

Development of Active Portal monitoring System for HANARO

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1. Introduction

A portal gate monitoring system, which reports the real time image information on contaminated personnel or objects in and out of the radiation area has been developed. This system contributes to the effectively preventing the propagation of the radiation contamination outside the radiation area.

2. Methods and Results

In this section, the system configuration of the portal monitoring system, logic for alarms in case of radiation contamination by a radiation worker in and out of the facility, and the control program are described.

2.1 Portal monitor system configuration

The developed system (Fig. 1) comprises two large-scale plastic gamma detectors, which is 11.5 cm in diameter and 213 cm long, IP Camera, LED display, voice alarm, an isolated power supply to suppress the noise background of the detector, and a data base server. All the components can be controlled via a PC and the interfaces were designed to show all the status of each component process.

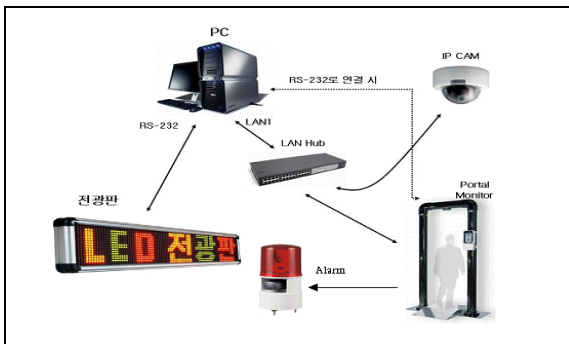


Fig. 1. Portal monitor system configuration

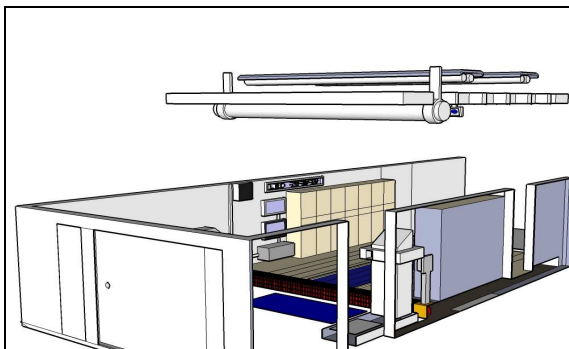


Fig. 2. Layout of installation portal monitors system

Since the main entrance area of HANARO is not very spacious and should accommodate many passengers, gamma detector has been installed on the ceiling and the floor to facilitate their easy access as depicted Fig.2. An IR sensor automatically scans passengers as a start timer to check the passenger contamination in one second.

2.2 Detection logic for radioactivity contamination

The system is operated after calibration with a standard 1 μ Ci Cs-137 source and high voltage bias setting.

In normal situation when there are no passengers, the contamination monitoring devices check the background count rate every one second and insert this data as an alarm reference count level at Shift memory buffers during 10 sec.

As passengers and object were detected by the infra-red sensor, the system transits its background mode to fast measurement mode (200msec), and decides the alarm signal based on the comparison of the average background measurement counts rate (alarm reference level) with fast measurement counts rate during the hold-in time(default setting value: 1sec).

The criterion for alarming signal is as follows: If the count rate signals are more than ($\sigma * BK^{1/2} + BK$), it triggers the alarm signal where σ is 4 as a default and can be adjusted by an administration operator.

The $4 * BK^{1/2}$ values were calculated as 0.1 μ Ci/sec as an alarm triggers value in a current measurement system because as low as background level for safety administration control.

2.3 Design of Operation Program

The portal monitoring program has a device driving program and a program for manager. Figure 3 is the device driving program, which shows the count rate of the plastic gamma detector and trends on the ceiling and the bottom on screen 2 and 4. The screen 3 in Figure 4 allows monitors the status of the entrance of the reactor hall as depicted Fig.3.

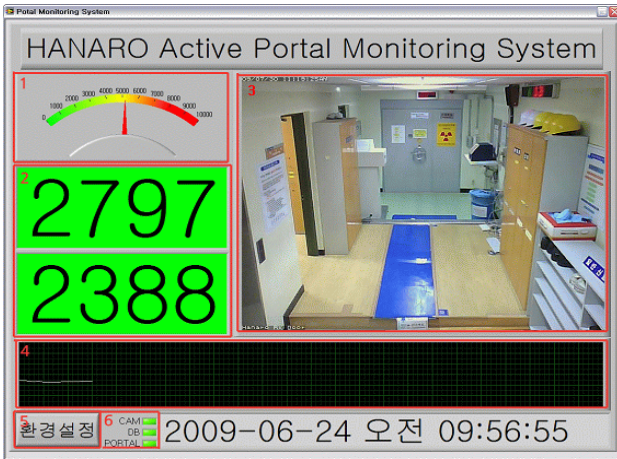


Fig. 3. Layout portal monitors operation program

Figure 4 is the outputs of program for safety manager. The screen 1 shows the capture image and the measured value at contamination monitoring device storing them to My-Sql DB every 5 second. Screen 2 monitors the entrance status in real time. Screen 5 and 6 in Figure 3 is designed to show the list of measured values and trend, and the time when the alarm signal is triggered.

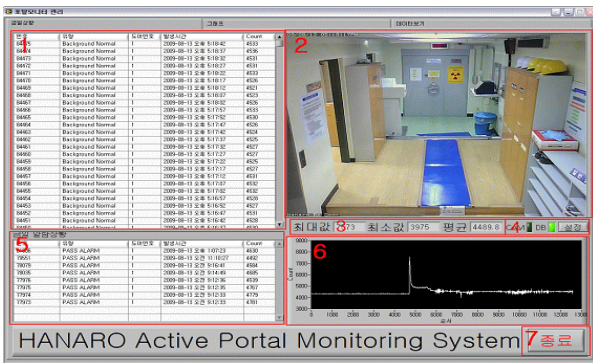


Fig. 4. Layout portal monitors administration program.

As depicted in Figure 5, an alarming pop-up messenger appears promptly to the health physics personnel and reactor control room for early treatment on the contamination when a radiation worker is contaminated or radiation material with the activity more than $0.1\mu\text{Ci}$ is detected.

In addition in Figure6, another alarm paging devices are LED display and voice alarm flash that notify the situation of contamination to the passenger in case of alarm signal. (In normal situation, LED display is used as a help or information window to the passenger)



Fig. 5. Alarm pop-up window



Fig. 6. Installation of voice-flash Alarm and Control PC

3. Conclusions

The developed active portal monitoring system can report the status at the entrance of reactor hall and store all the information in the data base for the follow-up analysis. The system allows the real time dose monitoring, alarm and real time image capture for the contamination above the regulation limit of $0.1\mu\text{Ci}$.

The system has been proven to be robust because it's performance test passed successfully with the 50 times repeated tunnel tests with $1\mu\text{Ci}$ Cs-137 check source and without source as shown in Table 1

Table1. Test for the false alarming rate of the system.

Tunnel performance test		
50 trial-source	Negative false alarm rate	0%
50 trial-no source	Positive false alarm rate	0%

REFERENCES

[1] Transportable Portal Monitor TPM903B, Operating and Service Manual, TSA system, Ltd.