Automated Services Order System

Rafael E. Díaz Carcache
Master in Computer Science
Juan M. Ramírez, Ph.D.
Electrical & Computer Engineering and Computer Science Department
Polytechnic University of Puerto Rico

Abstract — It is very common to see that in many restaurants, whether they are economic or gourmet, the customer always has a problem when ordering or paying for his order. Some of the reasons for these situations can be caused by the lack of waiters to provide customer service, the waiting time for delivery of the order, to the time waiting for the waiter to deliver the invoice to pay for your food. This will cause a discontent for the customer, who will probably not be going back to the restaurant because of the poor service. Because of these frequent problems, I identified the opportunity to implement the use of a system in which the client can see the menu, place his order and pay for the food through a tablet. This provides a more rapid and effective service which will make the restaurant not be fully dependent of waiters.

Key Terms — Automated Services, Business Optimization, Order Systems, Restaurant Services.

INTRODUCTION

This system is designed to give restaurant customers an overall improved quality of service during their visit. It would help to optimize the attention to the customers by giving them the opportunity of placing orders and paying for them at any given time by just using the tablet located on each table. The system will present a menu list of all the products available at the time. Customers can browse, order and reorder on their own, split the bill and pay directly through the tablet. Customers only need to choose the products they want and the order will automatically appear on a screen located in the kitchen, another screen located in the bar and on the cashier's computer for it to have control of the tables and orders. When the customer wants to pay for his order, the system will have an option to pay for his order thru the device or submit the order to the cashier which automatically sends a notification to the cashier's computer to give appropriate attention to the consumer. This way, the restaurant ensures that the customers will not be fed up of waiting in the restaurant by fulfilling their requests and needs in a smooth and efficient manner, increasing its service performance.

By giving the customer the opportunity to make an order so easily at any given moment, an increase of the total sale will be made compared to having to wait for a waiter to give follow-up to the customer. Similar systems that have been developed claim that restaurants that have given their customers the ability to order at their tables, have had an increase of 10 percent sales boost and improve table turnaround time by about 7 minutes [1]. Also, clients who could have probably been lost in the past because of the waiting time for a waiter will now probably be returning customers.

Besides benefiting the consumer, the implementation of this system can give the restaurant better attributes giving the restaurant a competitive advantage in the marketplace. Another benefit for the restaurant is that it will minimize the use of paper. The wireless menu tablets eliminate the need for paper menus and paper receipts since the customer will be able to receive the receipt via email. This will add to the environmental friendly "green" factor, as well as convenience for the customer.

EXISTING SYSTEMS

I will now evaluate some of the existing systems that are available for restaurants.

Conventional Systems

Conventional systems consist of restaurant services which require waiters to schedule

reservations, process orders by interacting with the customer and tacking the order to the kitchen for the chef to prepare the meal. When the customer has finished eating, he needs to notify the waiter that he is ready to pay for his bill, so the waiters will need to go to the cashier and ask to calculate the amount due for the order. After this, the waiter hands the receipt to the customer for him to pay at the cashier. Although this seems like a simple process, it increases the waiting time for the customer and the workload for the waiters. This procedure also allows errors to occur in the meal ordering interaction between the customer and the waiter. Also, because of the workload on the waiters, customers can feel that they are not receiving the expected attention when the number of waiters is not sufficient to deal with the number of clients, which will degrade the overall service quality [2].

Electronic POS Terminal systems

The electronic POS (Point of Sale) terminal system offers a service very similar to the conventional systems, but offers some benefits for the administration. The only main difference is that when the waiter takes the order of the customer, he introduces the order into the POS system which will automatically print a receipt of the order at the kitchen and keep a track of the order to calculate the bill. This eliminates the need for the waiter to have to take the order recorded with a pen and a paper. This system mostly only benefits the administration, since the customer will also have to wait for the waiter to take the order and when the customer has finished eating, the customer will also need to ask the waiter for the bill so he can pay at the cashier with the POS.

