Global Deployment of a Plant Failure Sign Detection Service

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Abstract

NEC has begun to provide a plant failure sign detection service by making use of a proprietary invariant analysis technology. It is promoting global deployment of the service via outside sale collaboration with information industry departments of various so-called So-Go Shosha (hereinafter referred to as a general trading company) which are the departments that handle the IT sales of the company.
This paper discusses how to adopt an approach that can enable customers to recognize the high value of global business deployment while collaborating with trading companies.

Keywords
So-Go Shosha (general trading company), global, invariant analysis technology, big data, the cloud, failure sign monitoring

1. Introduction

NEC has begun a service contributing to the monitoring and maintenance of facilities that makes use of an invariant analysis technology that was developed originally by ourselves. We are promoting the global deployment of this service in collaboration with various general trading companies. This paper is intended to introduce details of our work in this regard.

2. The Business Environment of General Trading Companies

Japanese general trading companies handle a wide range of merchandise. They are engaged in entire industries from upstream industries such as in the development of resources that include crude petroleum, iron ore and coal to downstream industries such as those engaged in the product development and manufacturing and their transportation and sales activities. In their activities aimed at the provision of a huge range of goods and services, the general trading companies collect not only data on the politics, economics, industry and enterprise of various countries worldwide, but they are also involved in the building of global networks.

Traditionally, the primary source of revenue of the general trading companies has been "trading," by which activities that raw materials and goods were sold/bought and commission earned. Recently, however, "business investment," which consists of investing in enterprises and earning profits in the form of stock dividends, is playing an increased role. In considering business investment, trading companies positively promote business deployment in the non-resource field in order to avoid resource-related risks.

General trading companies possess experience and expertise in the operation of the power generation business as discussed below. This is subject to positive investment by such companies as an investment target for expanding business in the non-resource field, with the aim of earning of profit.

3. The Role of the Information Industrial Sector

IT-related transactions conducted between NEC and the trading companies can be dealt roughly with two sectors: the system building sector that belongs to the corporate department and the information industry sector that belongs to the sales department.

The former department is in charge of the promotion of plans and projects and acts as the main contact office that

Fig. 1 Plant failure sign monitoring system.

handles requests of enterprise resource planning systems construction for executing individual business-related applications and also network construction. The latter department is in responsible for providing other sales departments, customers and group enterprises with the IT solutions; expertise cultivated by the trading companies or core business investment funds and the advanced technologies of the IT enterprises.

NEC has a longtime history of relations with the information industrial sectors of general trading companies and especially, in the honeymoon period that occurred about three decades ago. NEC was thereby able to expand business by minimizing country risks thanks to collaborations with the trading companies when deploying NEC products (such as the PASOLINK) in various overseas countries.

Nevertheless, the roles of the information sector are changing due to the adoption of changing strategies. For example, the previous main interest was how to sell commodities based on a "product-oriented" type strategy. However, this has recently been changed to the "market-oriented" strategy, by which the information sector defines the strategic target field and creates/deploys business that can implement newly added values.

At NEC, we are developing a plant monitoring service business model that makes use of the invariant analysis technology. This aims at establishing a scheme to build sales venders outside the company by collaborating with trading companies that we were able to create in the past (**Fig. 1**).

4. What is Invariant Analysis Technology?

The invariant analysis technology is NEC's proprietary technology for automatically extracting invariant relationships between measurement items (sensors, etc.) and detecting abnormalities and discovering plant status changes based on these relationships (**Fig. 2**).

At NEC, we are promoting plant failure sign monitoring service business by adopting this technology.

Traditionally, plant monitoring is based on surpassing thresholds and detecting abnormalities by setting known relationships for the system. However, threshold monitoring has certain issues, such as the significant labor requirement for setting the thresholds according to the operational status and re-setting them after plant modifications. Another issue is that any abnormalities tend to be detected only after they have advanced by a certain degree, as the thresholds are often set beyond the danger levels.

Since the invariant analysis technology detects relationships automatically from the changes of sensor data, modeling is easily achieved if or when the plant status changes. With regard to abnormality detection, an abnormality is discovered by detecting a break of the pairwise relationship between two points, which means that an abnormality can be detected before the monitoring data exceeds the threshold (**Fig. 3** and **Fig. 4**).

