PROJECT PROPOSAL

ChefBoyRD

Restaurant Automation

GROUP #6:
Richard Ahn
Zachary Blanco
Benjamin Chen
Jeffrey Huang
Jarod Morin
Seo Bo Shim
Brandon Smith

GITHUB:
https://github.com/ZacBlanco/ChefBoyRD

Team Profile:

Within this versatile developer team, each member has individual qualifications and strengths that he will demonstrate throughout the construction of this project.

Individual Qualification and Strengths:

Brandon Smith has exceptional skills in programming and documentation to guarantee that the code remains organized and coherent.

Zachary Blanco is an experienced full-time software engineer intern, technical content author and public speaker.

Seo Bo Shim brings forth analytical and organizational skills to the team, granting the team the ability to understand the difficulties of running a restaurant through personal experience.

Richard Ahn is a skilled programmer that creatively presents the analysis of problems and solutions to said problems.

Jarod Morin excels in exploring different problem cases and providing solutions with a flare of individuality.

Jeffrey Huang is skilled in programming that iterates through ideas by thinking of optimal ways to approach a problem and how to resolve them.

Ben Chen is skilled in writing documentation, coding, analysis and organization

Proposed Project Description:

Target Users:

This software is designed for use by the owner and restaurant staff of small to medium sized restaurants. In order to compete with large chain restaurant organizations, small business owners need to get an edge on their competition. By leveraging 21st century technology, these restaurant owners can increase efficiency in the day to day management of their restaurant. The technology can also cut down on wasteful actions by the management, which can increase profit margins. This isn't to say that large chain restaurants wouldn't be able to leverage our technology, but it is designed to cater to customers on a location-by-location basis. A large chain restaurant would need to implement this separately at each location in order for it to be most effective.

Problem Summary & Solution Overview:

General inefficiencies in several distinct aspects of the restaurant cause an overall reduction in productivity that needs to be addressed. The chefs utilize a predictive strategy for preparing dishes to minimize wait time between orders. The current procedure is effective, but results in a considerable amount of wasted food. It is desirable to refine the prediction method used, to provide the same reduction in wait time for customers in a way that is more food efficient. Other areas that can see an improvement in wait time is when dealing with table seating at high traffic. An improvement in reservations and table management, in terms of efficiency and information can remedy this issue. In addition, the management would like to hear suggestions and feedback from the customers. The restaurant's current approach is underutilized, offering only a small number of disorganized suggestions.

This restaurant automation application, ChefBoyRD, (ChefBoy Restaurant Development) is a software program that offers solutions to the specific problems mentioned. Relevant results generated by the program will be accessible by employees, e.g. chefs will have access to dish prediction, hosts and hostesses will see reservations. All of the program's functions can be centrally monitored by the manager.

Problem Diagnosis, Proposed Treatment, and Plan of Work

Subproblem A: Overproducing/Under-producing dishes
Subgroup: Richard and Zac
Description:

Restaurants are extremely turbulent in terms of the types of dishes made and the number of customers served. They also tend to have busy or slow hours. Due to this phenomena, chefs and managers end up needing to estimate how much food is required for each day. For this reason, chefs do not prepare the optimal amount of food each day; instead, he/she (or the manager) keeps track of when a certain number of customers are expected to arrive, and prepares a corresponding amount of food throughout the day. However, the estimation done by chefs or managers can prove to be subpar and inaccurate. Errors in the estimation can lead to a lack for foods for certain dishes or an overabundance of food, which leads to waste. According to the NRDC, approximately 40% of food gets wasted by producers and a major contributor to this number is restaurants[1]. A system that could help predict the amount of food consumed by customers could have a massive impact on the way a restaurant manages its food inventory and production. This can result in high cost savings, higher quality food for customers, and larger profit margins for the business.

Solution:

Instead of having a person keep track and analyze their historical records, we propose a prediction service that attempts to model as closely as possible the amount of ingredients that will be required for dishes throughout the day. This will be made possible by analyzing historical data of the restaurant orders based on the time of day, day of the week, etc.. allowing restaurant managers and chefs to gauge how much food will be needed on a particular day. The advantage of this methodology results in less food being wasted by restaurants and chefs. Furthermore, by being able to predict the amount of ingredients to be consumed at particular times, chefs can get a better idea for the amount of food they will need to prepare. By eliminating food waste and over preparation, restaurant owners can save money which can lead to higher paid staff, or invest the extra funds to find fresher ingredients leading to higher quality dishes. Another possible result of being able to predict the amount of food required on a single day is shorter waits for customers to receive their food. Typically, this results in happier customers. Being able to serve food faster can also lead to shorter times for whole parties, which can increase the customer throughput of a restaurant. Overall, this can lead to higher revenue streams and faster growth for the business. For small to medium size restaurants, this type of predictive service for chefs and food preparation can be the difference needed in order to expand and compete with more popular food venues.

