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The Design of Postal Service System using Software Component Technology

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Abstract— Postal Service software systems' component technology intends to provide complete engineered postal service management in one package. The basics of this service are to design, build, install, and implicate an integrated system of mail delivery, using the most advanced technology systems available. With these systems we can develop specific more efficient problem-solving and handling of mail, including greater reliability, and fewer maintenance requirements. In this paper we discuss the use of component technology in a postal service system. The Postal Service's mission is to provide a courteous, cost-effective, high-quality mail service by using Component Technology Postal Services processes, including incoming and outgoing domestic and international mail distributed by the Postal Service.

Keywords: component technology, Component-based, mail delivery, Postal Service System.

I. INTRODUCTION

Component-based software engineering (CBSE) has existed in one form or another for a number of years. The idea of constructing modular software has long been recognized as advantageous within the software community, even dating back to the early days of FORTRAN programming, with subroutines and libraries serving as "components". Work by Booch [1] and Meyer [2] in the 1980s, was generally regarded as seminal in the advancement of ideas regarding the fundamental nature of components, particularly with regard to low-level structural properties of the components. More recent work [3]-[6] extended these ideas along various dimensions, including the introduction of formal specifications into component frameworks, the development of new paradigms for data movement, and the development of improved design guidelines with regard to what constitutes a good component that is both efficient and independently verifiable.

Building software systems with reusable components brings many advantages. The development becomes more efficient, the reliability of the product is enhanced, and the maintenance requirement is significantly reduced. Designing, developing and maintaining components for reuse is, however, a very complex process which places high requirements not only for component functionality and flexibility, but also for the development organization [7]-[11].

The use of component technology software in the postal service aims to provide a fast and cost-effective system of processing incoming and outgoing domestic and international mail. The design of this technology is intended to receive, handle and sort mail more efficiently for its final destination.

In a large city, such as Jeddah, Saudi Arabia, with no house addresses, this poses a serious problem. This system will address this and various other problems needed for fast, efficient mail delivery. Once the system is integrated and installed it can correlate and provide solutions to the numerical addresses of houses, dividing the city into districts and establishing routes. The system information can also be enhanced by the use of bar codes, with reference to the delivery and tracking of certified, registered and all express mail services, such as overnight delivery.

Component technology software will offer greater access to information regarding the day-to-day operational systems within the postal service, including dates and times of operations, and specific laws and regulations governing the service in the Kingdom of Saudi Arabia, including search engines and links to specific questions and answers. In conclusion, the mail service software system's component technology will provide an easier to use service, employing the latest technology information systems needed for fast and accurate setups, distribution and execution of a national mail delivery system.

Our Proposed Postal Service System is a user-interactive computer system, designed specifically for delivering letters and packages. Its objective will be to manage existing and potential new customers, mail, carriers, routes, billing information and summary reports, as required by this type of business in today's market.

The system will be under the authority of the distribution manager whose tasks will include the coordination of the entire delivery system. Operators, working under the manager, can be trained easily to use the system efficiently and effectively. The system will make seemingly routine tasks easier by organizing the all-important aspects methodically, from adding a new customer to printing summary reports. Once in place, the amount of



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time needed to perform tasks and update the database base in the delivery system will be reduced, requiring only a few mouse clicks and key strokes to accomplish most tasks.

The postal system generally consists of five main sections, which are described briefly here to provide an overview of their functions [12]-[15].

- **Customers**, defined as the customers of the delivery system.
- **Mails**, defined as the letters and packages delivered by the service.
- **Carriers**, defined as those individuals hired to deliver newspapers and magazines.
- **Routes**. Customers to deliver to, according to route name.
- **Billing** generates bills for all customers on the system. Acts as the accounts for the business, keeping track of all financial transactions and the status of customer accounts.

The database managed by the system is expected to be quite large, and it is therefore essential that the system performs all required tasks as rapidly as possible. This will be accomplished primarily by the high-speed computer recommended, as well as by efficient algorithms used to access the data.

The goal is to develop a system that will function efficiently while maintaining simplicity. The interface will be very simple, to address all user skill levels, from beginner to expert. Documentation will be thorough and complete. Training of the users will be made available by the developers of the system, to ensure a complete understanding of its operations. It is expected that the system will greatly simplify the postal delivery service, by reducing the overall amount of time required for setup and maintenance, as well as facilitate the day-to-day operations of the business.