PROPOSED SYSTEM

Now that we have evaluated some of the existing systems that are available for restaurants, I will explain in detail the system that I'm proposing.

System Architecture

The system will consist of the following components: the frontend and the backend. The frontend includes the customer side (mobile application) and the restaurant side (web application). The restaurant side will include the following frontends: kitchen, bar, and manager. The backend is made up of the web server and the database.

System Features

The system is designed to minimalize the interactions between the customer and the waiter, with a tablet that will have a user friendly application. Because of this, the application could easily be used by a 12 year old or an 80 year old customer [3]. This requires the need of a design that is user friendly and attractive, making it a pleasure to use for the customers, employees, and the manager. We will now go into detail about the features that this system will be available for the customer side and the restaurant side of the system.

Customer Side

This application will be designed to give restaurant customers a great, astonishing service, providing much more information than a regular paper menu and waiters would provide. Once the customer arrives to his table, he will be presented with a tablet, running the Android OS. The tablet will be synchronized with the database running on a web server. The menu data will automatically be downloaded from the web server once the customer opens the application. The customer will be able to browse the menu on the tablet which will be divided into the following sections: appetizers, soups & salad, main entrees, daily specials, desserts and beverages. Each menu option will have the items name, a brief description and a picture.

Another benefit of the design is that the customer will no longer have to depend on the description of the recipe of a dish in case they are undecided whether to order it or not. By simply taping on the "more details" option that will be provided with every item, a popup window will expand showing the following information to help the customers make their decisions [4]:

- Dish ingredients

- Nutritional information: where the components of the products are from. Ex.: If you want information about a wine, you will be able to see the historical transcendence of the wine, who manufactures it, main features, etc.
- Approx. time to make plate:
- Reviews given about the product; where the customer will also have the ability to make a review of the product for other guests to see.
- Larger picture will be displayed to visually seduce the customers by enhancing the interactive experience.

The customer will be able to sort the products on various filters like special offers, price, popularity, ratings, and recommendations according to their daily activity, diet plan etc. The customer will be able to make an order by adding products to his order. When the customers selects each product, he will be able to personalize it by adding notes regarding their preferences for the item like meat temperature, extra salt, no spice, etc. After the order is built and confirmed, the user may submit the order to the bar and the kitchen. The staff will instantly be notified about the new order so that they can act on it. During the preparation of the order, the customer will be able of tracking the status of their order so that they know when to expect their food and drinks to arrive on their table. The customer will have a limited time in which the system will allow him to make changes to his order after it has been submitted.

Customer will have visibility at all times of the following:
- Help button – Call for waiter
- Account balance
- Approximated time remaining for order to arrive.
- Order status:
  - Not submitted
  - In process
  - Finishing / On the way to table
  - At table
- Map localization
- Restaurant Team

- Contact form

When the customer has finished eating and is ready to leave, he will be able to pay from the tablet or in the main cashier if desired. If the customer decides to pay thru the tablet, he will have the ability of splitting the bill number of people on the table and with different methods of payments. After paying, the customer will have the option of emailing the receipt or printing it.

The customer will be able to create an account or login with his account or other social media accounts (Facebook, twitter, Foursquare, etc.) which will allow him to:
- Create reviews of the ordered products, service, waiters, and restaurant
- View all of his past orders and reviews
- Check-in on the restaurant

Figure 1 an example of a flowchart diagram for the Customer Side interactions.

Restaurant Side

One of the main benefits of the design of the system is that it will eliminate order-taking errors from the waiters. The orders will be taken correctly the first time without the need of the waiter to run back and forth from the customer to the kitchen and bar, because the tablet taking the orders will always be with the customers. As mentioned earlier, the restaurant side of the system is divided between the following frontends: kitchen, bar, and manager. The kitchen frontend will only display the food orders submitted and will allow the chefs to update the status of each order while it is being prepared so the customer can track his order. The bar frontend will be very similar to the kitchen frontend, only differencing it by displaying the drinks ordered.

