

Development Of A Waiter-Based Service Management System For Entertainment And Hospitality Centres

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Abstract— The simplicity and ease of access of a menu are the main factors that facilitate ordering products and services in an entertainment outlet. This work describes the design and development of a waiter-based service management system which is considered as a possible solution to entertainment centre semi-automation of waiter services. Appropriating the knowledge of Prioritized and non-prioritized queuing methods such as First-in-First-Out (FIFO), Last-in-First-Out (LIFO) and Service in Random Order (SIRO), a queuing model was designed to handle prioritized queuing for customers in the entertainment centre where customers are divided into Very Important Personalities (VIPs) and Regular customers. The rule for determining a VIP customer is based on two criteria of expenditure in the entertainment centre and attendance record at the centre. During ordering, the sorting algorithm organizes all orders based on time slots. The importance of using time slots is that regular customers do not have to wait endlessly for their time to be serviced while the VIP customers are addressed with high sense or urgency. All orders created within a one (1) minute time frame are sorted based on the first criterion of the customers' VIP status and then the orders are arranged next based on the cost of items purchased and presented in this order to the waiters who prepare and deliver the orders. Where there are no VIPs in the order queue, only cost of items purchased is used to sort the orders. Apart from handling orders in an organized manner to cater for high value and normal customers, the application serves as a tool for managing staff and customers. The entire system is developed as a web application using Hypertext Process (PHP) and javascript as the scripting languages along with hypertext markup language (HTML), CSS and MySQL databases system and the system can be installed on an end user system running Apache web server. The web application was hosted locally and demonstrated using some sample data from selected case study bars, lounges and clubs. In all, the application satisfied the goal high quality service delivery in an organized or unorganized queue patterns that do occur in bars, lounges and clubs. Accordingly,

business owners can adopt this software to reduce unnecessary queues, raise service throughput and minimize unnecessary contact with the waiters and waitresses until the time where the order is served to the customer.

Keywords— *Service Management, Entertainment, First-in-first-out (FIFO), service management, Last-in-first-out (LIFO), queuing models, waiter-based service, system, K-means clustering algorithm*

I. I. INTRODUCTION

Nowadays, Nigeria is flooded with growing population of hotels, event centres and eateries as well as sit-out/relaxation spots and night clubs [1,2,3]. Relaxation and events management business in Africa and Nigeria in particular have thrived over the years with the major reason being the high percentage of the youthful population [4,5,6,7]. Mbachu and Alake [8] place the figure of the Nigerian youth population at 50 Percent of the 182 Million persons [9]. The youthful population means that they have less cumbersome responsibilities hence more spending power. Iwuoha [10] postulated that in 2011 alone, Nigerians consumed more than \$40 million worth of Champagne to become the second largest consumer of the product. Same can be said for the income generated by fast food and restaurant outlets. Mostly, in populous cities in Nigeria such as Kano, Abuja, Lagos and Port Harcourt there is a penchant for persons of working age to patronize fast food centres due to the need to conserve time and be at work or their places of business at the stipulated opening hours [11,12]. Also in the evenings, most of these youths are prone to relax at bars, lounges and clubs to cool off after the day's work or while deliberately waiting for traffic to ease off on their major routes home.

Orubo et al [13] gave a list of the ever growing online food vendor services. However, while it holds true that there is proliferation of online food ordering services in Nigeria [14,15,16,17] like the popular JUMIA food, Ginger box, Foodstantly, Area chops, Ofadahut and many others, one could still work into an eatery or restaurant during lunch hour and discover that every available seat is taken up with a corresponding loud contest from competing diners

who should receive service first because of the consciousness of returning to their duty posts within the one hour break window. This sometimes leads to exchange of words between customers, anger and dissatisfaction and in extreme cases, fist fights. This trend can also be seen in drinking bars, nightclubs lounges sit-outs or relaxation spots and in simple events organized across Nigeria. It is simply a service issue and a protest against delays, lengthy queues and a clear mark of disorganization.

Morgan [18] lists some uses of computer in restaurants, bars and entertainment centres as records keeping, stock taking, orders, music and billing. Whereas top-notch eateries bars and clubs employ the use of computers for records keeping, stock taking and billing, a vast majority of them still do all these activities manually. Event managers still attend weddings and parties with their servers largely unprepared to handle the agitated crowds. It is common place to hear customers and event goers screaming at the top of their voices (especially when loud music is on) trying to call the attention of a waiter to attend to them and take their orders. In many cases, businesses lose money to fraudulent or impatient customers who stand up and leave after being served without paying the bills because there is no attendant at hand to receive money. This work seeks to find a solution to placing and receiving orders within a bar, nightclub, lounge, event centre, restaurant or even large conferences as organized by churches without having to interface with the waiters/waitresses until the point where the meal or drink is delivered to the customer or guest. A hungry, thirsty and tired customer could place an order for his food or drink before getting into the service area and have it prepared whilst still on the way. A customer could also walk into an entertainment centre, take a seat, make his order and have it brought to him without interfacing with the waiter/waitress or cashier at the counter thereby avoiding unnecessary waiting lines and contention with other customers. In a

wedding or party, the invitees and event goers do not need to leave their seats or scramble to get served because these processes could be automated.

II. METHODOLOGY

An iterative incremental software development methodology [19] was used for the development of the waiter-based service management software system. The application is a web-based service management system that is hosted on a web server and can be accessed using an IP address or a domain name. Three (3) categories of users are expected to access the application which includes the admin who has limitless access to the entire application; the waiters and the customers with limited access to the management system. The entire web application was built using Hypertext Process (PHP) and javascript as the scripting languages along with hypertext markup language (HTML) , CSS and MySQL databases system and the system can be installed on an end user system running Apache web server.

