UNARM of the LANL and System Upgrade

Chul-Yong Lee*, Hee-Sung Shin, Ho-Dong Kim
Korea Atomic Energy Research Institute 150, Deokjin-dong, Yuseong-gu, Daejeon, 305-353, Korea
lcy@kaeri.re.kr

1. Introduction

An unattended remote and monitoring system (UNARMS) allows information to be captured and recorded continuously in the absence of an inspector. The Los Alamos National Laboratory (LANL) has developed UNARMS and implemented it in Kazakhstan and Japan. Here, LANL's UNARMS has been studied and upgraded. The upgraded UNARMS divides into hardware and software. On UNARMS's hardware, only a simple change was made that IP camera was used instead of the ALIS Camera. But in a UNARM's software, a completely new review program was developed according to the upgrade system. The developed review program is an integrated program in which the Review programs (Radiation Review, Digital Video Review, Operation Review) functions were integrated into one

2. UNARM of the LANL

UNARM collects data over those time periods when an inspector is not present and provides tools whether the activities performed were authorized or not. That is a main advantage and reduces an inspector's burden. The UNARM system has a redundant, multiple-layered, fault tolerant function. UNARM uses the Camera system, MiniGRANDs, MiniADCs and ILONs. Data from instruments go to collect computer and a Review computer. LANL has developed the MIC program for data acquisition and Review program for data analysis at the remote site. The MiniGRAND has four channels of pulse counting and two channels of current sensor. The MiniADC is an MCA instrument. Also the ILON is a networking device.

3. System upgrade of the LANL

A simple UNARM demonstration system has been installed at LANL. The system was demonstrated to monitor nuclear material in the safe. The demonstration used one miniGRAND for neutron measurement and one miniADC for gamma measurement. Material in the safe is monitored by a DCM-14 digital video camera with a balanced magnetic switch. Data from these devices is sent to a collect computer by the ILON. Also a review computer was used to reconcile received data from collect computer. This demo system has problems. The cost of using a video camera is very expensive and system complicated compared to a general camera. And LANL's Review program needed to be upgraded for easy use. As Fig. 1, the upgraded system used an IP camera.

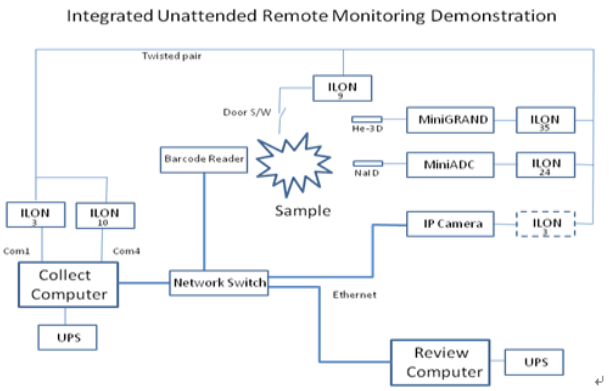

Fig. 1. Upgraded UNARM demo system.

4. Image acquisition from IP camera

The image acquisition program of the IP camera runs on the collect computer. Now, the image acquisition program and the MIC are running at the same time. Images of the IP camera are acquired every 5 min in the normal state but triggered images are acquired every 5 sec in the triggered state. The image directory at the collect computer is c:\CSData and the saving name of the image file is the acquired date. For example, a normal file name is "2009-04-21-10-20-30N.jpg". But a triggered file name is "2009-04-10-25-30T.jpg" ("T" is attached instead of "N"). The 5 sec timer and 5 min timer are used for image acquisition. And the internet transfer control was used for the reading trigger signal from the input port. Image files of C:\CSdata (collect computer) come to send with a review computer by the MicXfer program. The inserted texts in the MicXfer.ini are ;

SOURCEDIR2=C:\CSData
DESTINDIR2=\\192.168.1.5\images

5. Review program

The Review program reads image files from "d:\Images \Cam1" at the review computer. The Review program has a lot of useful functions.

- Confirmation of review information
- Confirmation of missed image file
- Review of only triggered image file
- Review of alarmed image file by alarm set
- Review by display set time
- Trend display

Fig. 2 is the main display after Review information. The user can see several items (review directory, display of review file, setup interval of review display, alarm setup, preview display, display setup time, data display and print image).