This system will offer great advantages to the restaurant managers. The managers will have access to the administration page of the system on the manager frontend. This section will make it possible for managers to customize the look and theme of their menus daily. This frontend has the following modules: orders, items, slider, users, customers, payroll and analytics.

The orders module will give the manager the ability to access and modify the orders seen on the kitchen and the bar. The items module contains all of the information of the products and its prices per quantity. It allows adding, modifying and deleting items of the menu, its attributes and selecting which products will be available of Special Offers of the day and happy hours. The system will be intelligent enough to handle the inventory of the products, so if the item is not available, customers will see the disabled item which they will not be able to order.

The slider module allows the manager to select the pictures that will appear on the main page. The user's module allows administering the user's access and privileges to the restaurant backend. The customer's module allows viewing the customer's information and order history. The Payroll module contains receipt of customer order which have menu item, price per quantity, total price, and restaurant account statement and employee name.

The analytics module will allow the manager view database data to evaluate the sells made and to analyze the feedback of the customers. Since customers will be able to give feedback of the order and service, the restaurant can improve based on the customer's behavior and customers complaints will be able to be addressed. There is no doubt that this analytics will offer guidance so managers can get a better sense of how their restaurant is performing. Figure 1 an example of a flowchart diagram for the Customer Side and Restaurant Side interactions [5].

Tools and Techniques

The tools and techniques that will be used to build and run this system are cutting edge and mostly all are open source. By using open source technologies we will help to maintain the cost of the system low, therefore enabling the establishments to use this setup without many concerns with regards to the costs involved.

Software Used

For our web development, we will by using Adobe's Dreamweaver which is a web design software for making websites and mobile applications. Dreamweaver supports all the web technologies that we will be using. Our user interface we will be developed using the HTML5, CSS3, JavaScript and jQuery which are the latest technologies available for web developing and design [6]. For server-side scripting and interacting with our database we will be using PHP.

Platform Frontend

The customer side frontend will be designed as a mobile application. This application will be accessed thru an Android tablet which must have Wi-Fi connectivity, high resolution screen capable of displaying high quality images and a card reader for accepting payments. The restaurant side frontend will be developed as a web application. This will allow the kitchen, bar, and manager to access the frontend via a tablet, laptop, or any other dispositive that has web access.

Platform Backend

Since our application will be accessed thru the web, our backend will be located on a web server. The web server will be hosted on a Linux operating system to reduce costs compared to Windows servers. By having a hosted server, restaurant owners will be able of synchronizing customer and product data between various restaurants having one centralized database.

Scalability

The system will have the potential of being used by millions of customers on different restaurants at any given time, with possible peaks at various rush hours at the establishments this may be implemented at. Because of this, the system will have to be scalable and should be able to accommodate as many users and as much data as required.