Naturally, certain dishes are more popular than others are. Some are favored more at a certain time of day, or in a certain season, or even a certain day of the week. These trends are the basis for this prediction service. Using as much information as we can possibly gather, our solution will take a data-first approach towards predicting and analyzing the trends of food production in the kitchen. With these insights, managers can more easily gauge inventory status and bulk food orders. They can even use some of the insights to help plan schedules. The nature of the solution we propose to use will allow us to easily integrate into other aspects of the business as well.

This solution requires a tight integration with the data collected by all other aspects of the business. We will mainly use the point of sale system (POS) data from the restaurant. But, gathering other information such as days of local events, holidays, and more can increase the accuracy of our solution. Another great feature is that over time the system will be able to collect more data, essentially becoming smarter over time. So, a small investment into the software in the beginning will see a greater return on investment over the time that prediction service is used.

The customer will be able to use our solution through a series of interactive dashboards. They will provide the restaurant with historical analytics about the performance of the business. There will be a dashboard dedicated to the predictive models so that managers and chefs can see what business trends will look like for the current day or week. Think of it as being similar to a weather forecast. Due to the nature of the job, chefs will have a difficult time interacting with their device because they must manage multiple cooking tasks all at once and cannot be looking at their screen. Thus, the predictive service will also be available through voice interaction with Amazon Alexa compatible devices. This will allow the user to get brief updates via simple voice commands.

In order for the effectiveness of our solution to be evaluated, a manager can compare the amount of food that was being prepared before our predictive algorithm service was implemented to the amount of food that they typically prepared before. They can also compare the amount of food predicted to be used with the amount of food actually made week over week to not only have a quantitative measurement of our algorithm's accuracy but also to see how the algorithm improves its estimates over time. Overall, the manager can see the results of their investment by how much money is being saved in unused ingredients day over day. There is also inherent value in being able to visualize the business metrics such as overall revenue, customers serviced, and dishes ordered on a daily, weekly, or monthly basis that the management staff can use in order to make other critical business decisions such as hiring and location expansion.

Sources:

1. https://www.nrdc.org/issues/food-waste#priority-why-matters

Subproblem B: Gaining effective customer feedback and subsequent analysis
Subgroup: Ben, Seo Bo, and Jarod
Description:

A crucial part of any business is to receive feedback from the customers, so the business's products and services can be improved. In a restaurant, there are several ways for a customer to communicate their feedback to the business. The customer can speak to the management, speak to the restaurant staff, leave a written comment, or send an email. Also, some eateries have websites or QR codes on the receipt that allow a customer to submit anonymous surveys. This use of technology is needed to gather the feedback, which can subsequently be analyzed as a whole by management.

Many different solutions are implemented and constantly being optimized to increase the response rate of feedback. A key idea for optimizing user feedback is that customers may find it inconvenient to go through many steps to submit feedback. For example, there is a large difference in the effort required to talk to talk to a manager to communicate feedback, versus submitting an open-ended form after a meal. Our goal is to make the feedback process convenient and thus maximize the number of useful feedback responses from customers.

In addition to customers being able to conveniently submit feedback, analyzing all the feedback comments can be done efficiently if the feedback is stored in an organized manner. The bulk of the feedback must be streamlined, so that this data can be analyzed. For example, it is time-inefficient to manually read through each comment. Although it is important for restaurants to listen to each customer's feedback, it is inefficient if a manager has to look through comments that all appear the same and convey similar ideas. It would be convenient to separate general comments such as "the food was good", "service was a bit slow" from specific comments (comments about a specific employee, etc.).

A feedback system is necessary where:

- the feedback submission is convenient
- the feedback data can be organized
- precise analysis of feedback data is presented to the manager to help make decisions

Solution:

An in-store feedback system will be provided at the end of a meal after the check has been requested. A table-mounted tablet, already present in certain restaurants, is the expected device for providing these feedback opportunities. The customer will be asked to rate different aspects of their dining experience, including wait time, service, and food quality on a scale from one to five, with five being the best score and one being the worst. Any noteworthy scores such as fives or ones will result in optional follow-up questions asking if the customer would like to elaborate on their rating.The customer will also be given the opportunity to provide a more detailed typed response to conclude their feedback. The written responses are made optional in

order to discourage the customer from leaving the survey incomplete, or submitting unhelpful comments.

In addition, because the survey is completed in the restaurant at the end of the meal, the time of the submission is directly related to the service staff, dishes cooked, and wait time experienced by the customer at that time. Using the table number of the submission, the time of the survey, and employee shift records, the employees responsible for poor or exceptional performance can be identified.