II. SYSTEM DESIGN

Our proposed Postal Service System will include the following features. It will keep track of all the customers of the mail, recording information such as their name, address, phone number, and status, with the option to edit and search for customers individually. Editing specific customer information fields is possible, as well as adding and deleting all information for a customer. Mail will also be listed along with their relevant information, giving the user the ability to edit information fields, add or delete mail, as well as search for selected items of mail. The system will also keep track of carriers that will deliver the mails to the customer. The user will be able to add or delete carriers, as well as edit their personal information

Customers will be linked to carriers by routes, which will list items such as the name of the route, and the number of customers on that route, and be defined by a list of zip codes (even though a customer may be placed on a route, although its zip code is not on that list). Through the routes, the system will allow the user to view the total number of deliveries per day to each individual route, as well as show all the customers on a route. It will also be able to make printouts per route, or for an entire set of routes, or a subset of selected routes.

The relationship between the system's components is shown in Fig. 1, and the context diagram of the system is shown in Fig. 2

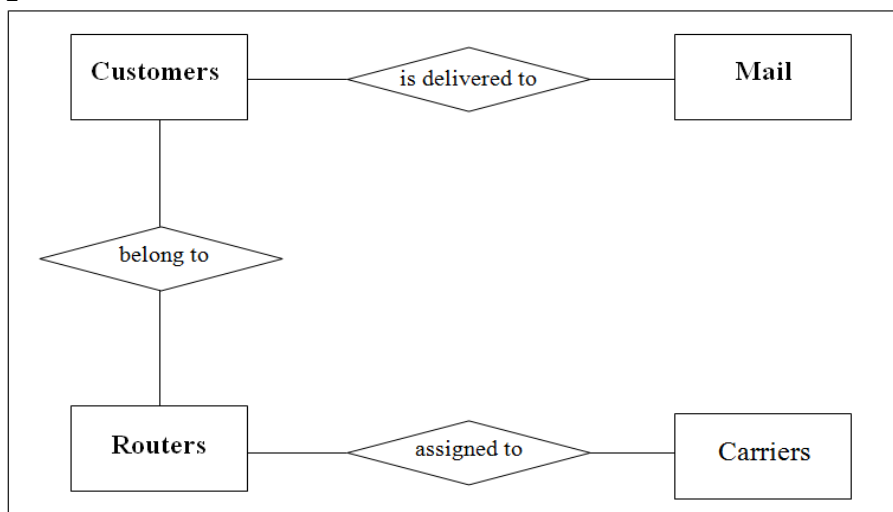


Fig. 1: System analysis

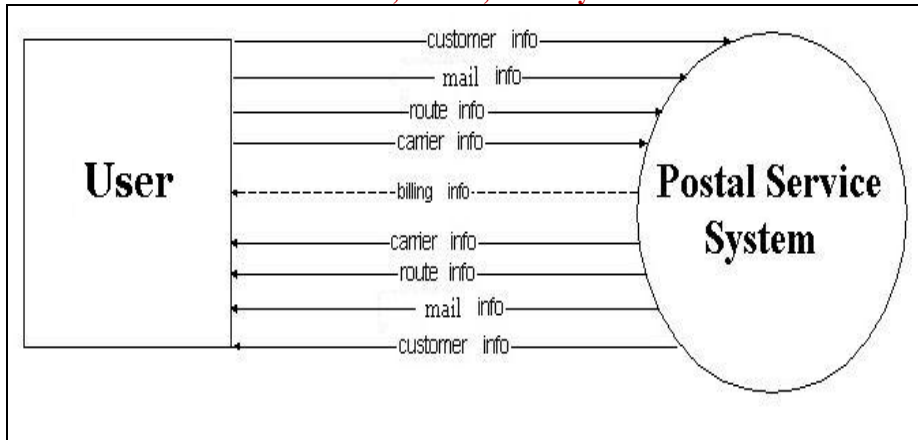


Fig. 2: Context Diagram

There are many different implementation options for a database system of this nature. We have chosen a personal Computer (PC) platform as it is the most economical and widely used system available

A. Customer Component

This component contains customer reference information. Specifically, the system will contain the customer's name, address, phone number, the status of their delivery, the mail they receive, their route information, and any notes specific to user requests or needs. This information will be entered via a keyboard into the computer, or modified/edited by the computer, using the following functions, which will be selected by the user, using either the mouse, or specific key strokes. The functions of this component are shown in Fig. 3, and described below.

