Bubbies

Restaurant Automation

Group #8

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Problem Domain

Several restaurants today encounter problems because their working style and services are outdated. This causes the overall restaurant operation to suffer because it leaves the managers, customers, and staff unsatisfied. This project mentions some of the major improvements that can be done to better the coordination of activities throughout the restaurant and increase the restaurant's productivity. Several restaurants surrounding the campus were interviewed, and the results were utilized towards narrowing down problems. Listed below are some of the problems in restaurants today and our possible solutions to them.

Customer Statement of Requirements

While many large scale restaurants have upgraded their technology to the benefit of their businesses, small to medium size restaurants continue to fall behind. Our hope is to create a simple automated solution to many problems faced in the restaurant business. The solutions proposed in this program are designed for the betterment of the key components of a restaurant: the manager, employees, and most importantly, the customers. The manager must be able to efficiently divide time between customers and employees in order to make the best decisions for the business. The customers are indeed the crux of the restaurant and therefore must also be handled accordingly. In the end, time and efficiency are the most important aspects of a restaurant in order to keep the business prosperous. Our program, Bubbies, will bring forth technological advantages to restaurants in need.

Problem Diagnosis and Solutions

Problem: Seating

As the customer enters the restaurant they need to be greeted and seated at the available tables. It is hard for waiters to know if a table is available or occupied. There is either a "dry erase diagram of tables, maintained on a blackboard" or the waiter has to personally walk around the restaurant and look for the table that will fit the party size. Either way, it is time consuming and too much of a hassle for waiters to keep track of the tables and update the tables' diagram on the blackboard by walking around in the restaurant. Hence, the customer has to wait more than necessary, and as mentioned the customer wait time is the main concern for the restaurant.

Solution: Customer Welcome Screen (CWS)

A CWS that has Bubbies running and is installed at the entrance of the restaurant. When the customer enters the restaurant they will be greeted by the CWS, and they will be requested to input their name, contact number (optional), and party size. The CWS will display the floor map and assign a table according to the party size of the customer, if available. If there are no available tables, the CWS will display a message requesting the customer to wait and will be notified through a text message or view the table status on the screen installed in the waiting area.

Bubbies is updated each time the status of the table is changed. When a customer is seated, the table status on the Customer Table Screen (CTS) is changed to occupied. Similarly, when a customer leaves and the busboy finishes setting up the table, the table status on the CTS is changed to available, and the floor status in Bubbies will be updated.

By the installation of CWS, the unnecessary wait time of the customer will be reduced. The waiter does not have to walk around in the restaurant and constantly update the diagram of tables on the blackboard. Hence, a smooth and efficient system of greeting and seating a customer will increase the restaurant's productivity.

Problem: Ordering and Payment

When the customer is seated and is handed the menu, the waiter leaves and gives time to the customer to decide on the meal they would like to order. Now, either the customer is ready to place the order and is waiting for the waiter or the waiter frequently checks on the customer if they are ready to place the order. The complete ordering procedure takes about eight to fifteen minutes. Customers wait for waiters for five to ten minutes as they attend other work. Since waiters are using a pen and notepad to write orders, they take about three to five minutes listening and repeating the orders to avoid any errors. Similarly, the waiter constantly questions the customer every few minutes to see if they have decided on their food. This overwhelms and rushes the customer to choose a meal to order, even though they are not ready. Either way, it is too time consuming and too much of a hassle for both the waiter and customer because they are dependent on each other to place the order.
Likewise, the payment of food takes more time than necessary. The customer has to wait for the waiter to bring them the bill after they finish their food and then wait again for the waiter to process the payment and returns receipt/change. The process to make a payment takes about ten to fifteen minutes if there are no errors in calculation. Splitting the payment among the customers may increase that time and also is tedious for the waiter to process. After the payment is processed the waiter has to store all the receipts for the bookkeeping.

Solution: Customer Table Screen (CTS)

A CTS that has Bubbies running is installed at each table. At these touch-screens, customers can directly place their order and do not have to depend on the waiter as much. The entire menu will be present for the customer to view and pictures of the items will be provided for the customer's convenience. Due to these installed screens, the amount of time it takes for the customer to place an order will not be due to the service of restaurant. The order placed by the customer through the CTS will automatically be sent to the Kitchen Staff Screen (KSS). If the customer is having trouble ordering, they can call the waiter via CTS to place the order for them on the CTS or answer any questions related to placing their order. Similarly, the customer can directly make a payment on CTS if they are paying with debit/credit card, split the bill, or call the waiter for assistance (cash payment).