The requirements used for the analysis and design of the software were obtained for the operational environment (all in Nigeria) and they include bars, lounges and a sit-out in Uyo (Akwa Ibom State) and Port Harcourt (River State); as well as the organizational environment that includes the customers, servers, several managers and admin personnel of those bars and lounges. The requirements elicited were analyzed to detect and resolve conflicts among the requirements. The web-based service management system is designed to meet the requirement specifications. The functional decomposition of the system is shown in Figure 1 while the use case diagram is shown in Figure 2. The main modules in the system are the admin module, the users' module which comprises of the staff and customers sub-module, as well as the ordering system which has the inventory and cart systems as sub-module.

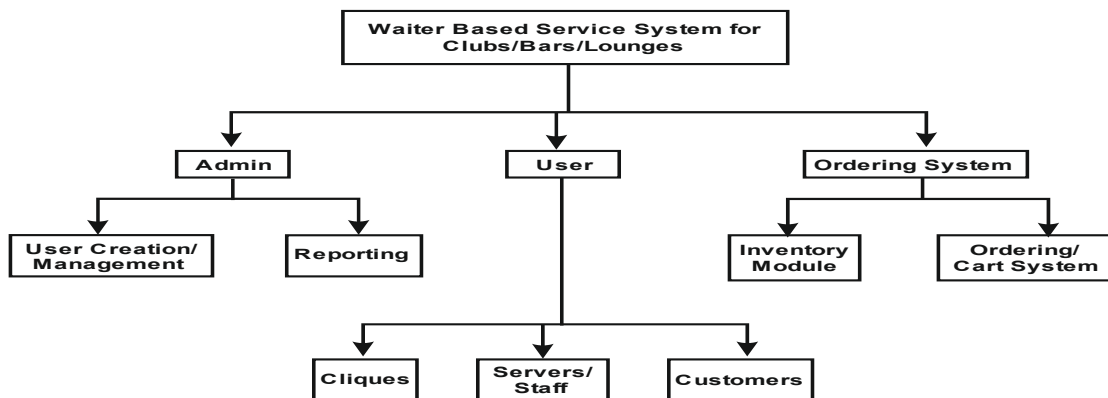


Figure 1: Functional Decomposition of the System

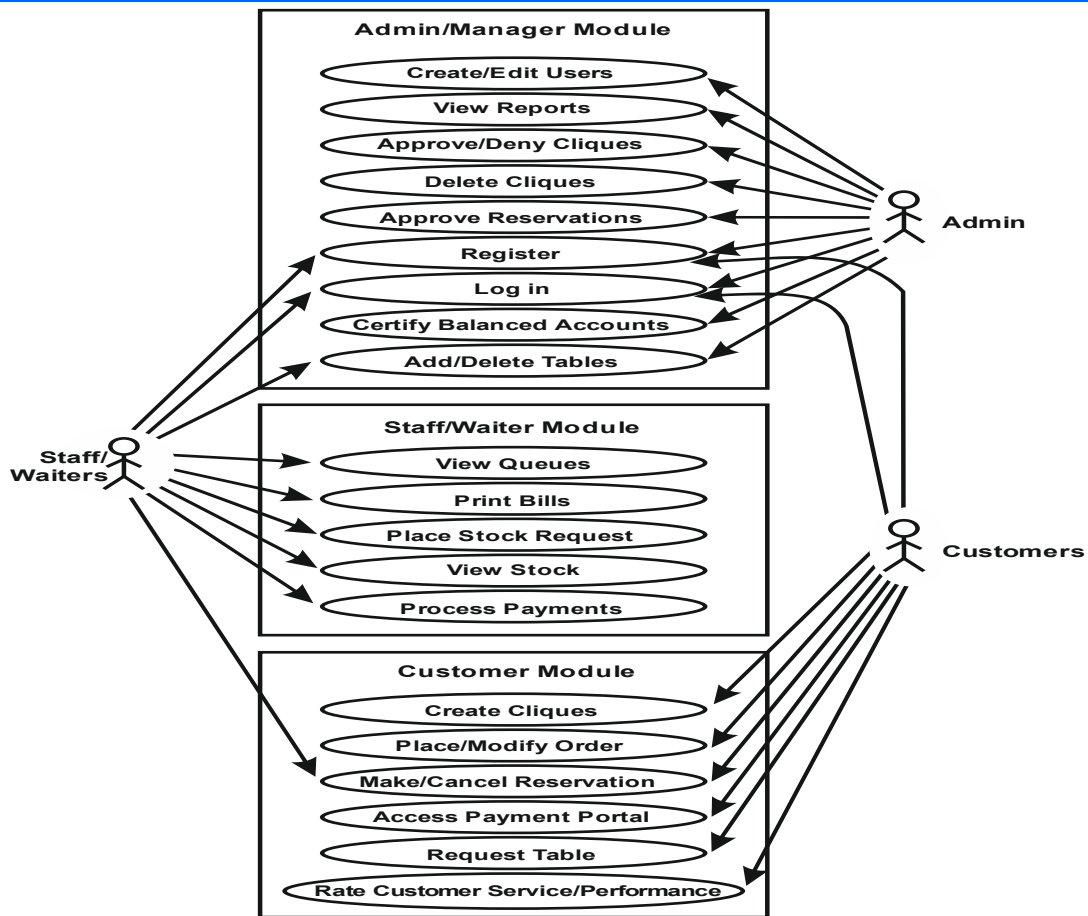


Figure 2: A Usecase diagram describing the interaction of the users on the system

A. The Admin Module

The admin user has limitless access to all the services in the management system, while the other users category have some restrictions. The admin is given the privilege to manage users and services

offered in the clubhouse, view, create or delete users, approve table reservations, delete cliques, and view sales reports , as shown in Figure 3 , which is the functional decomposition of the admin module .

