Development of the Radioactive Isotope Smart Storage for KOMAC

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Keywords : Radioactive Isotope Security, Radio Isotope Storage, Radio Isotope management, Radiation safety

1. Introduction

There may be methodological differences in radiation monitoring, but facilities that use radiation generating devices must monitor the radiation. Korea Multi-purpose Accelerator Center (KOMAC) monitors radiation by installing fixed-type monitoring devices in various places within the radiation area. These monitoring devices must periodically test their performance to confirm their soundness and ensure the reliability of their measured values through calibration. The use of radioisotopes is essential for the calibration of radiation detectors, and various types of radioisotopes are required depending on the type of the detectors and the calibration method. As the number of radioisotopes to be managed increases, the manual management method has latent risks such as missing records and lost the radioisotopes.

2. Methods and Results

2.1 Management system for radioisotopes

The Radioisotope Smart Storage (RISS) has the following functions to prevent loss and theft, and to identify the current location of radioisotopes.

1) Storage of carry in/out records including video
2) User identification to ensure that only pre-approved individuals can use the system
3) Prevent of unauthorized radioisotope handle, and alarm generation
4) Carry in/out status report function
5) User-friendly touchscreen-based man-machine interface
6) Locking Feature

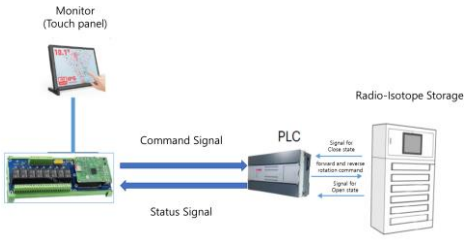

Fig. 1 Configuration of Radio-Isotope Smart Storage

The configuration of radioisotope management system is shown in Figure 1.

2.2 The Structure of Database

The database consists of a table containing information on radioisotopes, an approved user information table, and a carry in/out information table. Figure 2 is a database search screen in the system. In the searched carry in/out information screen, the administrator can search for the date/time of the carry in/out, the information of the handler, and video. When a problem occurs, the administrator can track the incident through the video search and handler information.

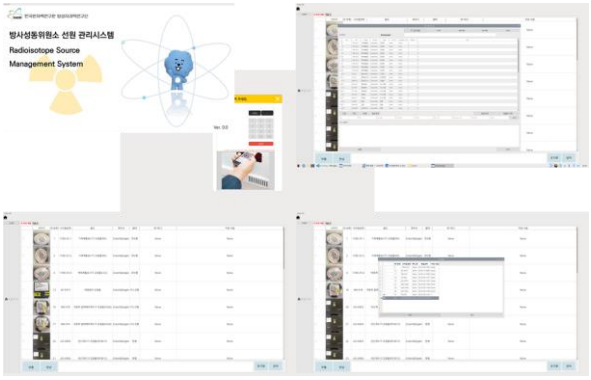

Fig. 2 Radio-Isotope Smart Storage Operation Screen

2.3 The configuration of Hardware

The hardware of the radioisotope management system includes input devices such as a touchscreen, camera, and QR tag reader for communication between the system and the user, a storage device for recording the carry-in/out history, and a Programmable Logic Controller (PLC) and Digital I/O board for performing predetermined actions based on logical judgments. Additionally, there is a drive motor and a motor drive board as part of the driving unit for operating and locking the storage drawer. The system also includes an RF tag and antenna for identifying unauthorized

exported radioisotopes. The RF tag is individually attached to each radioisotope for identification purposes.

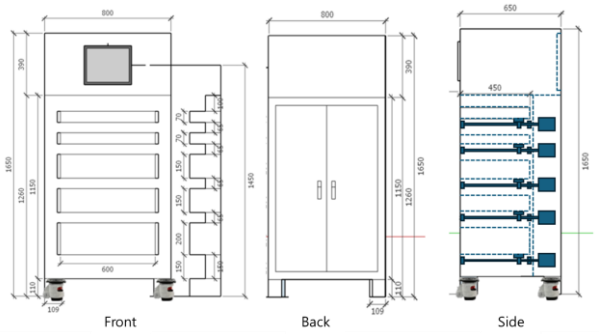

Fig. 3 Drawing for the Radio-Isotope Smart Storage

2.4 Operation

Anyone who wants to handle radioisotopes must request approval from the administrator in advance and register as a user in the system. After registering, the system recognizes the barcode of their TLD.
After registering as a user, the user can be recognized by the barcode of their TLD. Then, user selects the source to be handled on the screen, and presses the drawer out button. The system records the handler's identification number and opens the drawer where the selected source is stored. The user takes out the source to be handled and leaves the system. To return the source, the user presses the return button and selects the source to be returned from the list of previously exported sources. The drawer where the returned source should be stored is opened, and the drawer closes automatically once the source is returned.

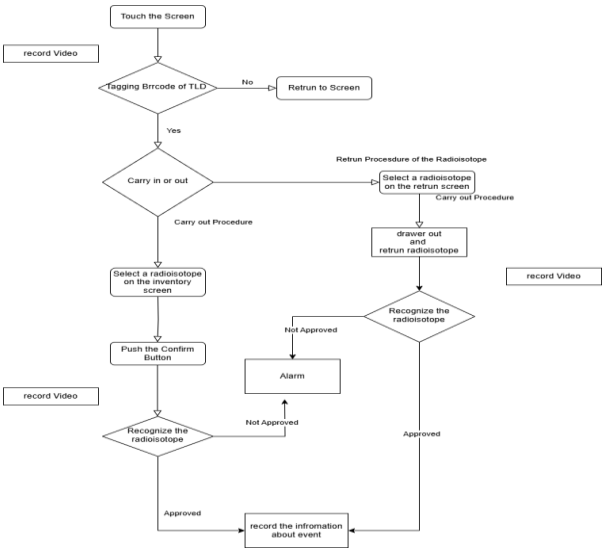

Fig. 4 Operation flowchart for Radio-Isotope Smart Storage

If the user attempts to take out a non-selected radioisotope source, the RFID system will detect the action and trigger an alarm to notify that it is not authorized.

3. Conclusions

RFID technology is commonly used to manage items and logistics movement. Since radioactive isotope sources are small and vulnerable to loss or theft, the risks associated with these factors can be significant. Therefore, security management is essential for handling radioactive isotopes above a certain level.

RFID technology has been implemented to manage radiation sources that require security measures, such as location tracking. The level of security management has been enhanced through features like handling approval, locking devices, event video recording, and event record-keeping.

Compared to the previous method of manually managing dozens of button-type sources, this system stores history in a database, making radiation source management more reliable and tracking easier in the event of loss or theft. Additionally, by using a motor-driven drawer system, a basic locking function is implemented, and automatic recording occurs when an event takes place.

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