By installing CTS, the customer's wait time to place an order or pay for the order will greatly reduce (almost cut in half). There will be neither errors in placing orders nor errors in calculations for the payment of the food. Bubbies will have the record of all the payments stored in its database for the management. Therefore, the waiter will neither have to work with a pen and notepad nor keep track of all the bills. Hence, the ordering and payment via CTS will get rid of the tedious "old-fashioned restaurant operation."
"They want what they want when they want it," and CTS will provide that for them.

References:
http://www.ece.rutgers.edu/~marsic/books/SE/projects/
http://restaurantengine.com/automate-your-restaurant/

Problem: Lack of Entertainment

When customers place orders, they are not told an estimate time as to when their food will arrive. Many parents with young children want their meal urgently because it is hard for them to control their children during the waiting process. During rush hour, many customers become bored because the waiting time for each customer is even greater.

Solution: Customer Table Screen (CTS)

After a customer successfully places an order the CTS will display at the top the estimated wait time. Under the estimated wait time will have the following options "Activities", "Add item", "View Offers", "View Tab", "Call Waiter/Waitress". The activities will consist of strictly open source games to prevent any legal issues, and also allow the developers to focus their attention on the other parts of the system. A source of open source games that can be ported to the software was found on Github. The games will be aimed at persons of all ages, to not only gauge the interest of children, but adults as well.

Source: https://github.com/leereilly/games

Problem: No Automated Method of Tracking Popular Menu Items

Management will typically have an "idea" or a sense of what items are popular. This method is not as robust or efficient as using Bubbies. Using a software system to keep track of the overall sales of items, and also ask for customer feedback.

Treatment: Customer Table Screen (CTS) - "Offers"

The "View Offers" button that displays after the customer places the order will go to another page, that will display all the restaurant's current offers. These offers will be able to be added and removed by the management. In addition to these offers, there will be a survey option, that will provide the customer with a determined reward. This reward can be determined by management, such as a free item, or a percentage discount off of the next meal. The survey's goal is to help the management as much as possible, and also not be to overbearing on the customer's time.

Problem: Inefficient Inventory Tracking

A common system to check if a certain item is out of stock is simply a board which is hung in the kitchen. This board is manually updated by an employee once the item has diminished. A bartender from *Barca City & Cafe Bar* explains that employees "constantly have to refer to the board during service", so it can be tedious checking on a usually empty board while assisting customers. Another downfall to this system is that since the board is manually updated, it consumes an employee's time from doing a more beneficial task. Furthermore, there is no warning given to employees that the inventory is running low. This can leave a customer unsatisfied since they would believe the dish they ordered is readily available, but would be forced to order another item due to an ingredient shortage.

Solution: Create an Inventory System for Optimal Inventory Checking

Our inventory system will be an upgrade from the outdated "hanging board" method. Once a chef realizes that their inventory is running low, they can put in a request through the system to inform the manager that it needs to be restocked. This would also lead to a notification which would appear on all applicable screens that the item used in the respective dish is no longer available to order. Hence, avoiding the unfortunate situation of explaining to a customer that they must choose another selection from the menu. For many groups who have done this project in the past, it seems that the only people who can see inventory alerts are chefs and managers. However, we believe that waiters should also be aware since they are in direct contact with customers. We have also made the decision to display the alert when inventory is low instead of when it is empty because managers would need prior warning when ordering more items. Since this solution is fully automated, workers can focus more on assisting customers instead of crowding around a board in the kitchen. Waiters will not have to worry about traveling to the kitchen as often since all the information they need is on one screen.

Problem: Complicated System for Managing Clerical Tasks

In a restaurant, it is important to prioritize time. In order to increase, say, time spent with important money making decisions and training employees, it is optimal for the manager to reduce time spent sorting paperwork and other data. Also, the managerial position is both psychologically and physically exhausting, as the manager may have to substitute as front of the house and keep track of employees during inopportune times. When a manager cannot prioritize and keep task organized, not only will time be wasted on simple tasks, but other larger issues will be left to become noticeable by customers, thereby risking the business.