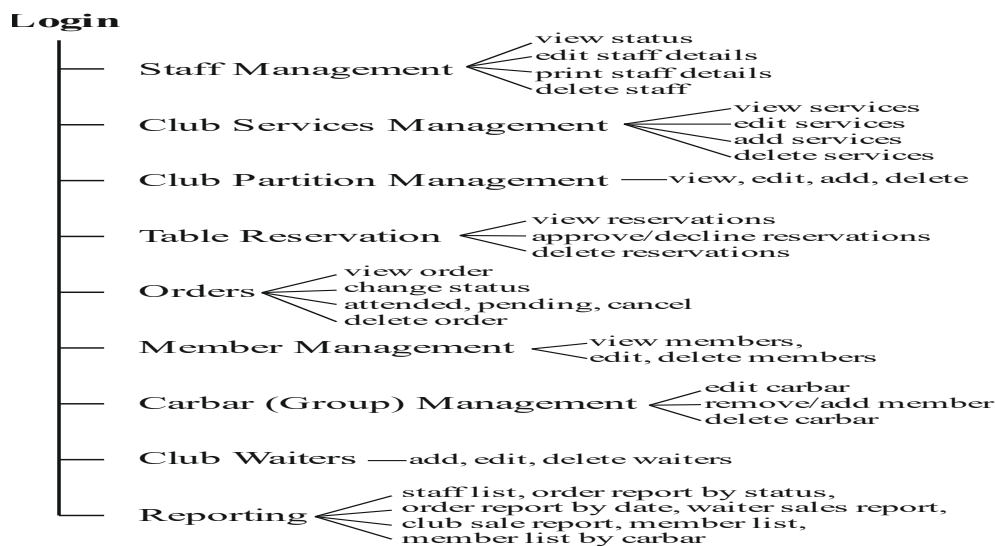


Figure3: The functional decomposition of the admin module

Admin Login Sub-Module: The diagram in Figure 3 shows the various functionalities the admin gains access to once he logs into the system.

Staff Management Sub-module : The application limits access to the ordinary staff and gives the control to the managers or admin staff to add, edit or remove

staff. Staff duties and privileges are determined by the admin/managers via the staff management module as

shown in Figure 4.

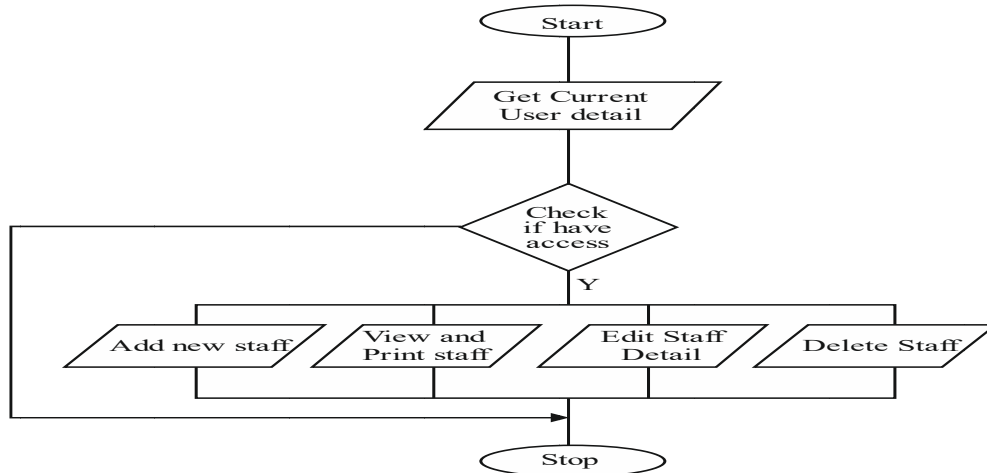


Figure 4: Flowchart Diagram of the Staff Management Module

Notably, the manager or admin can view reports of sales, club attendance and total time used to attend to the orders at the end of each working day. This is very important feature of the application because it enables the clubs or lounges to determine

if the club is making progress or not, checks the waiters and waitresses performance over the night in terms of attending to customers. Here, the manager can also view ratings of the staff and the DJ, as show in Figure 5.

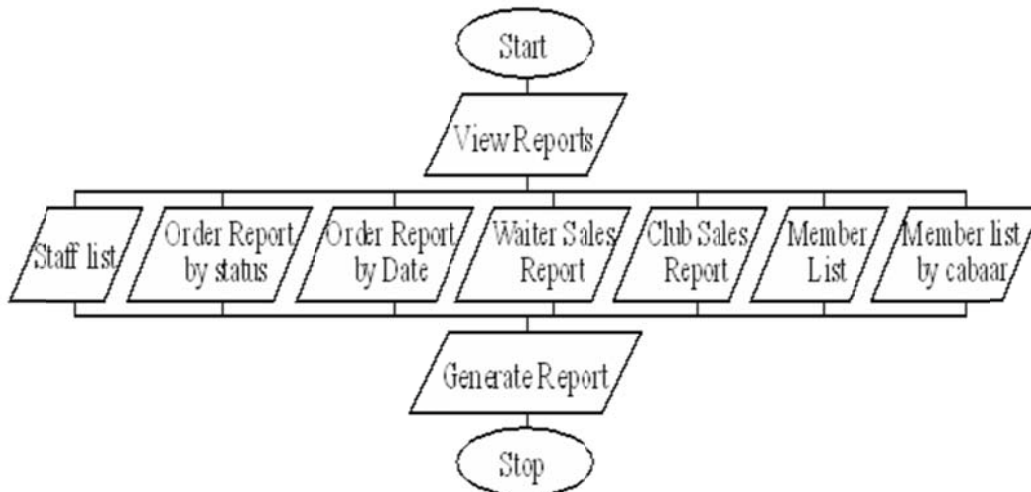


Figure 5: Flowchart Diagram of Admin Reporting Module

B. The Customers' Module

The flowchart diagram of the users or customers module is shown in Figure 6.

