

Remote Monitoring System of HVAC in Post Irradiation Examination Facility

Hyun Su Moon* and Sang Hee Jeong

Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Korea

*hyunsu@kaeri.re.kr

Introduction

The post irradiated examination facility(PIEF) is the first hot cell facility in Korea completed at the end of 1985. It has been performing experiments on commercial spent nuclear fuel for about 40 years. Each room in the facility is classified into four zones according to radioactive materials and has been safely managed. In particular, the HVAC(Heating, Ventilating, and Air Conditioning, HVAC)system is designed to maintain negative pressure inside facility so that the air inside the facility does not leak to the outside and flows only from a zone with low pollution to a zone with high pollution. In this research, the wireless monitoring system is installed for the effective maintenance of HVAC system and the health of HVAC system is analyzed through the system.

Method

◆ The Maintenance Method of HVAC System

The HVAC system is a device that maintains indoor air in a pleasant state through cooling, heating, filtering, etc. In particular, in facilities handling radioactive material, it is more important because it prevents the leakage of radioactive materials to the outside. In general, it is known that air conditioning system account for 50-65% of energy consumption and maintenance costs in buildings. Therefore, through effective maintenance of HVCA system, cost can be reduced and the life of the system equipment can be extended.

The traditional maintenance method is to inspect equipment and replace parts at regular intervals. In this method, there is a possibility that the replacement time may be delayed or accelerated because the actual state of the equipment is not considered. Recently, a PHM (Prognostics & Health Management) has been introduced to solve these limitations. PHM refers to collecting physical information of a equipment and diagnosing its health.

If an abnormality occurs in the HVAC system, there may be a change in physical data such as vibration and temperature. Therefore, failure and health of a equipment can be predicted from physical information. To this end, we want to predict failure by installing a wireless sensor to the HVAC system in PIEF.

◆ The HVAC System in PIEF

Fig. 1 shows HAVC system in PIEF. When outside air enter the facility, fresh air is supplied to laboratories and offices by passing through a pre-filter and a medium filter. The used air pass through a HEPA filter to remove contaminants before being exhausted to the outside. In particular, ducts are separated for each zone, and the inside and outside air is strictly managed.