Solution: Implement a PIN Number for Each Employee, and Create a "Manager Portal"

One of the largest concerns for the manager is managing the restaurant's employees. By implementing a simple punch in program for employees, the manager would be able to see updated time tables of who is on table, kitchen, and waiting duty. Also, a reliable schedule editor can be implemented in order to manage shifts when staff must take sick or vacation leave. All hours will be kept in check and quantized into payroll data that can also be analyzed at the click of a button. If certain employees have been shirking their duties, their behavior will be more easily monitored from visuals provided by the program. Also, instead of spending hours analyzing menu item popularity from table checks, all information on popular items will be listed for the manager to easily see which items to promote and which items to replace or remove from the menu. All of the restaurant's revenue will also be collected and displayed to the manager. Furthermore, restaurant expenses will also be quantized and the manager will easily be able to identify what is selling and what is not. Calculations will be made by the program and also visualized for the manager to easily see if the monthly quota will be met. The program will also be able to accept sudden expenses from the manager and the previous data will be updated for the manager to analyze the current state of the restaurant. By using our program, the manager will save time by avoiding crunching numbers; more time will be spent tending to the restaurant's customers, the main source of income to the business.

Problem: Need for Increased Chef/Server Communication

As the waiter finishes taking the customer's orders on a notepad quickly, they have to physically walk to the kitchen and deliver it. In fact, the waiter also has to visit the kitchen to constantly check the status of the food being made by the chef. This process of going from and to the kitchen wastes a lot of time for the waiter. The continuous check ups on the food by the waiter also makes the chef overwhelmed and causes more confusion in the kitchen.

Solution: Notification Queue

Due to the installation of the CTS, waiters will no longer have to walk back and forth from the kitchen to notify the chef about the customers' orders. Customers will order autonomously with the CTS and the information will be sent directly to the chef through Bubbies**.** The chef will able to see the orders using his Kitchen Staff Screen (KSS). The chef's interaction with the waiter will decrease greatly and allow him to spend more time cooking meals for the customers. When dishes are ready, he can notify the waiter by sending a notification to their delivering queue, stating the name of the item and which table that ordered it. In order to help the waiter prioritize, they will have two queues available for them to look at. One queue is filtered and lists the items ordered by the tables that they are responsible for. The other queue will state all the items set for delivery. As the waiter has free time, they can assist their coworkers. When items are delivered they are removed from the queue by the chef after he has notified the waiter that the food is ready to be served.

Plan of Work

Team Description:

The team is comprised of seven individuals. The team is split into three sub-groups:

Group 1:

- Shehpar Sohail: HTML, C++, MATLAB, Github/Git
- Nathan Morgenstern: HTML, CSS, JS, Node.js, Github/Git, Raspberry Pi
- Fahd Humayun: C++, Java, Network Simulator (NS-2), 2D Animation, Graphic Design (Adobe: Illustrator, Photoshop, After Effects, Premier Pro)

Group 2:

- Ama Freeman: HTML, CSS, C++, Java, UI/Visuals
- Raphaelle Marcial: HTML, CSS, C++, MS Excel

Group 3:

- Alex Dewey: HTML, C++, UI Design
- Dwayne W Anthony: HTML, PHP, C++, JS, Python

How to Achieve the Proposed Goal

Bubbies' main screen will have options for Customer Welcome Screen (CWS), Customer Table Screen (CTS), Kitchen Staff Screen (KSS), and LOG IN (as manager or as waiter/cashier). The reason for these options is because there will be screens installed at different locations of the restaurant. For each location the specific option is chosen.

Fahd, Shehpar, and Nathan:

The goal for this group is to develop and design the Customer welcome screen (CWS) and the Customer Table Screen (CTS). These systems should be linked to the Kitchen and Management modules.

Ama and Raphaelle:

The goal of this group is to create a "manager portal" and inventory system in order to make many of the time consuming tasks of the restaurant manager much more efficient.

Alexander and Dwayne:

One of the large sections of the overall model requires the development of a software to be used by the workers as they perform their everyday responsibilities. The main, overarching goal of this portion of the software is to improve the productivity of employees and aid in their ability to serve the guests. There are quite a few problems that this software should be able to address in order to make the worker's tasks easier. Each workstation will have a screen to display various relevant information to the team members. These stations include the hostess station, waitress station, busboy station, and chef station.

Team Size Explanation

There are three categories for the project:

1. Customers

2. Management
3. Kitchen

Each group is assigned one category, which means that a minimum of two people would be working per category. Each category has the coding, the user interface, and the database. Therefore, two people of the group are sufficient enough to work on those parts of the category, because the groups have been divided according to the strength and expertise of each individual to keep the groups balanced.