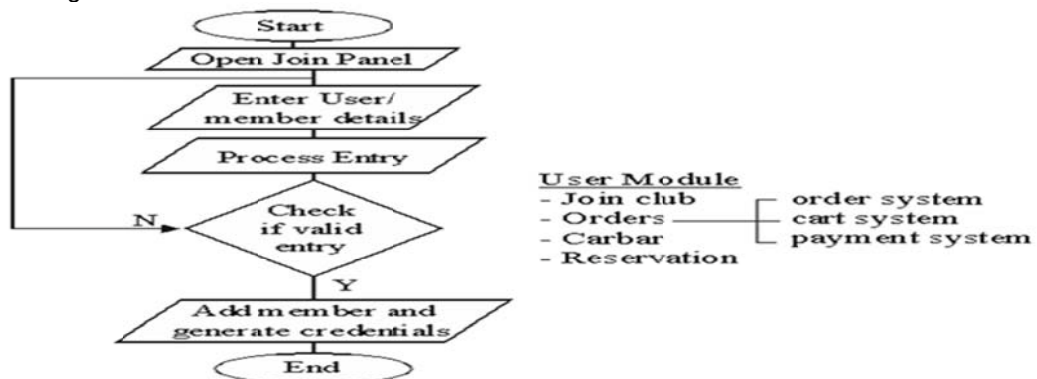


Figure 6 : Flowchart Diagram of The Users or Customers Module

The customer module allows access to customers who can book their orders, create cliques (social group of friends), make table reservations, book escort services and waiters, request songs and request for tables.

The Ordering System Module: This service management system is equipped with an inventory module that holds and shows available stock from which the customers can order. Customers can order multiple items at once and hold it in the cart to be paid for on time. The flow chart for this procedure is represented in Figure 7.

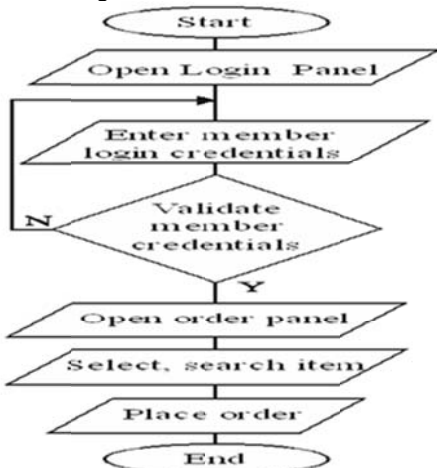


Figure 7: Flowchart Diagram of Items Ordering System

Cart System : As the items are selected, they are placed in a cart after which payment is made at once, as shown in Figure 8. The cart system enables the ordering of multiple items at once. Customers can decide to pay for several items at the same time.

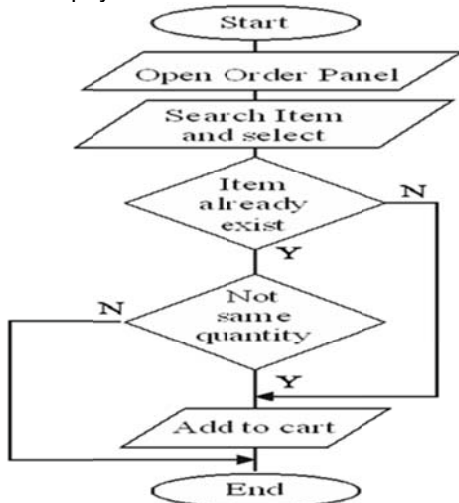


Figure 8: Flowchart Diagram of customer Cart Module

Order Payment : The application includes a payment system that enables payments to be made for items ordered as shown in Figure 9 while Figure 10 shows the flowchart for sorting the customers' order.

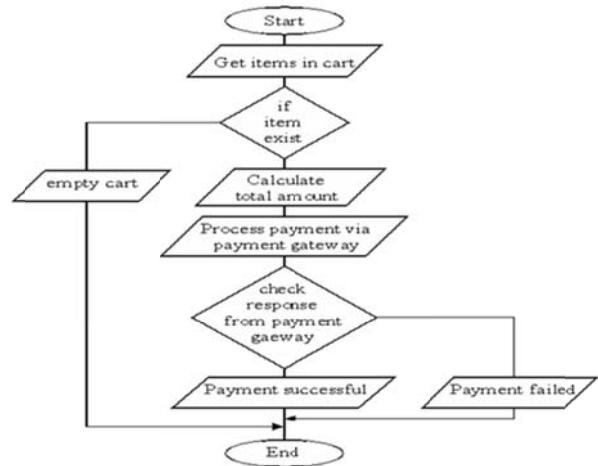


Figure 9: Flowchart Diagram of customer Orders Payment Module

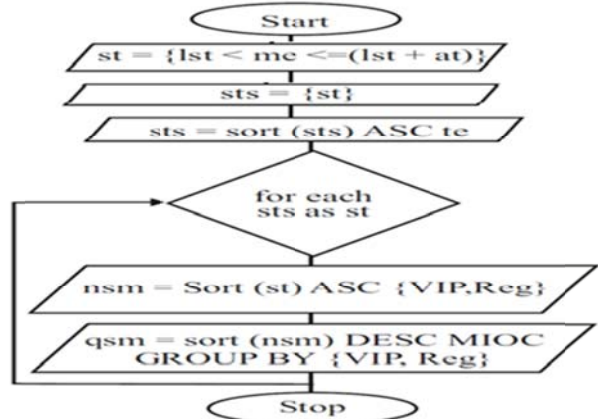


Figure 10: Flowchart for the Customers' Order Sorting

Clique or Group Management : One of the most exciting features of the application is that it serves as a social application. In a club, VIP attendees and regulars are equipped with certain privileges. One privilege a VIP member has on this app is the ability to create his cliques or groups of people that he wants in his circle. This is also important to the club owners to be able to keep track of friends of VIPs so as to ensure they attend on serious club nights. It is a known fact that people spend more money when they have some kind of persons in their company. Figure 11 shows the clique (group) management module.