There remain a small number of actual cases that can

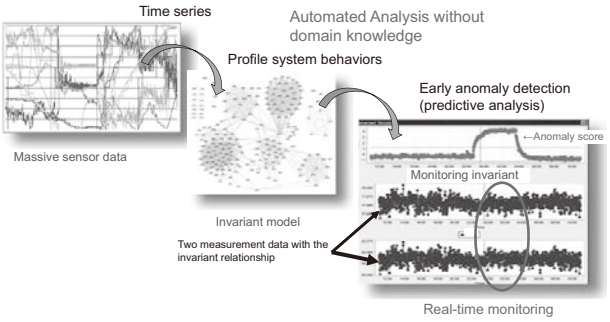

Fig. 2 Outline of invariant analysis.

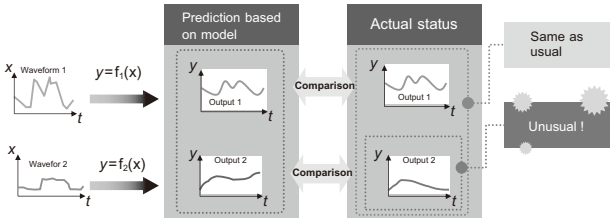

Fig. 3 Discovery of "unusual" events.

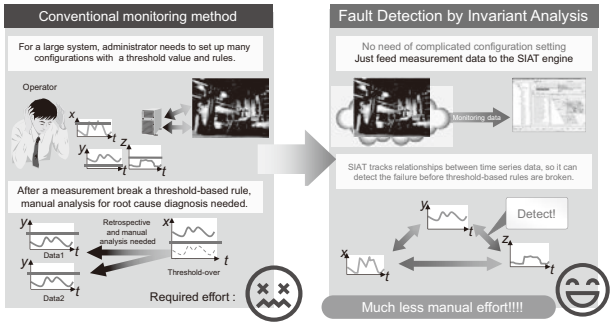

Fig. 4 Comparison with previous monitoring.

demonstrate the effectiveness of this advanced technology in actual operations, so a proof of concept (PoC) is required to demonstrate its effectiveness. In some of the PoCs that NEC has conducted in the past, we have been able to detect faults by up to half a day before a customer noticed their occurrence.

5. Power Generation Plant Invested by General Trading Companies

As described in section 2, the general trading companies are making investments positively in the power sector, particularly in power plants with a view to shifting their investments into the non-resource field. Since 2012, the equity capacities (product of total power generation capacity by stock holding ratio) of trading companies have shown a significant growth.

Now assuming that the plant failure sign monitoring service described in section 4 is the pertinent commodity, let us explain how effective the activities collaborated with the information department of general trading companies are. The main point in this description is the fact that the general trading companies have already established strong relationships with the targeted power plants. Since the general trading companies are stockholders of the targeted plants, they can effectively make use of the relations obtained via transactions in raw materials, etc. Compared to the case of an approach starting from a market survey of each country and then making contacts to potential customers, the effectiveness of the approach described above is obvious.

Fortunately for us at NEC, we have longtime relationships with the information departments of several general trading companies and we know that approaches collaborated with them bring advantages. Such as is the case in which the improvement of operational efficiency thanks to the introduction of a service leads to increased profit. This allows us to create a powerful scheme for the collaborated global deployment of services.

6. Service Platform Activation

The introduction procedure for this service is as follows.

(1) At the data center, data analysis models are created by subjecting the target sensors to the invariant analysis engine of the analysis server.
(2) Data is transferred to the data center via data transfer from servers installed in plants located in the field.
(3) The models created in (1) are compared with the data of (2) to monitor if any invariant relationships are broken.
(4) In case any breaks in invariant relationships are found in (3), the field is notified. (Upon reception of a notification, the plant in the field checks the current status on the service display and takes measures in the field as required.)

One of the concerns in the global deployment of such a service is how efficiently NEC's data analysts can be dispatched. After the actual service has been started, a periodical re-creation of the model becomes necessary due to aging of the equipment and also to the need for periodical servicing. Such re-creation enables the continual provision of a high monitoring accuracy, and its provision as a service enables efficient operation by accumulating the analyzed data in Japan.

However, the global deployment of service business often encounters restrictions imposed on the overseas vendors who provide newly developing countries with services across national borders. When we study the provision of services for such countries, we collaborate with the relevant general trading companies in order to find and avoid the risks that may be associated with specific countries.

7. Business Expansion in the Future

As described above, we continue to deploy our plant failure sign monitoring service globally for plants that invest in the customers of general trading companies via collaboration with the information sectors of such companies.

We anticipate that the results achieved in this field and the deployment of the service platform among the customers of other business departments will also be of assistance in the creation and implementation of the social values that we at NEC are targeting.

Authors' Profiles

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