Final Report

Abstract:
This report documents the solution design of the proposed improvement of in-store ordering process at Meet Fresh. An AI assistant is proposed to enable users to interact with a chatbot through speech, effortlessly check the menu, and conveniently place their orders. The AI assistant helps to enhance customer ordering experience by reducing waiting times during peak hours, providing voice interactions with customers, introducing product/ingredient for new customers, and offering personalized recommendations for both new and existing customers. This report includes five parts: customer problem and business case, user experience design, technical design, evaluation, and next iteration.

Outline:

- **Customer problem and business case**
  - Understand the business
    - users
    - store
    - decoration
    - location
    - menu
    - marketing
    - supply chain
  - Results of needs-finding: the pain points of the business and the user
    - Naturalistic Observation
    - Participant Observation
    - Interview
- **Summary of user experience design**
  - Solution design
    - A recommendation is not enough; we need to digitize the brick-mortar store
    - Start with: Voice version AI assistant (with third-party authorization)
      (Ex: LLM (ChatBot) + speech language processing)
  - **Benefits from AI assistance**
    - user engagement
    - product/menu optimization
    - marketing
    - supply chain
- **Summary of technical design**

- ○ Evaluation
    - ■ Offline evaluation
    - ■ User evaluation
- ● Next iteration based on technical analysis and user feedback

Customer Problem and Business Case

Through the expansion of Meet Fresh in the overseas market, the goal stays unchanged: bring delightful Meet Fresh products and experience to more customers around the world. Meet Fresh continues on its journey to meet and exceed customers' expectations on their products and experiences by using business strategies such as creative marketing and new time-limited products to keep the expectation high. However, problems will still arise.

Understanding the business

1. **Users:** Meet Fresh current users are mostly old Taiwanese and Asian family groups with some American users. We would like to spread the influence of Meet Fresh as we have collected data on a possible user group of young people who would also buy dessert within walking distance.
2. **Location:** Metro and rural stores have entirely different users, therefore different business strategies are needed for those stores. For example, store decoration, marketing strategies, menu, etc.
3. **Menu/product:** Unlike Asian users who know very well the ingredients and products Meet Fresh offers, American users have no idea what grass jelly or what taro balls. To them, Meet Fresh is just another milk tea store. We need a proper way to give users more information about the products and redesign the taste for American users.
4. **Marketing:** The American market is entirely different from the Asian market, and marketing strategies will also differ. We initially proposed a marketing system to help the business better understand the users.

To better understand the customer problem of the business, we use three need-finding methods, including naturalistic observation, participant observation, and interview to find the pain points of the business and the users. The results of need-finding are summarized as follows:

1. Low brand recognition
2. No knowledge of the product for American customers
3. Long waiting time during peak hour
4. Lack of interactions/recommendations during order process
5. No waiting areas for takeout customers, who also sit in the dining area while waiting for their order, making it crowded and hard to find a table to dine in

6. Long line for ordering during peak hours
7. Should provide delivery, and business hours should be increasing at night and in summer
8. Low in seating
9. Hygiene problem

We would like to focus on the problem regarding order process and aim to design an AI assistant with a voice interaction order system that can make improvement in the following aspects:

1. An alternative order option to reduce waiting time during peak hours.
2. The order system supports a voice version chatbot to enhance interaction with customers.
3. The order system is able to read from and write to the customer database. It automatically updates or adds new customer or order information to the database, and also generates personalized recommendations based on each user's order history.

Summary of User Experience Design

(QR code web → AI chatbot)

Main components of the AI chatbot:

- Customer information
  - Name
  - Phone number
  - Food allergy
  - Purchase history

Figure 1. Overview of UX Design

The figure above shows how to access our AI assistant at a kiosk. Customers can place an order following instructions and touching the screen only. Alternatively, the option of voice ordering is available by touching the chatbot icon at the top right. Main advantages of the AI assistant are as follows:

- Save time in the ordering process, especially for customers who already know what to order. To order via a kiosk, customers need to choose the category first and pick the items they want under the category. There is no search functionality, which could be added in future iterations to enhance user convenience. The AI assistant also supports a 'Repeat Order' feature for returning customers who want to reorder their usual items quickly. These enhancements aim to provide a more seamless and efficient ordering process, reducing time spent and improving overall customer satisfaction.