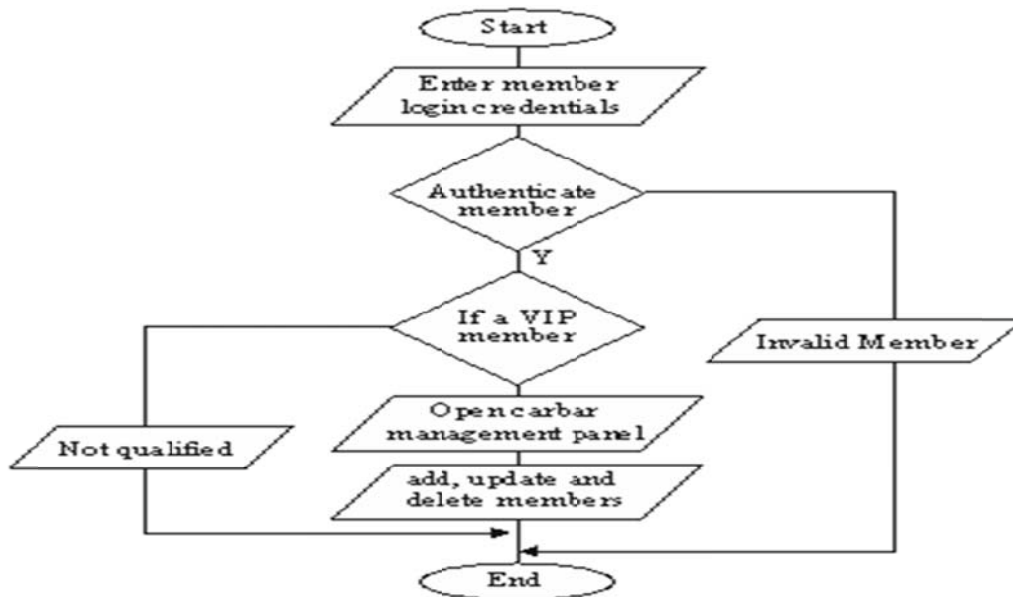


Figure 11: Flowchart Diagram of Clique (Group) Management Module

Table Reservation : Many times, a customer may not be able to get to a club or lounge venue on time but may want to have a particular seat or table reserved for him/her. The flow diagram of the reservation process is shown in Figure 12.

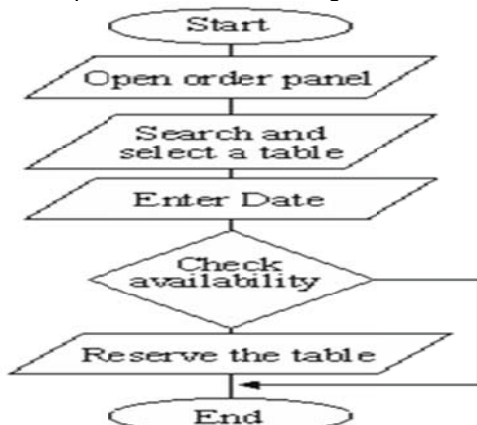


Figure 12: Flowchart Diagram of the Table Reservation Module

C . Queuing Process Implementation for the System

A very vital feature of this research work is to manage customer queues within an entertainment centre and properly cater to each customer without bringing up ill feeling and dissatisfaction among the other customers. Some assumptions were made to properly present the queuing system that was designed for the stated purpose. The assumptions are as follows:

- i. Each entertainment centre has two grades of customers which are classed as Regular and Very Important Persons (V.I.P).
- ii. Being a V.I.P customer is not a permanent privilege. In this case, V.I.P membership is like a lease and expires within a certain time

- iii. To be a V.I.P customer on the system, a customer must make a certain amount of Purchase monthly (this amount can be set by the entertainment centre in question) or must meet up a certain percentage of monthly attendance to the entertainment hub.
- iv. During the code implementation, V.I.P customers are always given precedence over the regulars in a specific service window.

The flowchart for determining the VIP status of a member is shown in Figure 13.

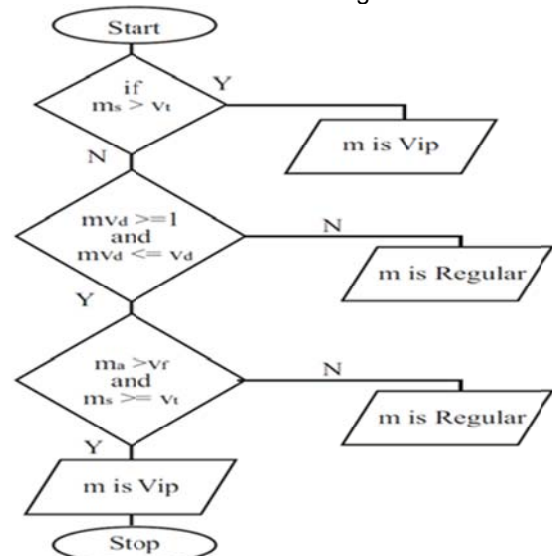


Figure 13: Flowchart for Determining the VIP Status of a member

The parameters used in the flowchart for determining a VIP are as follows:

- Member = m
 VipDuration = Vd (Duration of Member vip validity)

VipThreshold = Vt (Minimum amount a vip is required to spend within Vd)
LowerVipThreshold=Vt2 (Minimum VIP spending if below Vt but ma is above vf)
VipAttendanceFactor = Vf (the Percentage attendance a vip member must have within a Vd)
MembershipAttendance = ma (the minimum number of attendances a member can have to be considered for vip promotion)
VipMembershipDuration = Mvd (the predefined duration of which a member can be in vip status)
MembershipSpending = Ms
GracePeriod = Gp (Maximum allowable time period before a customer satisfied the conditions for Vip).