Security

Since private information about the restaurant and the customers will be stored in our database. We will need to ensure that the whole system; including the web service, the android application, the
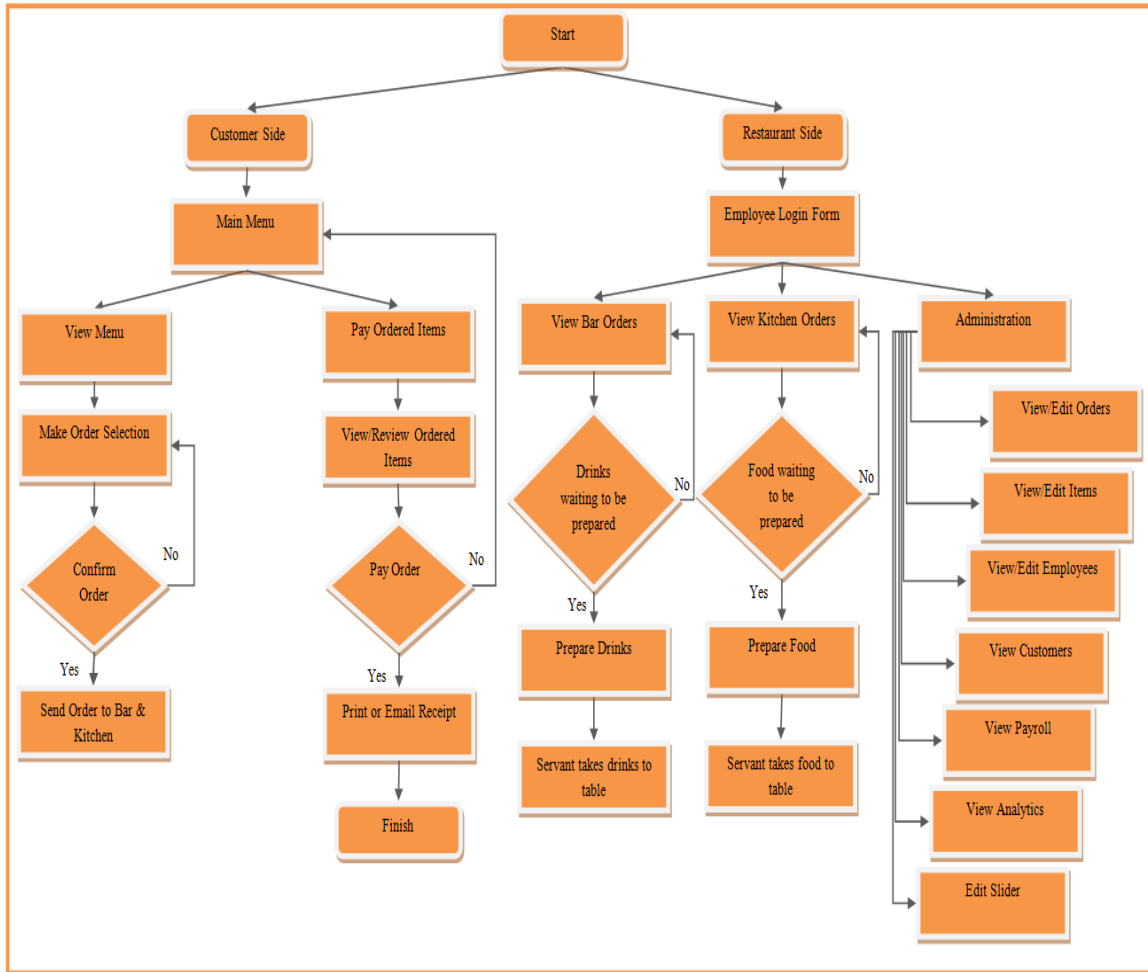
Figure 1
Customer Side and Restaurant Side Flowchart

database as well as the server be secure from external and internal threats. This system will have to types of user's access, the customer frontend and the restaurant frontend. The customer frontend will not be obligated to create credentials, because we want to reduce the complexity and time of customer using the system. If the customer decides to create an account, he will have the option to create it using his social media accounts. The restaurant frontend will require the employees to access by entering their username and password. This will be essential to secure the confidential data of the restaurant and to have control of the access to different screens by the use of different access levels. Table 1 demonstrates a comparison of existing systems vs. the proposed system.

Reliability

For the customers, the system reliability consists of the menu browsing, ordering and payment functions. Menu browsing reliability consists on displaying products that are available for purchase at the given time and price. The ordering function will require reliability since it will allow the customer to add items to his order and confirm it before submitting the order, providing real data transfer from the customer ordering tablet to the kitchen and bar. The important aspect of reliability on the payment function is that it will have various calculation functions to get the total cost of the order. Also, this function will be responsible of making the payment and printing the receipt or sending it via email to the customer.