In order to further encourage feedback submission, the user will be able to send a text-message to specified number to leave a comment. These open-ended comments submitted via text, along with the comments submitted from the mounted tablet, can then be analyzed to identify key terms that are useful for management. For example, separating unique comments from typical comments with negative or positive impressions from food or service.

This is a short example showing the use of our solution. A group of friends, Hank, Bill, and Bobby decide to eat dinner at their favorite restaurant, of which they are regulars at. They arrive, are seated, and throughout the meal the waiter asks them how their experience is. Hank is more outgoing and lets the waiter know that the food is excellent throughout the meal. The other two do not feel as strongly, or are not willing to share. Later at the end of the meal while the check is being processed, the waiter urges them to leave feedback via the tablet. Bill did not enjoy his meal, but he thought the service was good, so he decides to leave a mediocre rating with the tablet. Bobby is a bit more shy than the others, and doesn't leave feedback in the tablet, as he would like to describe his experience in detail. On his way home he decides use ChefBoyRD's text message service to leave feedback detailing the good and bad parts of his experience

This is to illustrate how the feedback responses could possibly be increased. They all have different personalities, and they respond differently to different mediums of communication. Allowing unique and convenient methods of feedback that appeal to different types of people will increase the number of responses. Feedback through the tablet and texting mediums are simpler to access and classify, while the current mediums (online surveys, suggestion box, face-to-face) of feedback submission are not centralized or particularly organized. Using ChefBoyRD, in-store feedback from only specific questions allows for simpler organization and analysis. Additionally, analysis of keywords and word usage from the open-ended text-in responses can be shown to the manager via a graph, or word cloud. This presents managers with a convenient way to gauge general customer satisfaction and quickly sort through more open-ended forms of feedback. This depth of feedback analysis is much greater than what is currently commonly used.

Subproblem C: Efficient table management
Subgroup: Jeffrey and Brandon
Description:

Typically, table management is broken down into three subsections, reservation of a table, seating customers in a timely fashion, and allocating tables by customer demands. Of these three subsections, seating customers in a timely fashion is the most important for restaurant business.

Before a customer would even arrive at the restaurant, a customer would want to make sure that they have a table ready for them to sit at upon the time of arrival. In order to guarantee their spot, customers would typically make a phone call or fill out an online form to make a reservation. An efficient and informative reservation system would make sure that the customer has their worries alleviated until they arrive at the restaurant. If a restaurant says that they reserved a table for a customer at a specified time and upon arrival, the customer finds that the table is not ready, the restaurant will potentially lose any future transactions with this customer. Most small to medium restaurants depend on a mouth-to-mouth advertisement to maintain their business.

There are customers who walk into the restaurant and expect to be seated and receive the services that the establishment provides. This means that the table management system would have to efficient in order for the host to provide a table for the recently arrived guests. If there is a non-reserved table available, the host will seat the customers and let the server start their routine. However, if there are no tables available, then the host will have to record the customer's name and the number of guests to be seated for a queue for seating. This would mean that smaller groups would be seated before a larger group and therefore often result in a frustrated group. Having a frustrated customer means that the customer could potentially leave the establishment to find a different location to acquire sustenance. Every restaurant depends on having customers, by losing out customers a restaurant will lose their potential revenue, therefore having a proper queuing system is essential to the restaurant business.

Hosts tend to have a difficult time keeping track of which table is occupied, which table is moved, and which table is available as the day progresses. A restaurant host normally works with a fixed diagram of which table is available and which table is not. This could potentially cause problems by having the host telling the customer that there is a table available and ready to be reserved when in reality that table has been moved to another location to accommodate a different group. This definitely poses a problem if a host tells the customer that the table is ready when there is no table there.

Solution:

The reservation systems implement a website or application-based form that allows the customer to input their time of arrival, number of guests, and seating preference. There should be a message that is sent from the customer to the restaurant to reserve that table a certain time

period depending on the time of arrival beforehand to prevent the lack of seating. After the server has successfully received the reservation from the customer, the restaurant will send a message back to the customer stating the table number, and if the reservation was made successfully. This confirmation message will also warn the customer that their table will be reserved for a specified amount of time depending of the demand of tables during that time period. This solution for the reservation system is more user friendly than current reservation systems because it allows the customers to select empty tables to reserve.

