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FIRE CONTROL IN BUILDINGS AND THE DEVELOPMENT OF RFID APPLICATION SYSTEMS

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ABSTRACT

Since Taiwan is a crowded island, serious disaster will cause personnel casualty and property damage. When calamity happens, how to effectively deal with the emergency is a significant task for the Fire Control Department. Currently the standard operation procedure for fire rescue is: (a) receives building fire report, (b) inquires available emergency rescue drawings, (c) asks for related drawings of the building. This procedure may waste precious rescue time, delay rescue effort and, even more, injure the fire fighters. In this research, PDA combined with RFID is used to develop the application package. This system will collect and return building rescue drawings and fire control information to rescue team in accident scene. This research can integrate the fire control related data, accelerate fire control operation, assist the responsible agency to manage the database and provide immediate inquiry capability through internet. Further, through RFID and PDA, the fire control data of a building can transmit immediately to the rescue team to carry out his mission effectively.

KEYWORDS

RFID, PDA. Fire Rescue, Building

1. REASONS AND GOALS

The traditional method for people to access previous fire control and disaster relief data archive files is both inefficient and time-consuming. To effectively shorten the time needed to proceed with relief efforts and increase the accuracy of the accessed data files, the planned goals for this study are as follows:

A. Obtain the A-type and B-type rescue diagrams and building fire control related data needed for "Standard Operations Procedures for Rescues in General Fires."
B. Establish various functional modules for "building fire control system mobilized identification system" through system analysis, and establish the database structure.
C. Establish an electronic database, which will provide for easy updating of data, increasing the effective management efficiency of related illustrations data, and combining PDA and RFID, achieving standardization, computerization, mobilization, and information integration in one consistent and integrated operation specification, thereby increasing rescue time efficiency, and decreasing the amount of damage caused by fires.
D. Combining PDA and RFID technologies, developing the "building fire control mobilized identification system", and managing the database through this system, thereby achieving the goal of making electronic data and improving the process of accessing this data so that the traditional inefficient paper-based methods will no longer be needed.
E. Verification of the feasibility and correctness of the system through case study, and the improvement of system defects.

2. FUNCTIONAL REQUIREMENTS

This entire "Research for the Mobilization of Fire Control in Buildings and the Development of RFID Applications" system includes the following items:

A. Establishment of the fundamental data structure of the system, and meeting user requirements.

B. Establishment of four main groups of system development requirements, which are: system operations, basic operations, building data operations, and data query operations.

C. System operations include user data management, authorization of parameter settings, and printer settings options. The main focus of this group will be on setting up the system environment.

D. Basic operations include city and county data management, township and municipality and area data management, and building type management. This group mainly establishes the basic area and locality information.

E. Building data operations includes building data management, single building query operations, various building floor and level data management, and the printing of building-related data. This group mainly sets up the basis for building data queries.

F. Data query operations include the query operations for the various floors of different buildings, query operations for the rescue diagrams for various floors of different buildings, building area query operations, and building type query operations. This group mainly deals with the establishment of rescue related information.

3. SYSTEM ARCHITECTURE

3.1. System Analysis

According to the functional requirements and user operation interface requirements for accessing fire scene illustrations and building related data obtained through the review of the data archives, we can develop a "Mobilized building fire control identification system" that is suitable for on-the-scene operation. By using data analysis technology to analyze operational procedures, simulate the relationship between the subsystem architecture and the database, confirm the necessary operations items, and eliminate unnecessary operational items, we can simplify system management operations, and produce an overall analysis on system security.

Table 1 System Modules

Operational Group	Operational Item
System Operations	User Data Management
	Authorization Parameter Settings
	Printer Settings
Basic Operations	County & Township Data Management
	Building Type Management
Building Data Operations	Building Data Management
	Single Building Query Operations
	Various Building Floor Data Management
	Related Building Data Printing
Data Query Operations	Data Query for Various Floors of Buildings
	Rescue Diagrams Data Query
	Building Area Query
	Building Type Query

3.2. Database Structure Analysis

The structure of the database is the primary core of the system. If the database structure is incorrect, or if it does not concur with user requirements, then the entire data stream will be erroneous, resulting in the output of unanticipated data. Thus, being able to devise a database structure that is concurrent with system functionality requirements is crucial to the success of the project.

With the advancement of technologies, database systems have evolved from traditional relational databases to object-oriented databases (OODBs for short), and object-oriented databases have already become the mainstream in database management systems. This study uses the ER/Studio tool to establish an ER Diagram, devises the data flow diagram according to this model and the user requirements, builds an E-R Model (Entity-Relationship Model), and then establishes the en-

tity database only after the various fields in the tables and the relationships between the various tables have been defined. This established database is the entity-relationship database.

After the user has established the ER/Model, the tools provided by the software can be used to convert the database structure into a script file that is compatible with generic database management systems, allowing the database console to read in the system database, its various table fields, the attributes of the various fields, and the relationships between the primary keys and the foreign keys of the various tables, thereby establishing the system database.

