

Smart Reagents Safety Management System using NFC

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Abstract

In recent years, embedded systems with various functions are being developed using ICT has increased both in industrial fields and also households.

In the case of the reagent cabinet to be used in chemical laboratories and universities, it has been developed to suit your needs. Current reagent cabinet is only going to show the internal environment to the administrator, and Data of the reagent itself is managed as a handwritten note. In addition, it shows the state of the internal reagent cabinet to the administrator, but does not notify administrators if there is a problem in it.

In this paper, we propose to solve this problem of safety management system using the reagent cabinet and ICT. By measuring the conditions inside reagent cabinet by utilizing the sensor shows a GUI to manage in real time. Using NFC, we convert the information of the reagent to data to improve the efficiency and safety of reagent cabinet to the administrator. Also it enables remote devices to check and control the information of the cabinet. This will enable to effectively and safely manage a reagent cabinet in a laboratory or university.

Keywords: Real-time Management System, Embedded Systems, NFC, USN, GCM

INTRODUCTION

With the recent development in information communication technology, the performance of the equipment has improved and its size reduced. In particular, many embedded Platform such as Raspberry Pi and Beaglebone black fused to improve the efficiency of existing products and equipment are proposed[1,2]. In addition an open source on the IoT and a public smart device has been developed on a number of systems, utilizing this system being developed for progress in many areas[3,4]. Many studies have been conducted for the management of medical materials and chemistry, especially this platform is being developed for the reagent management. The reagent material can be damaged or transform depending on the storage environment. Thus, according to the characteristics of the reagents is required systematic management of storage on the reagent. The cases need a systematic management of the risks of reagents and reagent

storage, depending on reagent properties. This issue does not identify the administrator in real time upon the occurrence of reagent cabinet internal problems[5-7].

In this paper, we propose a smart reagent cabinet safety management system that leverages the embedded board with NFC technology. Converting the reagent information into data and gives the user a list and usage record of the reagent via GUI and then we can connect a smart device or a remote monitoring system from anywhere.

DESIGN

This chapter deals with the design of the reagents safety management system.

Design of Algorithm :

Figure 1 shows a configuration of a system

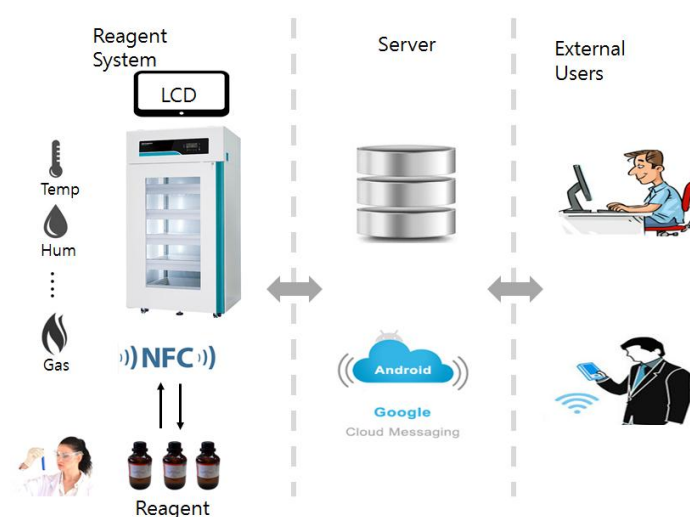


Figure 1. System Configuration

By utilizing the NFC technology to convert the reagent information data, we propose a system for managing and recording the history of the reagents used in the reagent cabinet.

Connect the embedded board in reagent cabinet and connect the NFC device to read the tag information (the name of the reagent, CAS number, expiration date, etc.) of the attached reagent. Also designs a GUI (Graphical User Interface) to show the information of the data to the user. The server, designing a database for storing information of reagent cabinet interior, the data stored in the database is in real time, to be able to check the current status via a mobile device or computer.

Design of Algorithm :

Figure 2 shows the algorithm used in this project. When I/O page is clicked, the button is moved to the User Login page which lets users login to their user access card, which reads the stored data in the access cards and tags on the card, and designed to bring correspondence data. If no matching data in found in the database, it shows a warning message. And if there is matching data in the database, go to the In/Out page, and shows call reagent data and display user view. Also, if you use the reagent of internal reagent cabinet, recognize the inside of the tag, to change the state of the reagents in the current database. When the data is recognized, by distinguishing the state of the reagent in the current database, if present therein, to change the current state and it is designed so that the number of currently available reagents are changed. If you put the used reagents in the reagent cabinet, it will change the state and changes the usable reagent Count.