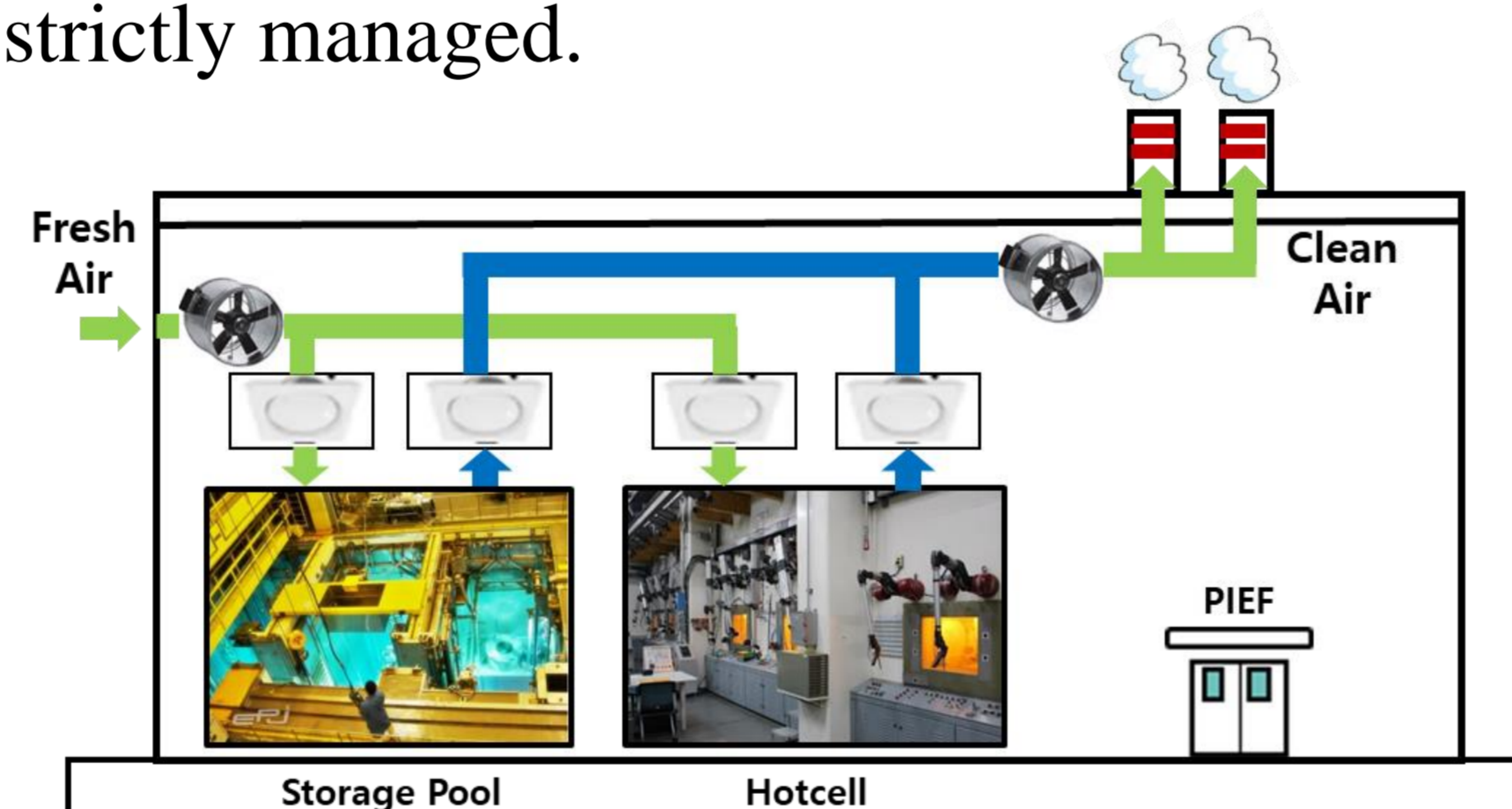


Fig. 1. HVAC system in PIEF

◆ The Installation of Wireless Sensor

To monitor the health of the exhaust fan and motor, a sensor that can measure 3-axis acceleration and temperature is attached to the bearing housing. Fig. 2. shows the floor plan of the exhaust fan and motor. Fig. 3. shows installed sensor attached to the equipment. By measuring data periodically, especially acceleration, the health of the fan and motor is going to be predicted by FFT analysis. The measured values can be saved on a smart phone or computer via bluetooth connection.