3.3. Establishment of Related Data

Through user requirement analysis, this study can clearly define the database to be established. The following is a brief description of the contents of the database:

A. Basic Operations

a. City and county data management: mainly establishes the data of various cities and counties to facilitate the setting of basic building data by administrators.
b. Township, municipality, and area data management: mainly establishes the data for various townships, municipalities, and areas to facilitate the setting of basic building data by administrators.
c. Building type management: mainly establishes type serial numbers and names for building types, for example, religious, public gathering, or residential buildings, etc.

B. Building Data Operations

a. Building data management: mainly establishes building serial numbers, building names, owners, emergency contact telephone numbers, owner mobile phone numbers, building latitudes and longitudes, building RFID label serial numbers, building types, and additional remarks data, etc.
b. Single building query operations: mainly establishes individual building information content, building types, and additional remarks, etc.
c. Various building floor and level data management: mainly establishes serial numbers for the various floors and levels of the buildings, renters, emergency contact methods, and notes, etc.
d. Printing of building-related data: provides users with printing of on-site query data.

C. Data Query Operations:

a. Query operations for the various floors of buildings: on-site users operate PDA query systems and send out information on various buildings through the RFID reader.
b. Query operations for the rescue diagrams for various floors of buildings: mainly establishes rescue illustrations for the various floors of buildings and provides users with query and access to these illustrations.
c. Building area query operations: categorizes buildings according to areas and then distinguishes them according to RFID serial numbers, allowing direct on-site query of information using PDA.
d. Building type query operations: performs queries and allows access through building serial numbers and building type names, such as religious, public gathering, residential buildings, etc.

3.4. PDA-End System Function Analysis

A. RFID Read Function:

Mainly provides a means for the on-site user to send or receive a message from the building's label through the read device. After the building serial number has been obtained, it is sent to the network server to proceed with building data query.

B. Building Information Query:

Provides users with a means for on-site building information query using the building's serial number as an index for performing the data query, including building serial numbers, building names, latitude, longitude, and floor levels, etc.

C. Geographical Information System:

When receiving building information through the wireless LAN, the user may select the floor level

of the fire through the system; to help the rescue operation after the information has been loaded.

D. Rescue Records System:

The fire control rescue records system provides fire scene records and information relative to the fire scene, and also transmits information back to the database for updating through the network.

4. SYSTEM FUNCTIONS

The following are the operations groups that this study has completed:

A. System Operations.
B. Basic Operations.
C. Building Information Operations.
D. Data Query Operations.

4.1. System Operations

The System Operations Module is divided into four pages: in addition to the basic printer, exit settings, and authorization parameter settings, it also includes User Data Management.

Six user authorization levels (Entrance, Edit, Insert, Print, Delete, Other) can be set for user data management; and the display information and display ratio of the illustrations can be specified through the parameter settings.

4.2. Basic Operations

Included in the basic operations are: County & Township Data Management (Figure 1), Municipality and Area Data Management.

4.3. Building Information Operations

The building data operations system includes: Building Type Management, Single Building Data Operations (Figure 2), Various Building Floor Data Management, and Related Building Data Printing.

4.4. Data Query Operations

The data query operations system includes: q Data Query for Various Floors of Buildings (Figure 3), Rescue Diagrams Data Query, Building Area Query, and Building Type Query combined with RFID.

Figure 1 County & Township Data Management

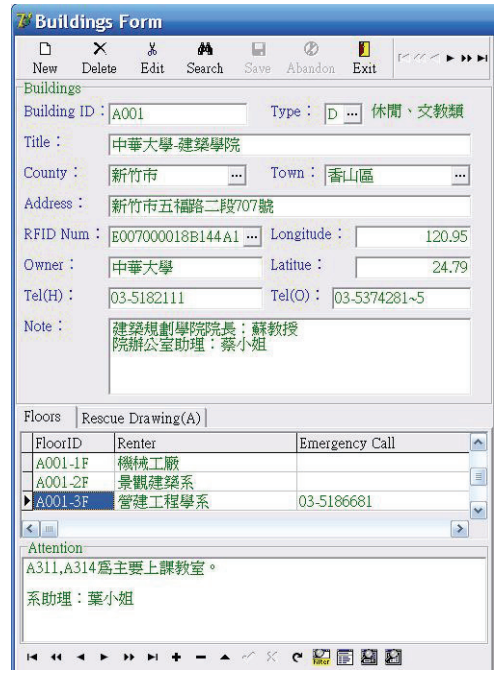

Figure 2 Building Data Input Dialogue

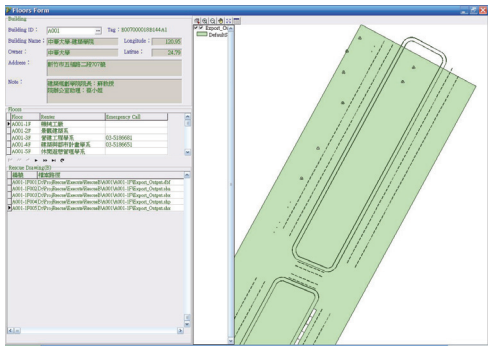

Figure 3 Loading of Illustrations Data for a Specific Floor Level

4.5. Application of RFID and PDA

A. Design and Planning of System Forms

This portion will focus on database data fields and the operational display of the PDA as the basic elements for form planning, and will take the user's operational requirements into consideration for the design.