- **Figure 2. Overview of AI Assistant Workflow**
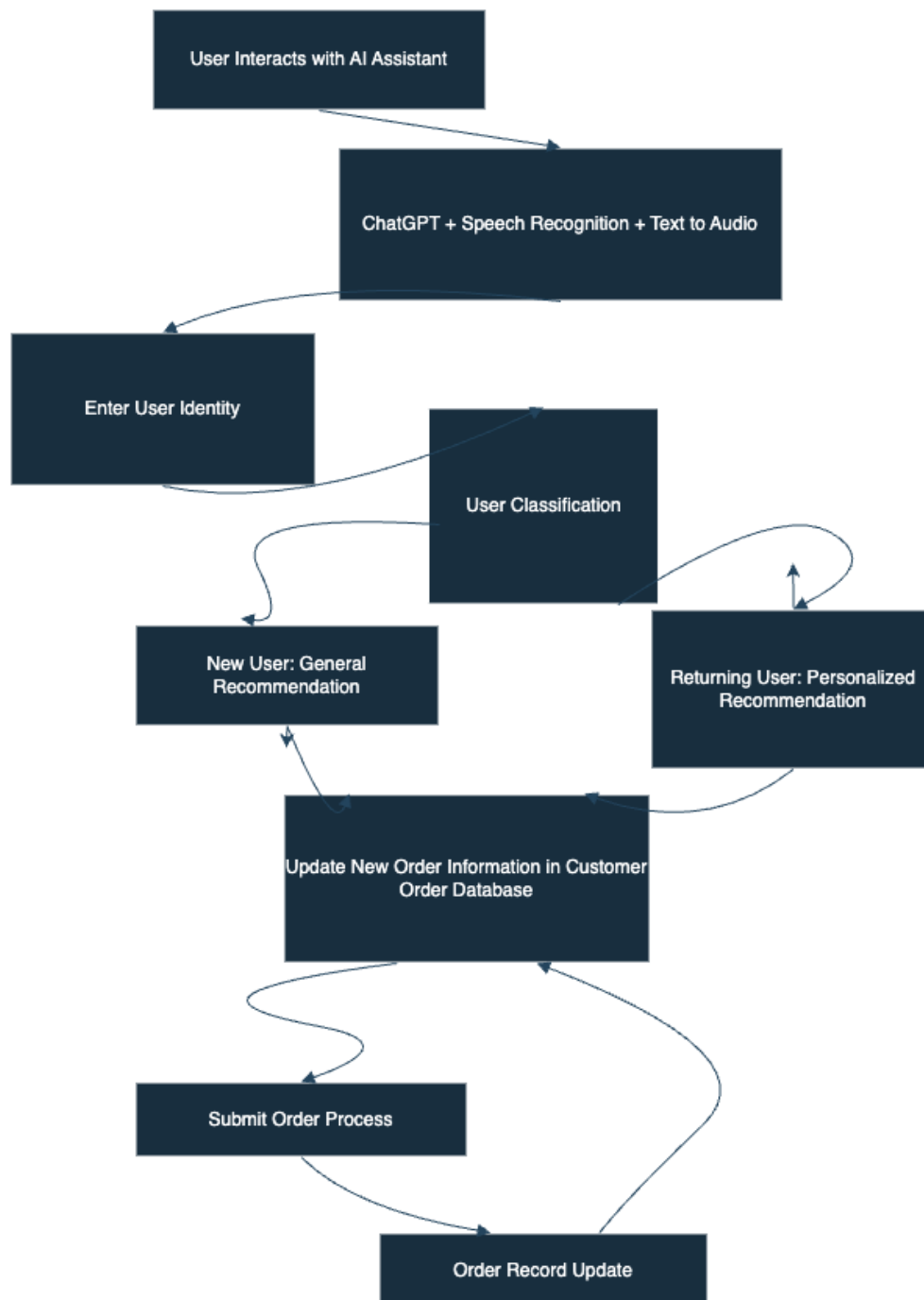
Solution Design:

1. **User Interaction:**
   - The AI assistant is deployed as a kiosk, where customers can interact with it in a self-service manner.
   - The customer can engage with the AI assistant through voice interactions, allowing for a natural and intuitive user experience.
2. **Voice Recognition and Chatbot Backend (decision making):**
   - The AI assistant utilizes speech recognition technology to understand and process customer queries and commands.