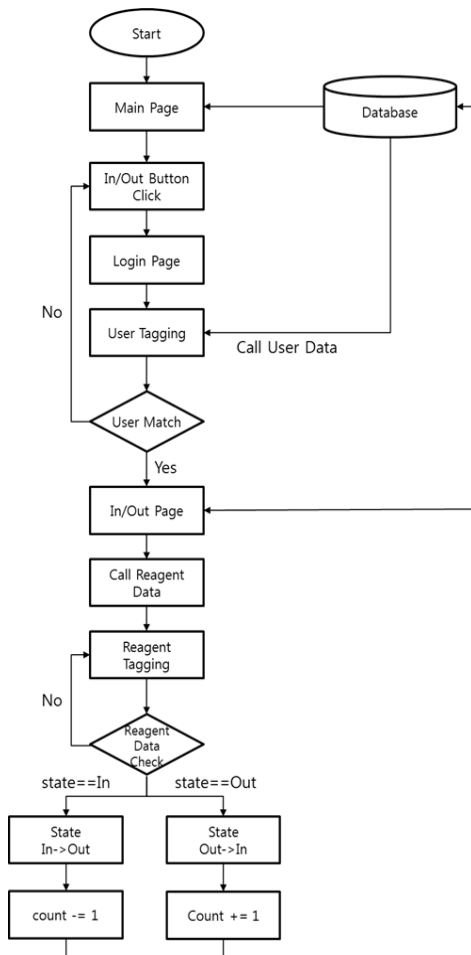


Figure 2. In/Out Algorithm of Reagent

IMPLEMENTATION

This chapter deals with the implementation of smart reagent cabinet system.

System Implementation :

Figure 3 shows the class diagram of the overall system. Main frame class is part of the check and verifies the functionality when the system is operating. Check the database connection for acquiring data of the internal reagent cabinet when operating the system, the set value is stored in a variable. Also, storage in a stack called the class of other pages may be shown to the user, when a user navigates to the desired page is designed to be able to switch the screen. The Main page shows the state of data received from the sensor data and database connected to the board to the user. The Login page is designed to determine the user coming to read the data of the NFC tag comparison with the data in the database. In / Out page is saved to bring the data of the reagent currently in the reagent cabinet from the database. Then, show the user the data in GUI View. In addition, users and administrators read the state of the reagent from In / Out to the NFC tag and compare it to the database to compare the state of the matching data. The system then stores the updated database by changing the current status and quantity. Reagent list page is a function showing the detailed data of the reagent. In / Out page, the name of the registered reagent, shows only simple information as characteristic variables. And Reagent list page, from one reagent expiration date, manufacturing date, is Implemented so as to be able to check the status of the In / Out and displays the History page, which shows the user record of when and how a reagent In/Out was used.

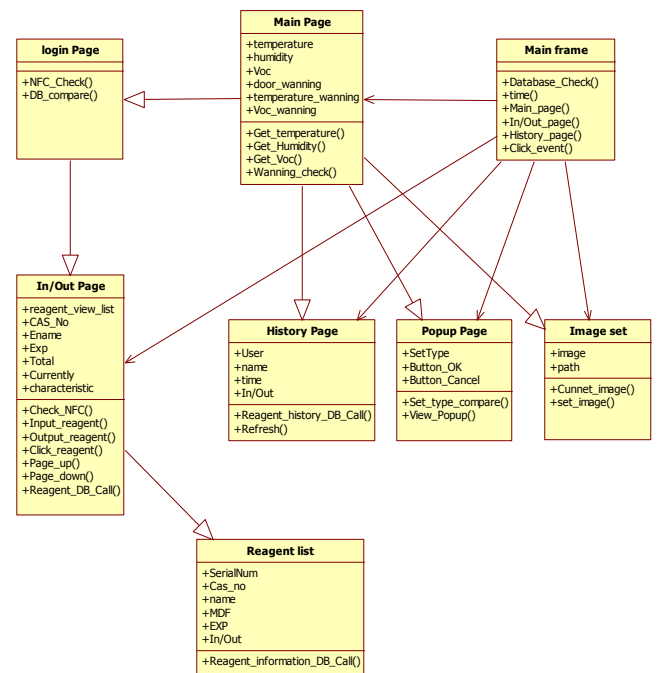


Figure 3. Class Diagram of Management System

Management System Implement :

Figure 4 shows the reagent management screen of reagent cabinet management system. When the user recognizes a reagent by reagent's NFC tag, it can be confirmed that the state of the usable quantity and In / Out data corresponding reagents are changed. When history button is clicked, you can check 'in / out' recording of user of the reagent, as shown in Figure 5. The data used in the In / Out Page and stores the write data (user, reagent name, time) in the History Page. And change the position depending on the storage state of the reagent by comparing the current state and the reagents, stored in the database shown in the user GUI.