Measurement of Success and Expressed Confidence in Solution

In order to test whether we have indeed saved time for the manager, we will compare average time a manager spends analyzing paperwork and manually setting shifts, to a manager using our software. We will emulate the manager ourselves and carefully take times for tasks such as shift table construction and expense calculation. We will also test for correctness in our software. Manual paperwork is extremely prone to human error, and while software is not immune from issues, there is a far less chance that it will cause complications. Careful comparison between those times, error percentages, and concise visuals will make it clear to the customer which to choose: continue manually filing paperwork or accept the help of a digital assistant. When testing the inventory system, we will observe how accurate the threshold is for low inventory. It is important that the system does not prematurely notify staff members of a shortage if there is actually a sufficient amount available. We will know that this method is a success because it will eliminate the hassle of having workers waste time running to the kitchen. All information will be easily accessible to them on various touch screens throughout the dining and restaurant area.

Relatability to Other Portions of Project Along with Individual Aspect

The manager position is an integral part of any business as they continuously troubleshoot conflicts while directing other workers in order to solve them. Therefore, it is essential to keep their job as simple as possible because they are the backbone of the business.

Independently, a manager has to perform activities such as data analysis and payroll calculations. These tasks are specific to the manager, and will be implemented in our "Manager Portal". However, managers must interact with every position for smooth operations. This is why we are adding the "chef's request for inventory" feature in our inventory system. The problem of low inventory is noticed by one person, and their request is directed towards the manager. This subsequently leads to the rest of the staff receiving the notification and allowing for a better flow of communication.

Customer Interaction with Bubbies

Bubbies will interact with customers via CWS and CTS.

Home screen for CWS will prompt the customer to input their name, contact #, and the party size. The information of customer will be saved in the database of the bubbies for bookkeeping of customer traffic e.g. the party size and the arrival time of the customers. Depending on the party size bubbies will analyze the floor map and check for available table, which is properly managed by the frequent checks of table status. The change table status is provided from the CWS, so, bubbies will transfer the information of the table status from the CTS to CWS. If the table is not available a message requesting the customer to wait is displayed on the CWS. Once the table is available the CWS will receive table status change from the CTS, and then bubbies will transfer the information to the screen in waiting area and notify the customer for the availability of table to be seated. Floor map will be displayed on the CWS. Using queue at the back-end of the bubbies is necessary as the first come first serve service is implemented at the restaurants so the first in first out behavior of the queue is perfect for this scenario.

Home screen for CTS will have options for placing an order, making changes to the order, payment, assistance, entertainment, log in (as waiter), and table status. Each of these options will have sub options e.g. for placing order bubbies will display the restaurant's menu with menu items broken down into categories like food, drinks, dessert, side orders etc. for the convenience of customer. Once the order is placed bubbies will transfer the information to the KSS. Similarly, a customer can make changes to their order by tapping on to the edit order icon of the CTS or call for assistance. By tapping on the make payment

icon the customer would be asked whether to make the payment via credit/debit card (which CTS will handle it) or make cash payments for which bubbies will notify the waiter's by the screen installed for the waiters. Bubbies will change the table status on the CTS to occupied once the customer starts placing an order, but, will be changed by the busboy to available once they are done setting up the table (the busboy will be notified by the screen installed (CSS) for setting up the table once the payment is complete at a specific table).
Information flow in bubbies is all linked i.e. from CTS to CWS, CTS to KSS, CTS to CSS, or vice versa. The bookkeeping i.e. of orders placed, and payments made etc. is frequently updated to the database.

Plan of Action for Managerial Processes

1. A central "hub" must be created for all elements of the "manager portal" to be combined. From this, a user interface will be displayed to the manager and they will be able to access their tasks from here.
    a. Multiple options in this field include, but are not limited to, employee scheduling, table availability, and expense chart. Since the manager must have access to all ongoings in the restaurant, aspects such as table monitoring and the menu will be implemented from the efforts of the other groups working on this project.
2. Algorithms will be implemented in the program to easily determine payroll and expenses in order for the manager to view the overall income of the establishment.
3. It is imperative to also include the inventory checking system. This will also be easily accessed in the portal.

Expected Project Duration:

Every group has a particular area of the restaurant to work on throughout the upcoming weeks.

Outline of Main Steps:

Our main goal is to create a software program that increases restaurant productivity by solving the problems we addressed above. This software should improve communication between the customer, kitchen, and management to better the coordination of activities throughout the restaurant.

Project URL:

https://github.com/ncm1/Bubbies

Individual Credentials:

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