D. The Queuing Mechanism for the Customers' Order

Queuing in the application is not based on just purchase made or membership status alone. It is based on the time slot, allotted time, membership status and then the amount of purchase made by each customer. The system breaks orders into batches of two batches of 30 seconds interval and treats the entire orders in a particular batch by first giving preference to VIPs then consideration is given to amount of purchase made.

Parameters' Description:

At = allotted time interval used to form a slot
St = Slot (orders placed within an allotted time)
Sts = Slot Set (batches of slots formed)
Me= the time a customer places an order
Te = Beginning time of a slot
Lst = end time of a slot
Vip = set of vip members that placed order within a slot
Reg = set of regulars that placed orders within a slot
vip,reg = sort order with vip taking precedence
Asc = Ascending order
Desc = Descending Order
Nsm = new arrangement after sorting vip and regular
Mioc = Member item order cost (the cost of item each customer orders within a slot of time)
Qsm = the new order of the slot when arranged by mioc (For a particular time slot, the waiters attend to customer based on the qsm result).

Pseudocode for the Customers' order Sorting:

```

{
  {
    St=Lst<Me<= (Lst +At)
    Sts = } st
    Sort (sts)
    For (Sts as st )
    nsm = Sport (st)ASC vip,reg
  }
  qsm = Sort ((nsm) Desc MIOC) GROUP BY vip,reg
}

```

E. Customer Segmentation Using K-means Clustering Technique

Coffey (2016) states that the optimum goal of customer segmentation is to divide customers into groups that share similar characteristics. One of the very special features of this application is its ability to use customer data and history to segment customers in order to provide personalized services that would further attract and keep customers coming back to the club. Also, the intelligent queuing system of the application was based on the data pooled from the K-means segmentation which was based on the following

- i. High Purchasing power
- ii. Frequency of attendance
- iii. Cliques (how often does a customer come with friends)
- iv. Sex and age (For females, younger ages are preferable, for males, Older men are preferable)
- v. Special events: how many times does a customer attend special events organized by the club?

III. RESULTS

A. The Home Page or Welcome Page

The waiter-based service management system is called LunikServiceWare. The welcome page of the waiter-based service management system that appears once the application is launched through a web link is shown in Figure 14 .

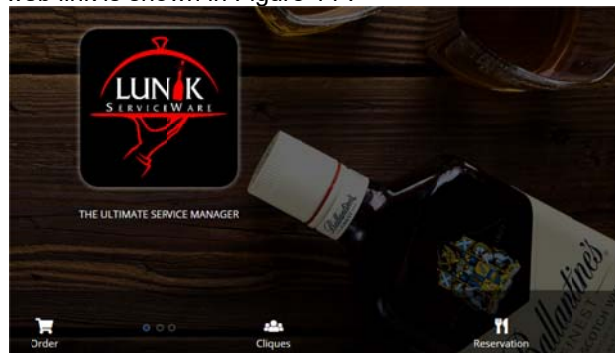


Figure 14: Screenshot of Main Page

B. Customers Registration Page and Login Page

The registration page and Login page for customers are shown on Figure 15. In the registration page, details of customers are required to enable them access the members' portal. Once the details are gathered, a membership or club code will be generated for the customer . In the Login page, customers can login. On registration, a unique code is given to each user from which they can use to gain access the system

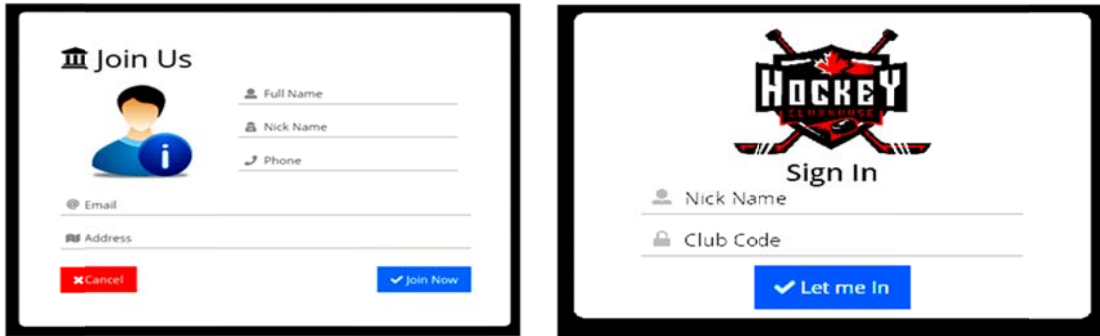


Figure 15: Screenshot of Customer's Registration platform and the Login page

C. Customer's Item Search Order Page

Once a customer logs in, the customer can easily find products and services in the club by navigating the search option shown in Figure 16.

