POINT OF SALES FOR SMALL BUSINESSES

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ABSTRACT

This paper describes the design, implementation and development of our final project, Point of Sales Management System created for Small Businesses. Firstly, the paper defines the potential of the Program, Point of Sales (POS) System for small businesses. Secondly, it describes the program, including the scopes and limitations, and its functionalities. Thirdly, it also provides a detailed information on the program design and implementation. Finally, it discusses the data structures and algorithms used with code snippets.

CCS Concepts

• **Information Systems**→**Information System applications** →**Process Control Systems**

• **Applied Computing**→**Operations Research**

Keywords

Point of Sales; Sales; Transaction; Programming; Business; Inventory; Product; Service; Terminal; Management; Product;

1. INTRODUCTION

Running a business means facing an ongoing series of ever-evolving challenges. It can be risky, and not all businesses succeed. New businesses often fail during the early years [12]. Managing inventory is an important task in many businesses. Inventory comprises the total amount of finished goods and materials on hand and the process of counting them. Many companies do periodic inventory checks to ensure that they will not run out of popular items, while others match the total amount of goods ordered with the physical count [6].

This paper describes the development of our Final Project, the Point of Sales Management System created for Small Businesses, that can keep a record of store inventories and eases the flow at checkout terminals, while recording all the information that can help business owners be more efficient in managing their businesses [7].

1.1 Overview

Starting something new from the ground up is always a challenge. But when it comes to business, especially if you haven't done it before, the amount of work it takes to get it started and keep things running can be overwhelming [5]. It is is a big achievement for many entrepreneurs, but maintaining one is the larger challenge. There are many standard challenges every business faces whether they are large or small [1]. A point of sale system is the heart of a business and used for many essential tasks such as inventory management, menu customizations, price adjustments, sales reporting, marketing initiates, and so much more [13]. A point of sale inventory management system is a step up from the use of a cash register.

Small, start-up businesses who sell services and not products may be able to survive with just a cash register and a simple accounting system. If your business is product-based, chances are you will eventually have to switch to at least a basic point of the sale inventory system. With a point of sale system, you don't have to worry how much inventory you have on hand. The point of sale system keeps track of that and you have the information at a glance [10].This paper gives a detailed information on how this program came to materialized and how its main functions will help small business owners be more efficient in managing their businesses.

1.2 Objectives

This project seeks to:

- Apply the skill sets acquired from CC 13: Data Structure and Algorithms and CC 12: Programming 2 through a program,
- Create a program as a solution for business inventory and monitoring, and;
- Implement necessary algorithms and data structures to create the program

1.3 Scope and Limitations

This project will focus on developing a Point of Sales system using various data structures and algorithms for small business owners. This system will let users add, delete, store information or elements as it reads and writes on files to record current inventory within the fixed array length. In addition, users of the system can perform tasks such as sales transactions and show the revenue or sales. Both of which utilizes the four basic mathematical operations such as; addition, subtraction, multiplication and division.

1.4 Functionalities

This Point of Sales (POS) program will give business owners a convenient way of checking out and recording their sales real time. It can keep a record of the store inventory, updating it whenever an order is processed. This program can help ease the flow at checkout terminals while recording all the information that can help small to medium business owners to be more efficient in managing their businesses. Point of sale systems take care of those problems that result when management isn't present [11].

Specifically, this program will include the following features:

- Add a product
- Delete a product
- Conduct sales transaction
- Check inventory
- Show revenue or sales

2. PROGRAM DESIGN AND IMPLEMENTATION

This program will utilize various data structures and algorithms to implement the program. Data structures will be used to store necessary information on the business's stocks and transactions, while algorithms will be used to manipulate the data.

The following data structures and algorithms were used to implement the program:

- An array of objects to hold information about the store's various products,
- Algorithms on adding and deleting elements to replicate the process of different store transactions,
- Objects and classes to store information on the business's items,
- Array traversal algorithms in presenting the inventory of the business, and
- Reading and writing files to record previous transactions by the program.

The implementation of these data structures and algorithms will be further discussed below.

2.1 Pseudocode

The program utilized five java classes which include the class that contains the main method. These five are:

- FinalMain which includes the main method of the program;
- Another_POS which implements the different functionalities of the point-of-sale;
- Product which contains the different attributes and methods for getters of an item;
- Product_Node is a class that serves as a node for items sold by the system which will be used in a linked list; and
- LinkedList which is an implementation of the data structure linked list. It holds the nodes of sold items.

```
1. Program will read from POS_History file and store
to POS object.
2. Print menu.
case 0: search a product in inventory
        choose to search items by name or code;
case 1: add product
        if product is in array, add only quantity;
        else, add a new object to array;
case 2: //delete item from inventory
        user will input name of product to delete;
        program will return a message if it was
        successfully deleted or not;
case 3://conduct sales transaction
        user will be asked to enter product name to
        add to cart and will loop until terminated;
        checkout will add items in cart to a linked
        list and calculate total sale;
case 4: //print inventory
        prints contents of inventory;
case 5: print sales report
        prints contents of linked list;
case 6: exit program
        stops loop;
3.User will be asked to select from menu.
4. Menu and selection will loop until 6 (exit
program) is selected.
5. Write POS object to POS_History.
6. Terminate program.
```

Figure 1. Pseudocode of the Main Method

The class containing the main method mainly uses a switch case to create the selection from a menu. Figure 1 shows the pseudocode of the implementation of a switch case for different transactions.