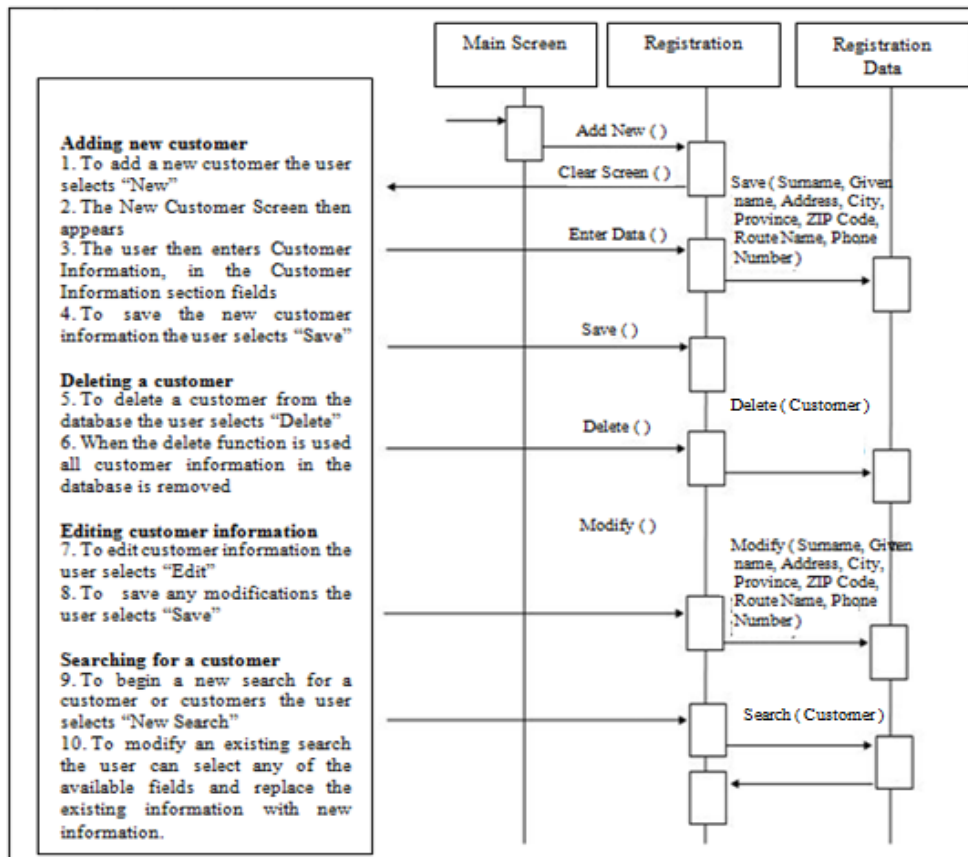


Fig. 3: Customer Component



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For route name, a pop-up list of all available route names will be available from which to select. The zip code will be matched to a route, and this route will either be highlighted in the list, or be displayed as a suggestion.

a) Adding a Customer

The data mentioned in Fig. 3 will be entered into fields on the computer screen. If any data fields are left blank, except the notes information, (there will be a not applicable default for the notes field), or the incorrect format of information is entered, the system will prompt the user to enter data for all fields, or to reenter the data correctly in the proper format. The user will not be allowed to continue until all record fields are complete. An example of the transaction adding a customer, and the format for the data to be entered is shown below.

1. The user selects the “add a customer function”.
2. Enter the customer name; e.g., Almuhiayyi, Ahmad (last name, first name).
3. Enter the customer’s address; e.g., 123, Prince Abdullah (street name) Jeddah, Makkah (city, province) AAA 333 (Saudi zip code).
4. Enter the user phone number; e.g., (966) 666-6666 ((area code) phone number with dash).
5. Fill in special data for notes; e.g., be sure to put paper in mailbox, not on the step.
6. Select a route from pop-up list and system’s suggested route.
7. Enter the status of delivery; e.g., suspended indefinitely; suspended for a specific time period; or regular delivery.

b) Deleting a customer

A user selecting this function would enter “Search for Customer Records”. *The system would return the data from the search for this customer in the database, and the customer’s information would be displayed on the screen.* The user could now choose to remove the customer information from the database at this time, or exit from this function and do nothing.