For customers that walk in, the customer will be put in a queue based on order of when they arrive. If a customer would like to be seated at specific location due to preference, the system should be overwritten by a manager or host that will inform the server that the seating arrangement has been changed. There is also the potential of creating sections of certain number of seats for that number of customers by moving multiple tables together. Individual customers should have seating at a common table or a bar-like area. Ideally, the number of seating options allows the restaurant to seat the most amount of people without being overcrowded (i.e.: Three people will seated at a table for four). Basically, seating is determined by the next available table that is either the equal to or one larger than the total number of guests to be seated. If there are no seats available then the program will initiate separate queues depending on group size. With the queues, a seating timer will be provided to give guests an idea of how long they will have to wait depending on how many people are there. For groups that do not fit at a standard table, multiple tables will have to be grouped together in order to accommodate them. This type of queue will speed up the number of people being seated on average. Smaller groups have a tendency to eat faster while larger groups tend to spend more time eating. As a result, the queue time for smaller groups is going to be faster than larger groups. This means that smaller group queue times will increase significantly since we put the preference of smaller groups over larger groups. However, if a large group is waiting, the solution will look for the best possible way to merge surrounding tables to accommodate large groups over smaller groups. This allows the customers to see an average wait time and their position in queue while waiting for their tables. This system is more friendly and intuitive for the customers because it allows them to visually see where they are located in terms of when they will be seated. Most restaurants gives you an estimated amount of time before the customers will get seated but they don’t allow customers to see how many people are ahead of them.

In order to allow the hosts to keep track of all the tables, the graphic user interface (GUI) on the restaurant end will allow tables to be moved from one location and another and merged with another table. This interface will automatically find a space that is available based on the required number of guests that needs seating. This interface will also keep track of how long a guest has been seated at this location or if the table is unoccupied, if the table is ready again to accommodate the next group of customers.

Functional Features:

- For customers: a convenient post-meal survey from that can be completed to provide restaurant feedback.
- For customers: a text-in system where customers can submit open-ended feedback
- For customers: can make reservations on a website, choosing seat, time of meal through a graphic interpretation of the restaurant layout.
- For host/hostess: Graphically visualize table seating integrated into reservation system.
- For host/hostess: automatically generate merged tables and relocation for large tables.
- For host/hostess: automatically seat customers by group size and allow overriding power to host/hostess.
- Employee Portal (Shift Management)
- Dashboards for manager/chef
    - View food order trends
    - See which specials and dishes have been most popular
    - Ingredient prediction each day
    - Financial spending/revenue
    - Manage inventory
    - View associations of customer feedback and staff members
    - Access individual anonymous customer feedback submissions that have been categorized
- Amazon Alexa Skill for brief reports on analytics and predictions.

Plan of work and Product Ownership

Plan of work

Task	Estimated Completion	Team
Customer Statement of Requirements (CSR)	2/3/17	ALL
System Requirements (REQ)	2/3/17	ALL
Functional Requirements Spec	2/10/17	ALL
UI	2/16/17	ALL
Interaction Diagrams	2/24/17	ALL
Class Diagram	3/4/17	ALL
System Architecture	3/10/17	ALL

Subproblem A team - Richard and Zac:

Over the next few weeks, we plan to accomplish:

1. Implementing a configurable dashboard interface
2. Algorithm analysis of predictive solutions
3. Connecting the voice service to our backend.

Subproblem B team - Ben, Seo Bo, and Jarod:

Over the next few weeks, we plan to accomplish:

1. Implement basic text-message receiving system
2. Brainstorm possible parsing algorithms to analyze received text messages.
3. Design GUI of how feedback analysis will be shown of managers
4. Design basic feedback form

Subproblem C team - Brandon, Jeffrey:

Over the next few weeks, we place to accomplish:

1. Design a basic reservation form and customers can leave the necessary information
2. Implement a basic text message notification system
3. Design a server database model to hold and return required information
4. Brainstorm possible seating algorithms to efficiently seat customers
5. Create a savable graphical interpretation based on restaurant.

Product Ownership

Each team will be responsible for the following features and qualitative property of the subproblem solutions. Throughout the course of the project, the following teams will implement the following functional features and qualitative properties of our project:

Subproblem A team - Richard and Zac:

- A simple easy-to-use interface to view the restaurant business trends
- A predictive service to determine the amount of food that will be needed on a given day.
- An interface to create custom dashboards with analytics based on manager preferences
- Voice commands to report to managers and chefs.

Subproblem B team - Ben, Seo Bo, and Jarod:

- A convenient post-meal survey that customers can complete to provide restaurant feedback.
- Feedback submissions remain confidential via each user being given a unique non-identifiable ID
- Customer receive a confirmation of feedback entry. (maybe include some of the organizing data that was parsed)
- Manager receives a summary and analysis of the feedback included
- Send out notification of action from management to customers who provided relevant feedback

Subproblem C team - Brandon, Jeffrey:

- An efficient and convenient system that allows customers to provide information and reserve a seat.
- Server notification that the table is now reserved as well as text/QR notification that the table is reserved for a guest.
- Manager/Host will receive seating confirmation and reserve the seating to prevent walk-in customers from taking the seat.
- Queueing of walk-in customers depends on the size of the group that comes in, basically table size demand queue.
- Designing a webpage for reservation systems, which implements a graphical interface that allows customers to reserve seating with the knowledge of where they are sitting.