The usage of these five classes along with the essential methods found in Another_POS will be further discussed in the next subsection.

2.2 Data Structures and Algorithms Discussion with Code Snippets

The program uses two types of data structures to implement its functions and three important algorithms in the program. These will all be discussed in the following subsections.

2.2.1.1 Data Structures Discussion

One of the two data structures used in the program is array. The array used is one-dimensional arrays [3] which stores an object in each index. This object is considered to be the store product. For the program proper, it uses two arrays.

```
private Product[] stocks = new Product[size];
private Product[] cart = new Product[size];
private int pointer_Stocks;
private int pointer_Cart;
```

Figure 2. Arrays and Array Pointers Used in the Program

As seen in Figure 2, the first array is called stock which stores all items to be sold by the business. The second array is cart which stores items that a client will buy. Since Java does not explicitly use pointer, referencing can be a way to keep track of the contents of the arrays [2]. One application of this is the use of two pointers; pointer_Stock for stocks and pointer_Cart for cart to keep track of the number of elements in the array as well as the next available index.

```
public Node_Product reference;
public Product item;
```

Figure 3. Attributes of Node_Product

On the other hand, a linked list is implemented as a singly linked list [2] which stores the history of transaction. This does so by storing all pertinent information needed in a node including the reference to the next node [2]. Figure 3 shows the attributes used for a single node in the list. The information it stores is an object of data type Product. This will include all attributes of any object of Product.

As stated earlier, the linked list will store all items considered as purchased. In order to do so, the elements of cart will each be added to the linked list. Since all elements of cart are of data type Product, this will be stored as item. Each new node will then be connected to the previous node.

2.2.1.2 Algorithms Discussion

There are three essential algorithms used in the program. These are the linear or sequential search algorithm, deletion of elements in an array, and reading and writing to files.

A linear search is implemented multiple times in this project. Often, it is conducted at the beginning of a certain transaction. Linear search algorithm is done through traversing all the elements of the data structure [3]. Since the elements in the arrays are not sorted in any manner, this search algorithm would be effective in searching the array .

```
while(i < this.pointer_Stocks){
    if((this.stocks[i].getMod()).equalsIgnoreCase
    (item)){
        //print attributes of stocks[i];
        found = true;
    }
    i++;
}
```

Figure 4. Implementation of Linear Search Algorithm

Figure 4 shows a sample of the implementation of a linear search algorithm in the program. This searches for elements in the array whose attribute matches the variable item. This algorithm will traverse the whole array and return all matches made. In order to do so, the program visits each index with an element. Any modifications to any matches will be done through accessing those element's index.

One of the modifications than the program can do to the array is deleting elements. To delete an element in the array, one has to remove the element by setting it to its null value. It then has to shift all elements to fill the empty index.

Figure 5 shows how deletion of elements in an array is done in the program. The element and index el is removed by assigning it to null. This leaves an empty spot in the array. To fill this, the program swaps the elements of two indexes starting from the empty index until the index which pointer_Stocks points to.

```
int el =0;
Product temp;
el = input.nextInt();
this.stocks[el] = null;
while(el < this.pointer_Stocks){
        temp = this.stocks[el];
        this.stocks[el] = this.stocks[el+1];
        this.stocks[el+1] = temp;
        el++;
}
this.pointer_Stocks--;
```

Figure 5. Deleting an Element in the Array

Another essential function of this point of sales program is the ability to store the history of sales transactions as well as the products stored in the system. To do so, the program utilizes reading and writing to files.

```
FileInputStream file_Input = new
FileInputStream("POS_History.txt");
ObjectInputStream object_Input = new
ObjectInputStream(file_Input);

Object obj = object_Input.readObject();
    if(obj instanceof Another_POS){
        POS = (Another_POS)obj;
}
object_Input.close();
file_Input.close();
```

Figure 6. Reading Objects from a File

Instead of reading and writing per character to a file, codes found in Figure 6 and Figure 7 reads and writes an object to the file. This keeps the contents of the objects intact and allows easy retrieval of its contents. Figure 6 shows how ObjectInputStream [8] was used to read the object stored in the file. It uses casting in order to assign the stored data to a variable of the same data type which it was stored as.