The confirmation process should offer the option of removing the customer information, remove the customer information and print an invoice or to exit. Once a customer is removed, the route and products data-bases should be updated. The unique customer key data for searches has not been determined.

c) Modifications to customer information

In this function the user uses “Search in Customer Records”, after which the system would search for the customer’s records and display them on the screen. At this point, all data fields could be accessed by tabbing on them, and reentering the correct, or new customer information via the keyboard. This data would then be saved in the database.

Specific security measures are not required, so it has been assumed that all fields of a customer’s records can be changed at any time, by any person with access to the system.

d) Searching for a customer

The user starts a search using route number, route name, customer name, phone number, zip code, address or reference number. The search finds any unique match, or gives the user a list of multiple matches from which to select. The list will be formatted to have one customer per line, and any data on a customer not displayed will be accessible via a button click. Once a single customer is selected, all their information is displayed on the screen.

B. Carrier Component

The database must be able to record and keep track of the carriers, and the routes to which they deliver. Items recorded in the database will be the carrier’s name, address, phone number, and the routes they deliver to. These records will be created and modified, using functions similar to the ones mentioned in Customer specifications. The functions of this component are shown in Fig. 4 and described below.

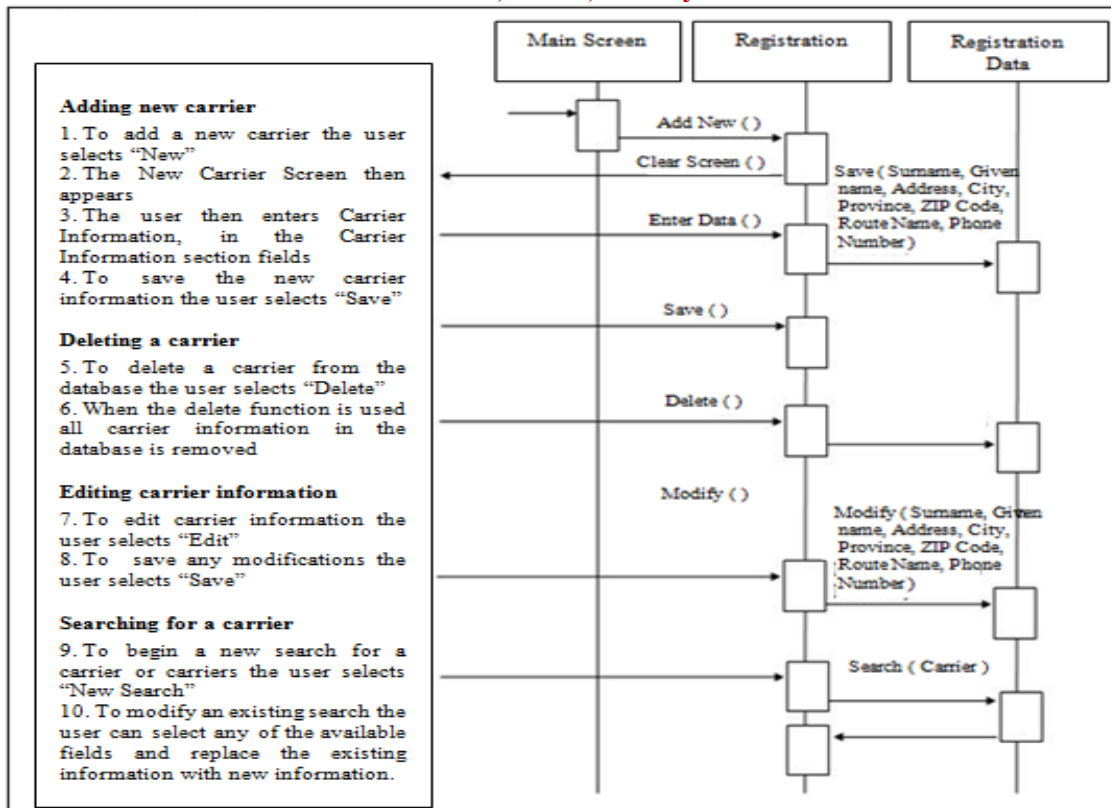


Fig. 4: Carrier Component

a) Adding a carrier

The user selects the function, and enters the data via the keyboard.