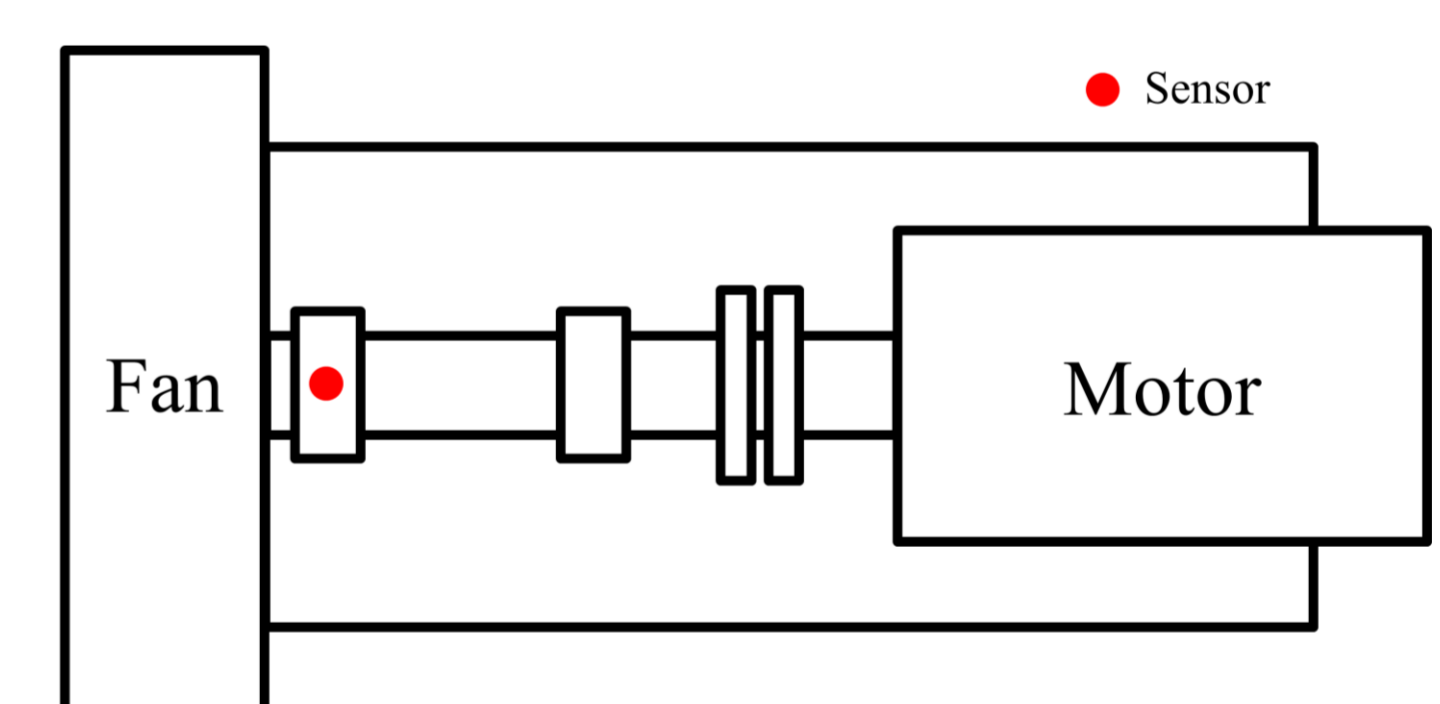


Fig. 2. Floor plan of the exhaust fan and motor

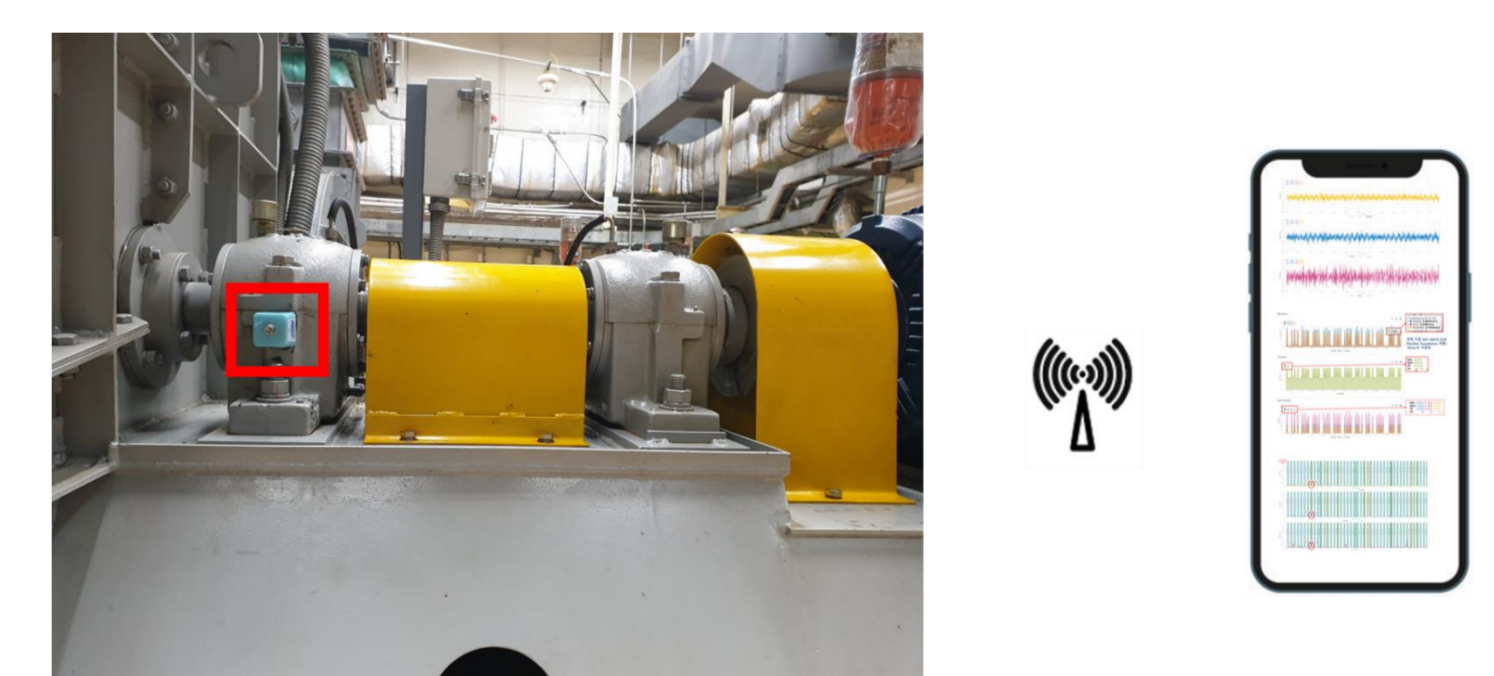
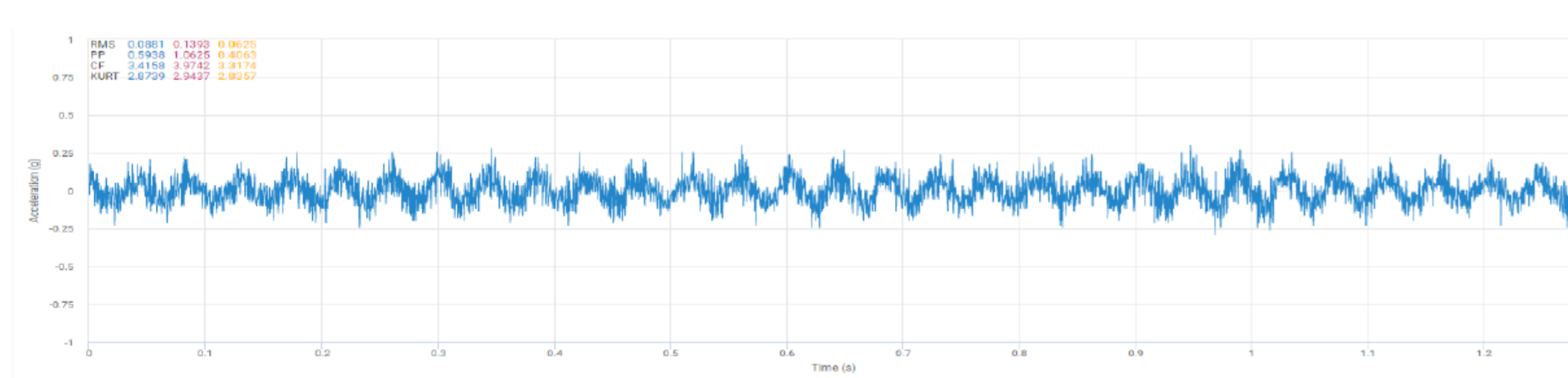
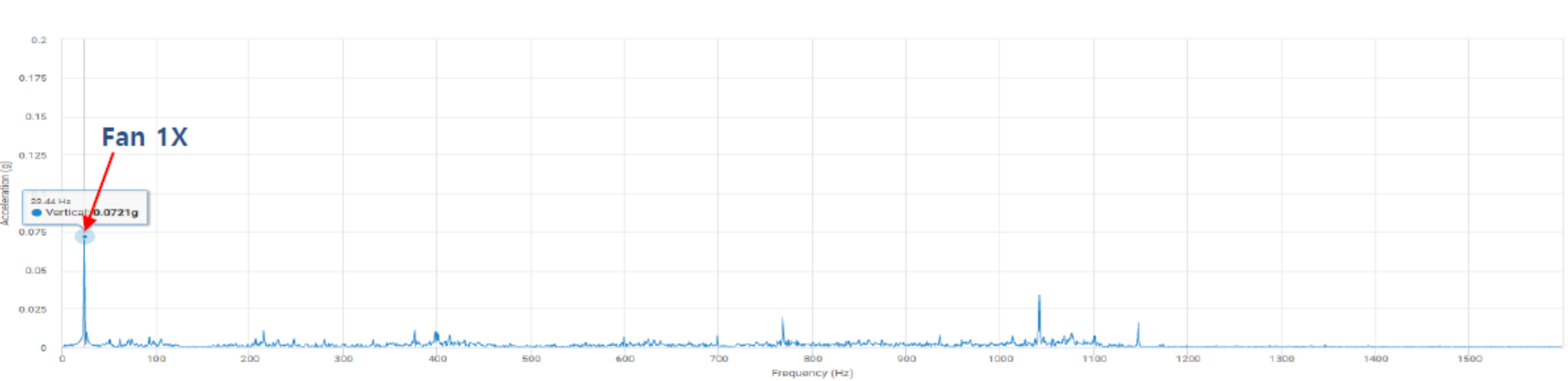


Fig. 3. Installed sensor and application

Results and Discussion



(a) Measured acceleration(Vertical)



(b) FFT spectrum

Fig. 4. Analysis of measured data

Fig. 4. shows the measured acceleration and FFT spectrum. From FFT spectrum of the vertical acceleration, it can be seen that the amplitude at the natural frequency of the fan is relatively large compared to others. This is considered to be due to eccentricity in the fan. Therefore, it is judged necessary to check the acceleration of the fan periodically.

Conclusions

In this paper, the installation of a wireless monitoring system for efficient maintenance of the HVAC system in PIEF is described. From the FFT analysis, the health of fan is predicted. In the future, we will check the possibility of predicting the failure of the exhaust fan by analyzing the measured data periodically.