B. Establishment and Operation of the System

a. RFID Label Reader Function

Primarily provides on-site users with a means of sending a read message to the building's label through the reader card. After the serial number of the building has been obtained, it will be sent to the server to proceed with queries of building related data, such as building number, name, geographical location, etc.

b. Geographical Information System

Through the included Superpad function, the on-site user can directly proceed with the query, creation, deletion, modification, and measurement of building illustrations, updating the illustrations instantly, and thereby ensuring that the illustrations are as up-to-date and meaningful as possible.

4.6. User-End System

A. Building Label Identification

Using the RFID read function for building label identification. First, select the connection port and verify whether or not the CF-Reader has successfully connected, as shown in Figure 4.

B. Building Data Query

This sends the building serial number to the dynamic data webpage to proceed with data query, as shown in Figure 5.

C. Various Floor Level Information Query

This proceeds with query of the data of various floors through relative menu selection, as shown in Figure 6.

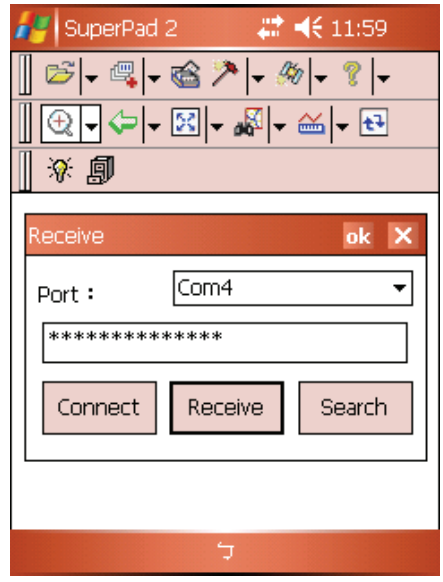

Figure 4 Reading of Building Labels

5. CONTRIBUTIONS

By going through archives and research papers, this study has obtained knowledge and understanding of the principles and applications of current RFID technology and the information needed on-site at building fire disaster scenes, and has proposed recommendations and strategies regarding the manual review of illustrations at these disaster sites. This study has also proceeded with system analysis and database establishment according to current PDA, RFID, and GIS technology applicability, and has established a "Mobilized Identification System for Fire Control in Buildings", with the goal of creating a mobilized querying platform for building fire control rescuers.

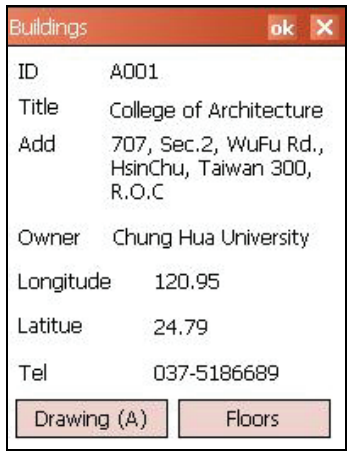

Figure 5 Query of Building Information

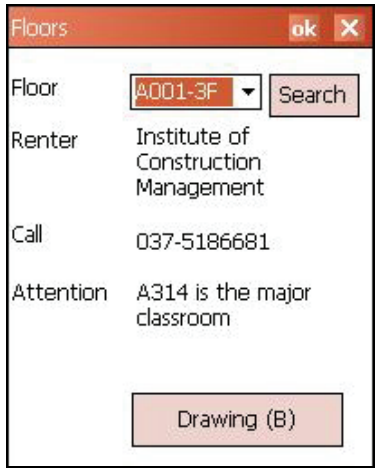

Figure 6 Query for Data from Various Floor Levels

By establishing the "Research for the fire control in buildings and the development of RFID application systems" in this study, the following contributions can be made to domestic fire rescue operations:

A. Relative "Standard operation procedures for general fire emergency incident rescue operations" data and illustrations that must be accessed will be collected and stored and managed electronically, making the data less susceptible to loss. Integration of PDA and RFID will rationalize, standardize, computerize, mobilize, and integrate information into a single consistent and streamlined operation, increasing the available rescue time in domestic fire emergency rescue scenes, and decreasing the damage resulting from such disasters.

B. Establishment of a comprehensive database system, taking advantage of wireless PDA transmission systems to directly transmit rescue diagrams and illustration data related to the particular fire scene, thereby providing instant, rapid, and accurate query of relative data, boosting rescue efficiency and time-effectiveness, and preventing any impact or errors resulting from human error.

C. Conversion of the rescue diagrams and illustrations from paper-based documents to electronic files, thereby achieving rationalization and standardization, which will in turn boost overall computerization, systemization, and networking, which will further reduce required human resources and cut costs.

6. ACKNOWLEDGMENT

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