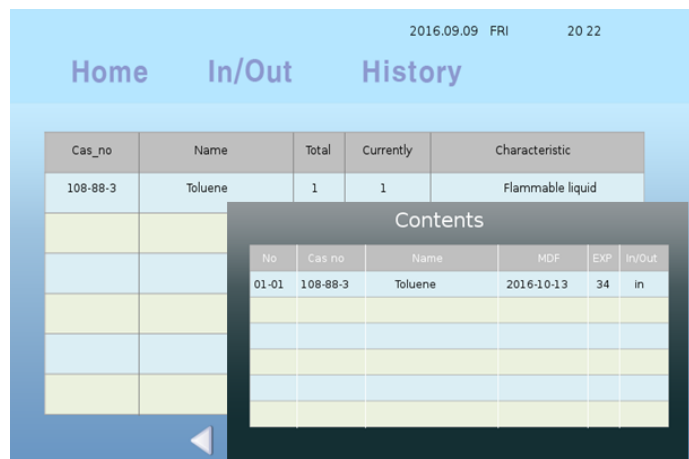


Figure 4. In/Out Page GUI

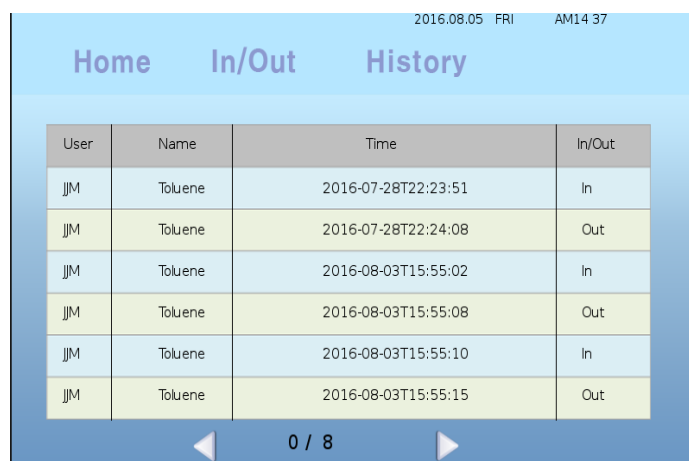


Figure 5. Reagents used records management

Application Implement :

Figure 6 is a screen for confirming the information on the reagent cabinet within a mobile device.



Figure 6. Remote Reagent management

Bring list of the reagent present inside reagent cabinet using PHP from the server's database. Also, bring the name of the current holdings to have reagent, indicate to the user. And when you click the name of the reagent, show the reagent detailed data of the name, create a new pop-up window.

Review:

Table 1 shows the functions of the reagent cabinet system sold in the market. A System is for a system for managing an exhaust device inside reagent cabinet. System B is measured by the sensor data such as temperature, humidity, and performs a function that shows the user data. C System, which performs a function similar to B System, is different reagents that are managed by refrigerated type reagent cabinet. D System performs a temperature control function and an electronic door. Thus the existing system and reagent cabinet to manage them are being used to manage the environment for storing reagents.

Table 1. Reagents cabinet System

System	category	Function
A	Hermetic cabinet	Advanced electronic control, Door open (notified lamps) Exhaust device Lighting device
B	Hermetic cabinet	1-Temperature, humidity, gas concentrations Check 2-Door Lock Function
C	Refrigerated Cabinets	Displays temperature sensor, VOCs sensor and filter replacement cycle
D	Refrigerated Cabinets	Check the temperature, thermostats Magnetic Door Filter and purification by anion

Method presented in this paper has a characteristic as shown in Table 2. In addition to the internal state of the reagent cabinet

by showing the information in a GUI reagents utilizing NFC technology allows an efficient reagent management. Then by utilizing the NFC, it was implemented to improve the security so that only users who have registered in the database can be used. Administrator confirms the reagent cabinet inside of the data in real time, to allow remote control. The advantage of this system is in the management over existing reagent cabinet, efficiency can be considered high.

Table 2. Feature of the proposed system

Function
Efficient reagent management
Real-time access function using the NFC tag
Improvement of security using NFC tags
Safety management through real-time control

CONCLUSION

With the development of embedded systems, homes and factories, a combination of information and communication technology in real life, such as the Institute, has progressed in a new direction. Inside a typical chemical laboratory, reagents are stored and managed in the cabinet. The administrator can check the status of reagent cabinet's interior, and check reagent information. And it is necessary to provide by outputting a Material Safety Data Sheet. However, laboratory reagents accident rate is a trend that is increasing every year. Thus, the safety of laboratory research in several directions is underway.

In this paper, we discuss how to efficiently manage the information of the internal reagent inside a reagent cabinet for laboratory safety. We achieved this by fusing NFC, which improves the safety of the reagent management to save the usage record of reagent. State of the reagent cabinet can even be remotely monitored with a smart devices, and implemented to control, efficiency and stability of the management over existing reagent cabinet, have appeared to be greatly improved.

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