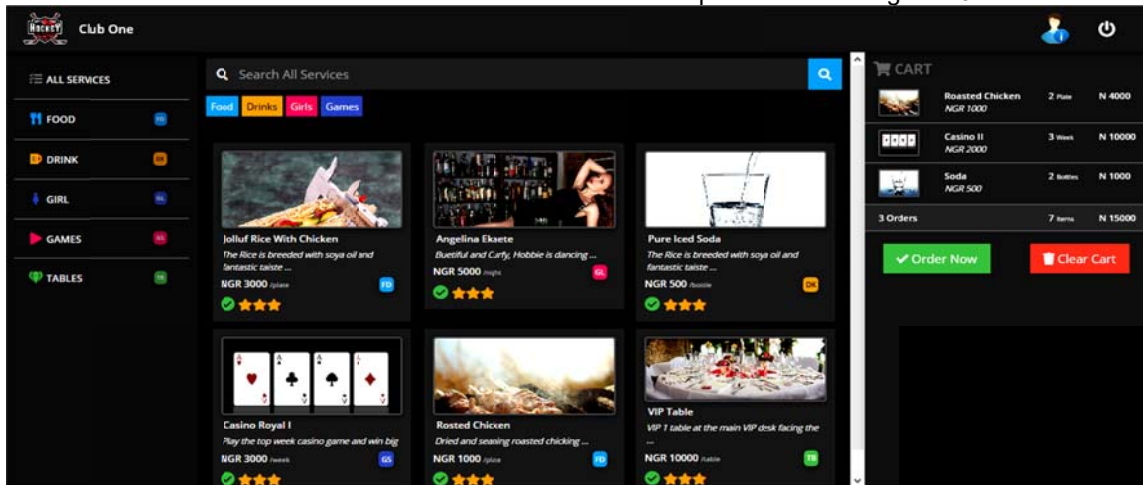


Figure 16: Screenshot of Customer's Item Search Order Page.

D. The Active Order Queue

A list of orders made by customers in the entertainment centre is shown in Figure 17. As stated earlier, the orders are grouped according to customer status and then costs of item purchased within a specific order time. The admin can view to see the status of the order if the customer has been attended to or if the order is pending. This section is really

critical to the business. It shows the orders grouped according to customer status. From the screenshot, a regular customer is up on the list because he ordered within the previous window. From the next order, both are VIPs so they are treated equally even when the cost of purchase is less than the next order.

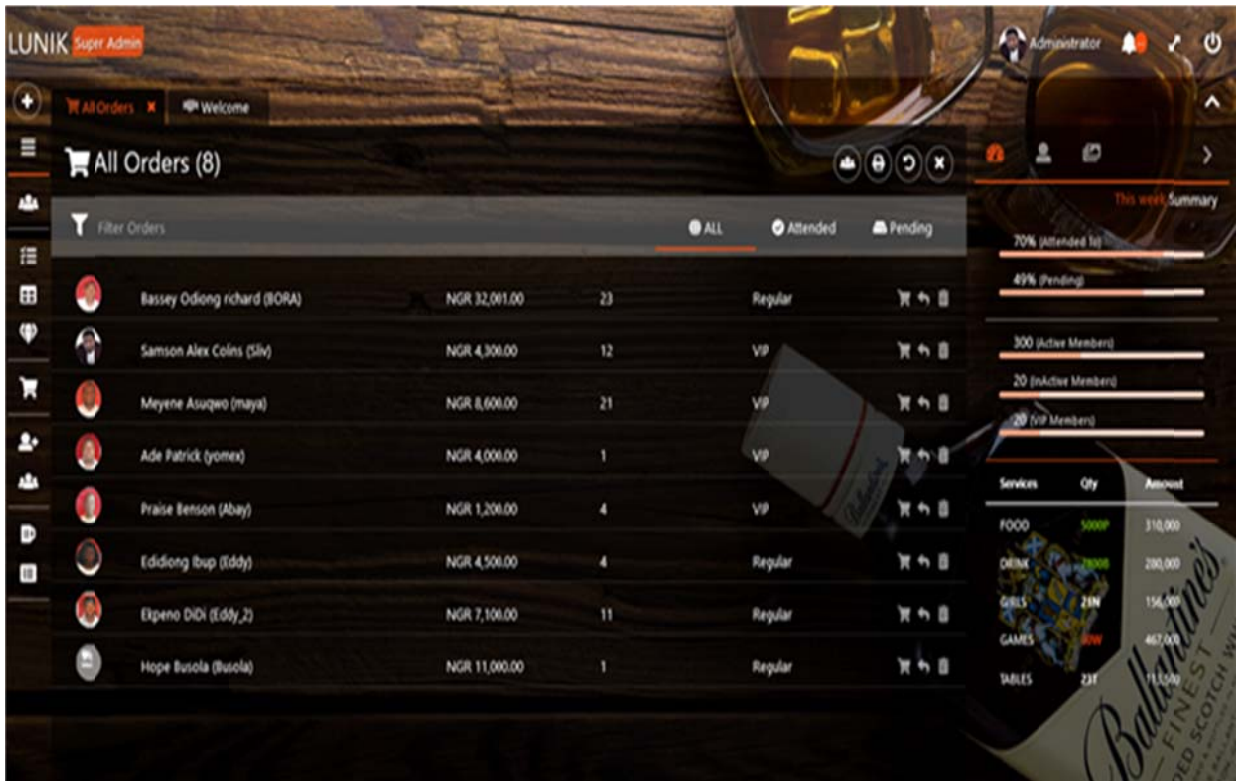


Figure 17: Screenshot of orders in the queue

E. The Admin Access Page and the Staff Management Page

The management system admin gains access to the admin page by logs in using the Admin Login Page

shown in Figure 18. The Admin can carry out unlimited activities; among the activities is staff management, The Staff Management Page is also shown in Figure 18.