In the event that the file is empty, the this will encounter an EOFException [4]. This exception will be neglected since it will not affect the program in anyway.

```
FileOutputStream file_Output = new
FileOutputStream("POS_History.txt");
ObjectOutputStream object_Output = new
ObjectOutputStream(file_Output);

object_Output.writeObject(POS);

object_Output.flush();
object_Output.close();
file_Output.close();
```

Figure 7. Writing Objects to a File

On the other hand, Figure 7 shows how ObjectOutputStream [9] was used in the program. The object being written to the file POS_History is the object POS since it includes the arrays: stocks and cart as well as the linked list called list. These lines of code will be executed before the program terminates.

3. CONCLUSION

While this system is not yet able to compete with the commercialized Point of Sales (POS) systems in the market today, it showed a lot of potential in terms of its capabilities and functionalities.

Overall, this project is able to perform the basic needs for business trade such as: search, add, edit, delete products in the inventory, perform sales transactions, print inventory and sales reports. This will help the user easily analyze sales data which can help them in making better decisions about ordering and merchandising.

4. ACKNOWLEDGEMENTS

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APPENDIX A
PROJECT PROPOSAL

A Proposal to Create a Point of Sales Program for our Final Project in CC13 - Data Structures and Algorithm

Brief Description of the Program:

Running a business means facing an ongoing series of ever-evolving challenges. It can be risky, and not all businesses succeed. New businesses often fail during the early years. Keeping an accurate inventory is one of the challenges for start-up-businesses. This document proposes a program that gives business owners a convenient way of checking out customers and of recording sales. The proposed program can keep a record of the store inventory and eases the flow at checkout terminals, while recording all the information that can help business owners be more efficient in managing their businesses. This proposal includes a brief description, functionalities and features, and the possible data structures and algorithms which will be utilized for the program implementation.

Functionalities and features:

This Point of Sales (POS) program will give business owners a convenient way of checking out and recording their sales real time. It can keep a record of the store inventory, updating it whenever an order is processed. This program can help ease the flow at checkout terminals, while recording all the information that can help small to medium business owners be more efficient in managing their businesses. This program will include the following features:

- Add a product
- Delete a product
- Conduct sales transaction
- Check inventory
- Show revenue/sales

Possible data structures and algorithms to be used:

The possible data structures and algorithms that can be used in this program includes:

- array of objects which will store the different products the store offers
- algorithms that can add and/or delete certain elements in an array to replicate the process different transactions
- objects and classes for store items
- array traversal algorithms in presenting the inventory of the business
- files in recording previous transactions conducted by the program

```
0 - Search a product in inventory.
1 - Add to inventory.
2 - Delete a product from inventory.
3 - Sales Transaction
4 - Inventory List
5 - Sales Report
6 - Exit

Choose a number:
```

Menu

```
Choose a number: 1
Enter a product to be added to the inventory: Oishi Prawn Cracker
[0] Add more stocks.
[1] Add new product.
Select option: 1
NEW PRODUCT
Variant: Original
Size: 60
Cost: 15
Quantity: 10
Code: 031412
Item successfully added.


Press Enter to Continue...
```

Adding a New Product to Inventory

```
Choose a number: 4
Product Name            Code    Variant        Size          Price  Quantity
Palmolive Shampoo       31401   Pink           500      199.750000        10
Creamsilk Conditioner   31402   White          500      197.750000        10
Creamsilk Conditioner   31403   Pink           1000     379.500000        10
Datu Puti Vinegar       31404   Vinegar        100        4.550000         8
Datu Puti Soy Sauce     31405   Soy Sauce      100        5.500000         5
Creamsilk Conditioner   31406   Pink           500      197.250000         5
Silver Swan Vinegar     31407   Vinegar        100        6.000000         8
Purefoods Corned Beef   31408   Corned Beef    210       92.500000        10
Argentina Corned Beef   31409   Corned Beef    210       46.500000         5
Colgate Toothbrush      31410   Soft Bristle   1         70.000000        12
Colgate Toothbrush      31411   Medium Bristle 1         70.000000        12


Press Enter to Continue...
```

View Inventory

```
Choose a number: 2
Enter product to delete: Palmolive Shampoo
[0]Palmolive Shampoo            31401    Pink              500      199.750000
Select item to delete: 0
Palmolive Shampoo has been deleted.

Press Enter to Continue...
```

Delete An Item in Inventory

```
Choose a number: 5
Sales Report:
Product Name            Code    Variant        Size          Price  Quantity
Oishi Prawn Cracker     31412   Original       60        15.000000         2
Palmolive Shampoo       31401   Pink           500      199.750000         1
Total Sales: 229.75
```

Sales Report