Table 1
Comparison of Existing Systems vs. Proposed System

	Conventional System	Electronic POS Terminal systems	Proposed System (Tablet)
Operating System	N/A	Windows	Android
Server Location	N/A	Local server	Web server
Customer Identification	N/A	N/A	User account secured in database.
Menu Type	Paper Menu	Paper Menu	Menu is on Tablet
Ordering Method	Customer gives order to waiter. Waiter then takes order to kitchen and bar.	Customer gives order to waiter. Waiter then introduces the order into the POS system which will automatically print a receipt of the order at the kitchen.	Customer orders thru tablet. Order goes directly to the kitchen and bar.
Payment Method	Customer asks waiter for bill. Waiter gives order to cashier. Cashier calculates the total bill. Customer pays bill at the cashier.	Customer asks waiter for bill. Waiter goes to POS and prints the bill. Waiter gives bill to customer. Customer pays bill at the cashier.	Customer pays bill at Tablet and receives receipt thru email or printed at cashier.

Assumptions

The success of the proposed system is based on the following assumptions:

- Customers and staff should be able to use tablets
- Tablets should work without errors
- Network connection will always remain stable
- Security of server is maintained

Risks

The above mentioned assumptions, give rise to a various risks. These risks include the following:

- Customers and staff are not able to use the tablets
- Network connection is lost
- Server or tablet tablets suffer a defect

Maintainability

The maintenance of this system, including the source code of the application and direct database access will not be included in the user's functions to prevent security breaches and changes in the system configuration. The maintenance can be included as a package with the purchase of the system for an extra fee.

USER INTERFACE DESIGN

The following figures are some of the prototype user interface design pages of the application's frontend.

Figure 2 is the interface of the main page that appears when a user opens the application. If the user clicks "Customer" it will take them to the "Customers Main Page" interface. If the user clicks "Staff", it will take them to the "Employee Login" interface (Figure 5).
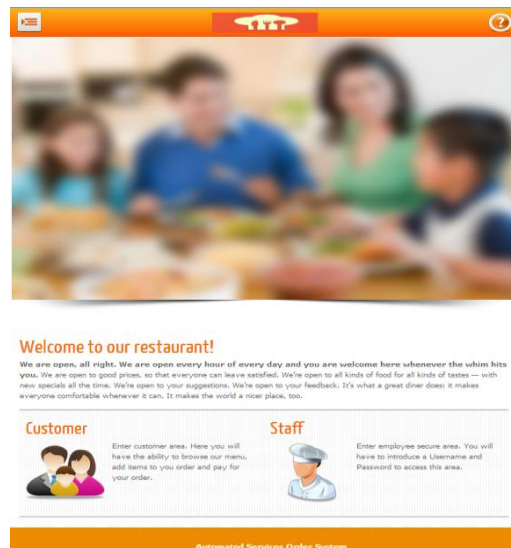

Figure 2
System Welcome Screen

Figure 3 is the "Menu Screen" interface. It is displayed when a customer wants to browse the restaurant menu. When customers press "Appetizers", it will take them to the "Appetizers Menu" interface. When customers press "Soups & Salads", it will take them to the "Soups & Salads Menu" interface. When customers press "Main Entrees", it will take them to the "Entrees Menu" interface. When customers press "Daily Specials", it will take them to the "Daily Specials Menu" interface. When customers press "Desserts", it will take them to the "Desserts Menu" interface. For last, when customers press "Soups & Salads", it will take them to the "Beverages Menu" interface.

Figure 3
Customer Side - Menu Screen

Figure 4 is an example of the interface when a customer clicks on "More Details" of an item. It describes the food more detailed and has the option of selecting the quantity wanted. When the customer clicks "Order", the item is added to the order built.