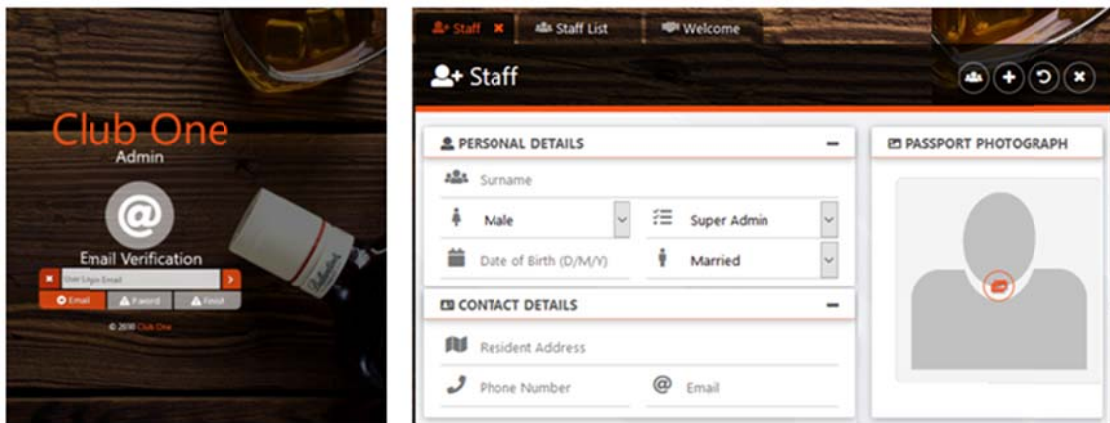


Figure 18: Screenshot of Admin Login Page and the Staff Management Page

F. The Payment Module

The admin can view to see how payment was made by the customer. Here, there are several

payment options available to the customers. Orders can be paid for by Cash, advanced deposit in the designated bank, by Point-of-sale (POS) or by transfers as shown in Figure 19.

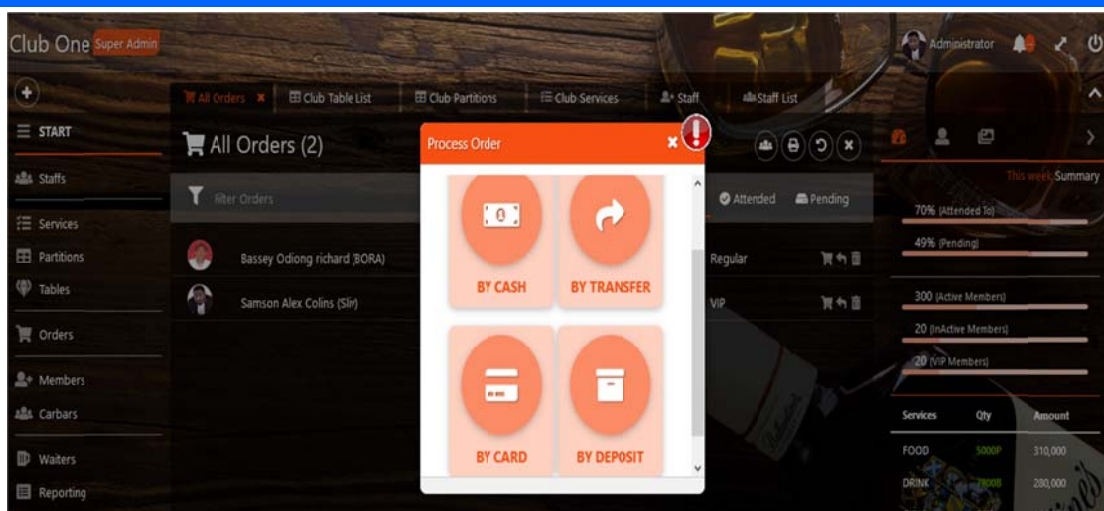


Figure 19: Screenshot of Order Payment System page

G. The Reporting Page

The admin also have direct view of the entire sales and attendance of the entertainment centre for a

day or night. The statistics page is very useful for a proper understanding of the level of sales or not for the entertainment and hospitality centres.



Figure 20 Statistics and Reporting Page

The admin can have a direct view of the entire sales and attendance of the entertainment centre for the night. The statistics page is very useful for a proper understanding of the level of sales or not for the entertainment and hospitality centres.

A summary of the comparison of different existing related software with the developed system is shown in Table 1 . From Table 1 it is clear that the newly designed system has remarkable advantages over other existing related works in service management system.

H. Comparison of the Different Existing Related Software with the Developed System

Table 1 Comparing the different existing related software with the developed system

Reviewed Serviced Based System	Web-Based	Customer Autonomy	POS/Inventory Integration	Prioritized Queuing For Service	Clique Management	Customer Data Segmentation &Reporting
Md Al-Amin	x	x	x	x	x	x
Waiter Locator	x	✓	x	x	x	x
Lavu POS	✓	x	✓	x	x	✓
Vemos	✓	✓	✓	x	x	✓
POS Sector	✓	x	✓	x	x	✓
LunikServiceware	✓	✓	✓	✓	✓	✓

IV CONCLUSION

The study in this paper is focused on the development of a Waiter Based Service Management System for the improvement of service delivery in entertainment and hospitality centres. Notably, manual servicing of orders in event centres, conferences, restaurants and club houses poses a challenge to both the waiters and customers. As such, in this paper, a queuing mechanism was developed to handle order queues and ensure that waiting times are reduced to the barest minimum so as to eliminate balking, reneging and jockeying. Priority is introduced in customer management such that high priority customers guests are satisfactorily served while not neglecting the low priority members. Furthermore, unlike available service management system, the one developed in this paper, reduces direct interaction with the waiters to the very minimum. This is achieved through various waiter and customer order management modules built into the system. This allows customers to have autonomy of placing their orders irrespective of the busy nature of the waiters in club and the system ensures that the customer's orders are routed to waiters without any physical contact with the customers. The entire system is developed as a web application and it is hosted locally and demonstrated using some sample data from selected case study bars, lounges and clubs.

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