Review files are image files. If the check of 'data display' is clicked as in Fig. 3, the data of review file can be shown. Display data is data nearest to the day of review file. Also, the trend is to display 2 hours data shown on the base day of review file. If the repeating option is checked in the data display, the image and data will be displayed continuously. But the repeating speed can be slow because of the data reading time.

If the area of trend display is clicked at Fig. 3, the details of 5 trends will be shown as in Fig. 4. Other trends can be displayed by a combo selection. Also the other selection of 'view' can display trend at a different time. In the pause status, other data points can be displayed by a mouse click. Then the cursor point will be changed.

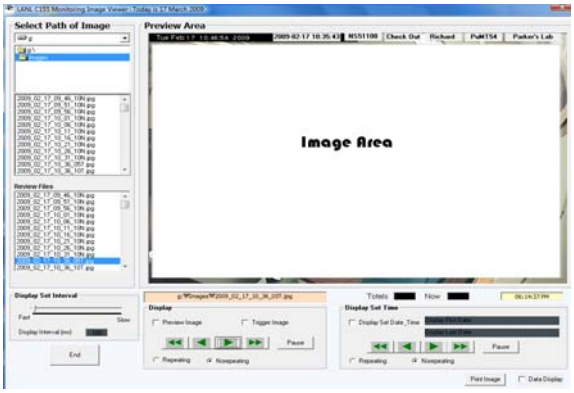

Fig. 2. Main display of Review program.

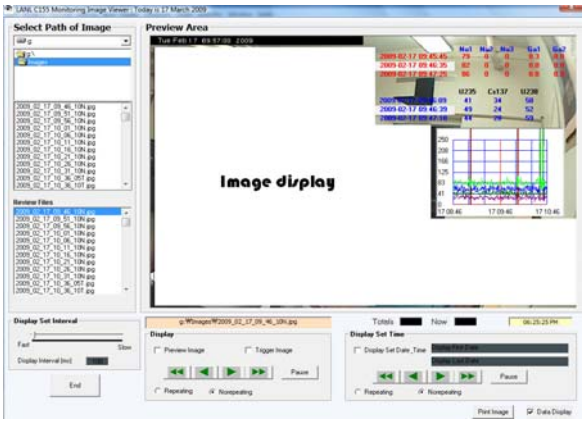

Fig. 3. Data display of Review program

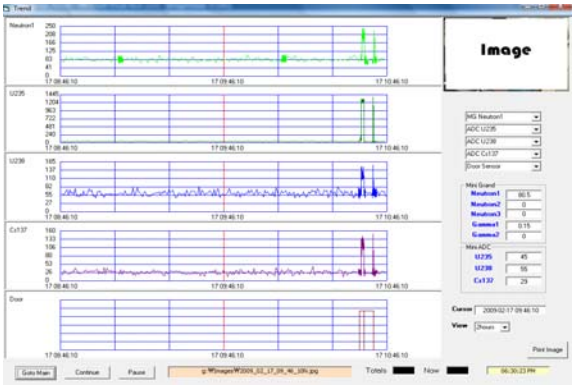

Fig. 4. Detail Trend of Review program

6. Conclusion

The UNARM is a robust and useful system. In the UNARM, an image gives very important information. But the current camera system's problem is that its cost is very high. So, the IP camera was used as an upgraded item. The IP camera is easier from a practical standpoint and more powerful from a technical standpoint. A new review program was developed because the existing review program can't read the image files of the IP camera. But a new review program was developed and its use is easy and convenient. If this upgraded UNARM is used at a nuclear facility, it will provide a viable system for inspectors and facility operators.

As a future plan, a little program revision will be needed and after that, the application for KAERI's pyroprocess facility will proceed.

Acknowledgement

This work has been carried out under the Nuclear R&D Program of the Korea Ministry of Science and Technology (MOST).

REFERENCES

[1] James K.Halbig,"Overview of an Unattended Monitoring System", LA-UR-01-4547, 2001.
[2] K.Alvar, " UNARM(Unattended and Remote Monitoring) an Overview of Los Alamos Activities", LA-UR-01-3609, 2001.
[3] D.G.Pelowitz, "An Internatioal Standardized Utility to Collect Data, MIC", LA-UR-04-4360, 2004.
[4]A.L.Tornton, J.K.Halbig, "BN-350 Mirror System", LA-UR-04-4402, 2004.
[5] MiniGRAND User Manual, LA-UR-99-4400, 2000.