Figure 5 is the login form for the employees of the restaurant. Depending on the privileges of the employee, it will take them to "Bar Orders" (Figure 6), "Kitchen Orders" (Figure 7) or "Administration" (Figure 8).
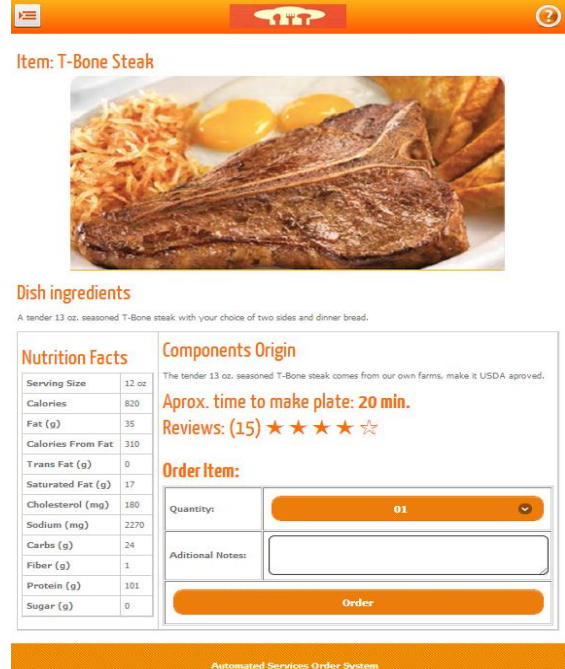

Figure 4
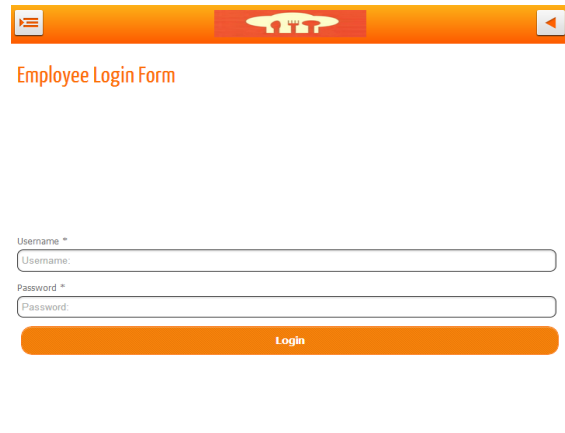**Customer Side - More Details of Item**

Figure 5
Restaurant Side - Employee Login Form

Figure 6 is the "Bar Orders" interface. It displays the drinks ordered on each table. Also, it displays the time elapsed from when the customer ordered it.
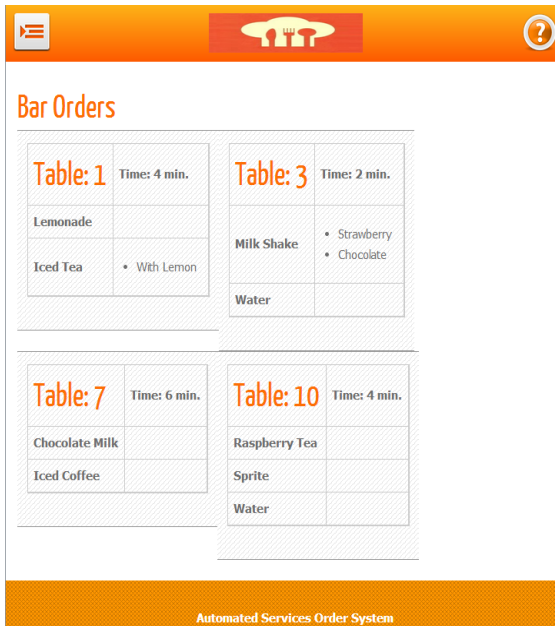
Figure 6
Restaurant Side – Bar Orders

Figure 7 is the "Kitchen Orders" interface. It displays the food ordered on each table. Also, it displays the time elapsed from when the customer ordered it and any note that the customer added.

Figure 7
Restaurant Side – Kitchen Orders

Figure 8 displays the Administration interface. The managers will be the only user that will have access to the administration page of the system. This section will make it possible for managers to customize the look and theme of their menus daily.

