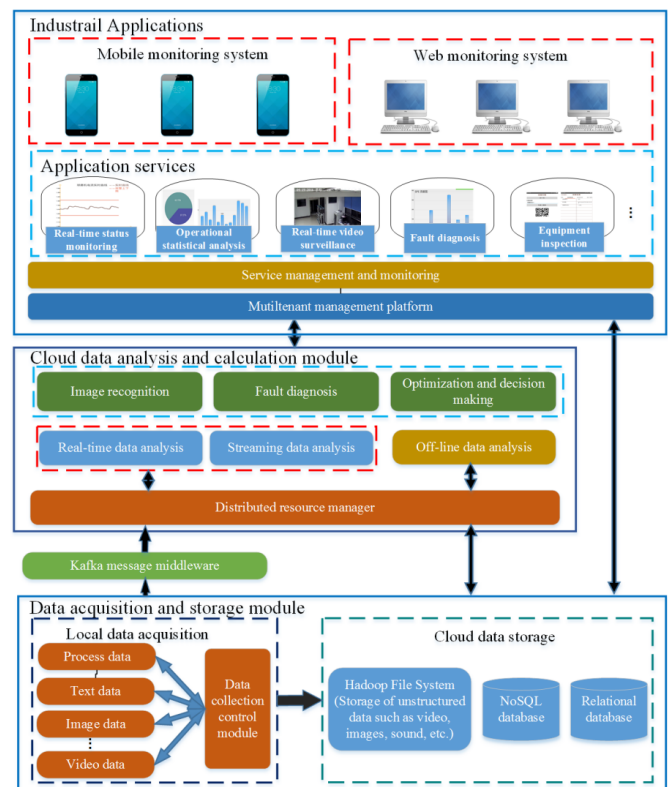


Fig. 1. Monitoring platform architecture for mineral processing equipment.

II. MONITORING PLATFORM ARCHITECTURE FOR MINERAL PROCESSING EQUIPMENT

The architecture of monitoring platform is shown in Fig.1, including data acquisition and storage module, cloud data analysis and calculation module and industrial application module.

The data acquisition and storage module includes the local data acquisition module and the cloud storage module. The local data acquisition module uses the "Wired + wireless" data acquisition way to collect the process data, image data and video data of the mineral processing equipment, and the cloud data storage module uses distributed file and distributed object storage technology to realize the efficient storage of data collected. The video and image data are stored in the Hadoop file system, and the process data is stored in NoSQL database and the results of data processing are stored in relational database. The cloud data analysis and calculation module is used to analyze the operation status data of the equipment which is transferred in cloud through Kafka distributed message middleware. This module includes image recognition, fault diagnosis, optimization and decision making, real-time data analysis, streaming data analysis, off-line data analysis and distributed resource manager. Industrial application module, including multi-tenant management module, service management and monitoring module, application service module, mobile monitoring system and remote monitoring system module.

furnace, filter machine, strong magnetic separator, high gradient magnetic separator, high-frequency fine screen, plunger pump and weak magnetic separator, such as 8 types of equipment. The system includes real-time status monitoring, equipment operation status monitoring, fault diagnosis, equipment inspection, alarm statistics, real-time video monitoring, and so on.

IV. CONCLUSION

The condition monitoring platform for mineral processing equipment provides application services such as real-time condition monitoring service, operational statistical analysis service, fault/abnormal condition alarming service, on-line fault diagnosis service, real-time video fusion diagnosis and monitoring service, which can provide customized equipment monitoring cloud service for different mineral processing plant.

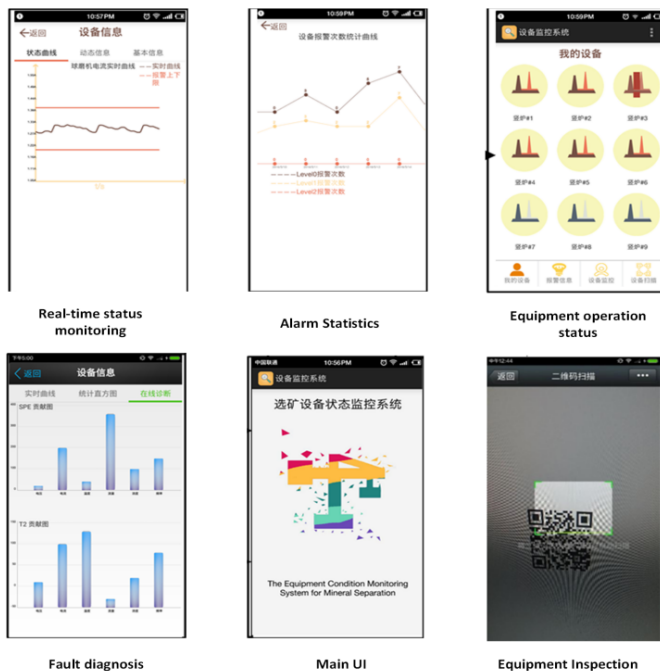


Fig. 2. A mobile equipment condition monitoring system of a mineral processing plant.

III. CASE STUDY

A mobile equipment condition monitoring system of a mineral processing plant has been developed rapidly by using this platform, as shown in Fig.2. The plant has ball mill, shaft