1. The user selects the add a carrier function.
2. Enters the carrier's name; e.g., Almuhiayyi, Ahmad.
3. Enters the carrier's address; e.g., 123 Prince Abdullah (street) Jeddah, Makkah (city, province) AAA 333 (Saudi zip code).
4. Enters the carrier's phone number; e.g., (966) 666-6666.
5. Enters the routes to which the carrier delivers; e.g., R1 R4 R6 (route #1 route #2 route #3).

The user will be shown the entered information when finished and asked for confirmation that the information is correct. Errors can now be corrected, or the function can be exited adding the information to the database.

b) Deleting a carrier

In this function the user enters or selects the carrier's name from a list, and performs a search to display it on the screen. The user then prints the carrier routes for reassignment to other or new carriers. The carrier's routes are deleted, and finally the carrier can be removed from the database.

c) Modifications to carrier information

In this function, the user enters or selects the carrier's name from a list, after which the system searches for the carrier's records and displays them on the screen. At this point, all data fields can be accessed by tabbing on them, and reentering the correct, or new carrier information via the keyboard. This data is then saved in the database.

d) Searching for a carrier

The user can select a carrier from the Carriers List, or enter information in the Carrier Information fields to reduce the size of the Carriers List. The user can then select a carrier from the Carriers List provided



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C. Route Component

The database must be able to record and keep track of the Routes and the customers who are in this route. Items recorded into the database will be the route name, route number, number of customers, customers list . These records will be created and modified using functions similar to the ones mentioned in Customer specifications.

a) Adding a new route

When adding a new route, a route name and a carrier have to be assigned to that route. In addition, a list of zip codes defines the boundaries of the route. Note that zip codes may be assigned to multiple routes (i.e. the same zip code can be found in more than one route). This is to help find in which route a new customer should be placed. The zip codes, customer reference numbers, and addresses of all the customers, as well as the number of customers belonging to the new route, are also needed.

b) Deleting a route

Entering or selecting a route will remove it, but a route can only be removed if there is no Customer in that route; i.e., the number of customers is zero.

c) Displaying route information

When a valid route name is entered or selected from a list, the user has the option of viewing either all customers belonging to the route, or the total number of deliveries on the current day. An error message will be displayed if the route name is invalid

d) Generating a Printout

A printout containing the route name, carrier name, carrier address, carrier phone number, route customer addresses and status, and the mail received by each customer, is generated, and given to the carrier before they make the deliveries. The user can print either a single route, the entire set of routes, or a subset of routes may be selected from a list.

D. Mail Component

An item of mail is the most important component of our proposed system, and the database must be able to record and keep track of the mail, and the routes to which they deliver. Items recorded into the database will be the mail name, sender name and address, phone number, and the routes they deliver to. These records will be created and modified, using functions similar to the ones mentioned in Customer specifications.

a) Adding an item of mail

When creating a new item of mail, the user has to enter the following:

Name, Sender, Sender Name, Sender Phone Number, Sender's address (Return address), Type of Mail (e.g. regular, packages), Frequency of Delivery (e.g., Daily, Weekly, Monthly)

Before the above information is stored, the system will ask for confirmation so that the user can make necessary changes.

b) Deleting an item mail

The user has to select from a list or enter the name of a piece of mail that is to be deleted. Otherwise, it responds by displaying all information of the item of mail. The user confirms the delete action. The sender of the mail should be notified, but this is not required by the system. Nevertheless, their accounts should be updated.

c) Editing mail information

Any information about a piece of mail can be changed. The user selects from a list or enters the name of the piece of mail. The system returns an error if the item of mail does not exist. Otherwise, it responds by displaying all information about the piece of mail. The user then can make modifications in the appropriate field(s).

d) Search for an item of mail

All information about a piece of mail can be listed on the screen, by selecting or entering name of the piece of mail. The system returns an error if the item does not exist. Information displayed here is for view only, and cannot be modified.



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III. CONCLUSION

This paper discusses the use of component technology in a postal service system. The Postal Service's mission is to provide a courteous, cost-effective, high-quality mail service by using Component Technology Postal Services processes, including incoming and outgoing domestic and international mail distributed by the Postal Service. When completed, this system will be user-friendly to help employees complete their everyday work, tasks, and projects. All system functions, modes, interface screens have been described in detail above. All efforts have been made to make this system easy to use and easy to maintain. Logical flow is emphasized so that tasks seem to follow a logical order. Owing to time constraints, the billing system is not implemented within the current system. However, our advanced design will permit the integration of a future billing system, accompanied by a summary reports system, thus making the finished system completely usable.

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