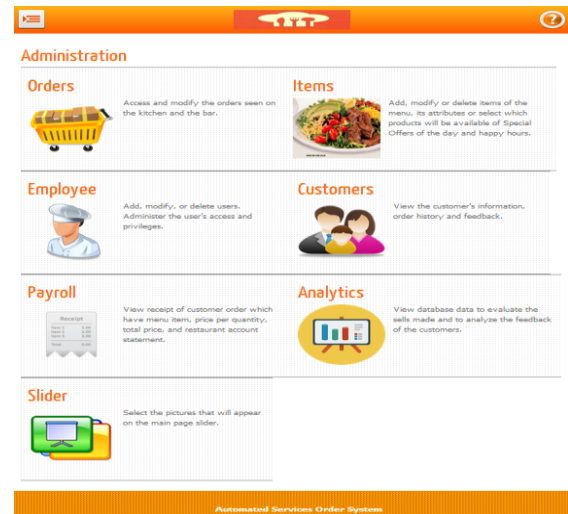This frontend has the following modules: orders, items, slider, users, customers, payroll and analytics.

Figure 8
Restaurant Side – Administration

CONCLUSION

Over the years, technology has greatly revolutionized the restaurant industry. From having conventional manual systems in the past, a large amount of the restaurants now have Point-Of-Sale terminals. This has greatly improved the administrative aspect of restaurants, but the technology has not been focused on the quality of service for the customers.

Traditional restaurant service requires waiters to interact with customers directly every time the customer has a need; from making an order, asking for a refill, asking for the status of the order, and to ask for the bill before leaving. With the emergence of digital tablets and user-friendly touch screen, technology has given us a tool to help customers interact directly with the restaurant, without having to rely on a waiter [7].

These tablets will also benefit the waiters by making their jobs less exhausting since they will not have to be taking orders from the customers and will no longer be responsible of giving false information of plates. Another benefit for the waiters is that, since the client will browse the dishes and take the order by himself, the waiter will not be responsible

of taking the order and the customer receiving something different.

The advantages are large; restaurant owners can increase efficiency and improve quality of service, increase guest satisfaction and sales with this tablet ordering systems by recording more accurate orders, decreasing wait staff, lowering wait times for guests, and creating an easy way for guest to purchase more products at any given moment with the use of the tablet. This automated order system will definitely revolutionize the restaurant industry by offering the quality of service that the customers deserve.

REFERENCES

[1] Hardawar, D., *et al*. "Restaurant tablet startup E la Carte orders up $13.5M." *VentureBeat*, 2013. Web. 24 Oct 2013, http://venturebeat.com/2013/06/24/restaurant-tablet-startup-e-la-carte-orders-up-13-5m/#jp4sXBHiJQRlQDpL.99.

[2] Nikesh, V., *et al* and Varma, N., *et al*. *Intelligent e-Restaurant using Android OS*. Paper. 2013. University of TCET, Mumbai.

[3] Buchanan, N., *et al*. AN EXAMINATION OF ELECTRONIC TABLET BASED MENUS FOR THE RESTAURANT INDUSTRY. Thesis. 2011. University of Delaware.

[4] Drew, S., *et al*. "Maxx Menu brings an interactive wine and cocktail menu to various locations of The Melting Pot restaurants." *Restaurant Magazine*, 2013. Web. 24 Oct 2013, http://www.restaurantmagazine.com/maxx-menu-brings-an-interactive-wine-and-cocktail-menu-to-various-locations-of-the-melting-pot-restaurants/.

[5] Bora, P., *et al*. And E Gupta. *Application on Order Management System in Restaurants*. Thesis. 2012. International Journal of Application or Innovation in Engineering & Management.

[6] Powers, D., *et al.* "HTML5 and CSS3 in Dreamweaver CS5.5.", Adobe, 29 Aug. 2013, http://www.adobe.com/devnet/dreamweaver/articles/dw_html5_pt1.html/.

[7] Rogers, K., *et al*. "Restaurants Start to Harness Power of iPads." *Fox Small Business Center*, 2011. Web. 24 Oct 2013, http://smallbusiness.foxbusiness.com/technology-web/2011/02/21/using-ipads-restaurants/.