Development of the Monitoring and Diagnosis Technique on Emergency Diesel Generator Engine System

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1. Introduction

The importance of emergency diesel generator (EDG) has confirmed in the safety evaluation of PSA and the study on aging of EDG has been progressed actively as a part of the project of nuclear plant aging research in the U.S.A.. As the result, the concept of performance evaluation is being transferred from statistical analysis of test results to performance monitoring and trending analysis for monitoring of aging and reliability.

Recently, the study related aging characteristic and reliability for EDGS has begun in Korea. And the performance monitoring of diesel engine and procedures related reliability program of EDG introduced in recent is recommended to be complemented. Consequently, the efficient performance monitoring based systematic and integrated monitoring and failure diagnostic technology is necessary.

Especially, because the operating hours of EDG for nuclear power plant is brief extremely, ordinary monitoring is liable to be negligent and it is difficult to adopt a high degree expert, too. Therefore, it is important for duty engineer to cope with an emergency state easily as a system displays the results of condition monitoring and failure diagnosis.

Putting the goal of this research on a development of monitoring and diagnostic system, diagnosis parameters of EDG is analyzed before anything else. And the prototype monitoring and diagnosis system is developed with this analysis result for a basis.

2. Methods and Implementation

The system is composed of 3 modules for measuring, monitoring and diagnosis with the target of Pielstick PC2-5V i.e. the EDG for Uljin 5/6.

2.1 System classification of diesel engine and diagnosis module

The necessary diagnosis knowledge to compose diagnosis module is acquired as following procedure.

(1) Diesel engine is classified with systems and each system is expressed by object-oriented methodology. In this study, the system is classified with 7 groups (Fig.1) and symptoms, state and sensors of devices is defined in each system. Besides the condition is classified with 5 levels (VL/L/N/H/VH) from the present sensor value and assumed 3 kinds of trend (increase/steady/decrease) by time-series of sensor value.

(2) Prescribing the device symptom and relations of conditions in each system.

(3) Transferring the provided relation to a ruled knowledge

2.2 Monitoring module and measuring module

Indicated following elements to offer effective function of state monitoring to expert.

(1) Real time trend

(2) Historic trend

(3) System mimic diagram

(4) History list of alarm

(5) Present alarm

(6) Indication of diagnosis result

Measuring module must measure the real time sensor value. But because the change of DMDS hardware for Uljin 5/6 EDG is difficult, the values of 'shorttrends_dg 56' table in MySQL DB is used as a real time sensor value.

2.3 Implementation of system

This system is composed as Fig.2 and each module is implemented as follows.

(1) Java language is used to define diesel engine with object-oriented methodology .

(2) The data using real-time measurement are selected after analyzing the MySQL DB of Uljin 5/6 EDG DMDS to develop measuring points.

(3) Monitoring module is designed with In-Touch developing tool. Macro language built-in In-Touch tool is used to call diagnosis module and measuring module.

(4) Diagnosis module is framed with Jrules and connected with monitoring module by interface using Java language.

(5) In the monitoring module, analog data are displayed in monitor. Data are added alarm list and warned alarm in abnormal case. When a diagnosis is needed, diagnosis is required to the diagnosis module. For the sake of this function, monitoring module and diagnosis module are interfaced via DB.

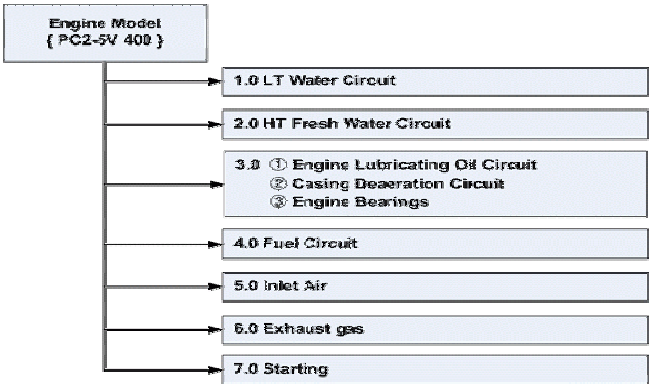

Figure 1. Subsystem of a emergency diesel generator system

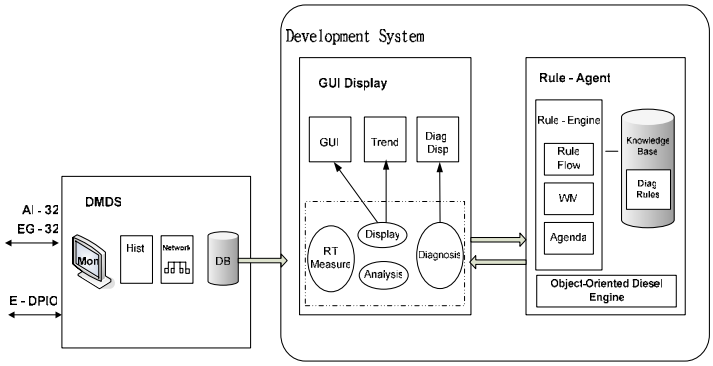

Figure 2. Structure of a monitoring-diagnosis system

3. Conclusion

As the main purpose of this study is to propose the method on monitoring and diagnostic possibility for EDG, the system is developed using developing tool to reduce develop term.

Especially, in the case of measurement section, the trial data of DMDS for Uljin 5/6 EDG(Pielstick PC2-5V) is used as a real time measuring data not to change hardware. And the parameters which can not be measured in EDG are analyzed because sensors are not installed, to examine diagnosis parameters closely. To change these parameters to diagnosis knowledge, these should be modified. In this study, only diagnosis knowledge of 3 systems are drawn up. Hereafter, complementing these, this monitoring and diagnosis system will be complete as practical system.

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