- The backend of the AI assistant is powered by a chatbot, which employs natural language processing (NLP) techniques to interpret and respond to customer inputs.

3. **Customer Record Database:**
   - The AI assistant is connected to a customer record database that stores customer information and order history.
   - When a customer interacts with the AI assistant, they may be asked to provide their name and phone number as identification.
   - The AI assistant then checks the customer record database to determine if the customer is new or existing.

4. **New Customer Interaction:**
   - If the customer is new and no existing record is found in the database, the AI assistant establishes a new customer record for them.
   - The assistant can provide general recommendations for popular or recommended items from the dessert and drink menu.
   - The AI assistant can also offer assistance by providing information about the available options, ingredients, or special offers.

5. **Existing Customer Interaction:**
   - If the customer is recognized as an existing customer based on their record in the database, the AI assistant retrieves their historical order information.
   - Based on the customer's order history, preferences, or dietary restrictions, the AI assistant provides personalized recommendations tailored to their taste.
   - The assistant can suggest new items they might like or remind them of their previous favorites.

6. **Order Management:**
   - After the customer has made their selection, the AI assistant facilitates the ordering process by capturing the chosen items.
   - The assistant communicates the order details to the backend system or point-of-sale (POS) system for further processing.
   - Once the order is completed, the AI assistant updates the customer's record in the database, including the new order information.

Who can benefit from the system:

1. **Business Owner:**
   - Save labor cost.
   - The purpose of AI assistance is to identify and predict the best products according to each user's personal taste, thus shortening custo

mer's selection time, promoting sales efficiency, and increasing overall revenue for the business.

2. **Inventory Management:**
   - By analyzing customer data and purchase history, an AI system can help identify which products are popular and which ones are not selling as well. This can help store managers make better decisions about which products to stock and how much inventory to keep on hand.

3. **Sales Forecasting:**
   - An AI system can also help with sales forecasting by analyzing historical sales data and identifying patterns and trends. This information can be used to make more accurate sales projections and plan for future inventory needs.

4. **Marketing Strategy:**
   - The data collected by the AI system can also be used to inform marketing strategies or advertisements. For example, if the system identifies that certain products are popular among certain customer segments the business can tailor its promotional campaigns to target those segments more effectively. For instance, if younger customers tend to prefer certain dessert items, the system can suggest offering targeted promotions or discounts via social media or in-store advertising to attract this demographic. Additionally, the AI system can help identify seasonal trends and preferences, enabling the business to adjust its product offerings and marketing messages dynamically to maximize engagement and sales. This data-driven approach to marketing ensures that campaigns are more relevant and impactful, leading to higher customer retention and acquisition rates.

Customer Loyalty:

By providing personalized recommendations and improving the overall shopping experience, a recommendation system can help build customer loyalty. Satisfied customers are more likely to return to your store and make repeat purchases, which can help increase revenue over time.

Attracting New Users:

As long as the main customers are native Chinese speakers, we may expect the new immigrants or students from native Chinese-speaking areas to be the customers of Meetfresh. A general recommendation system may track and advertise these potential new users.

Summary of Technical Design:

The primary objective of our application is to develop a seamless and intuitive voice ordering system for Meetfresh. By harnessing the power of cutting-edge technologies, we aim to enhance the overall customer experience by enabling users to interact with a chatbot through speech, effortlessly check the menu, and conveniently place their orders.

To enable voice interactions, we have devised a multi-faceted technical design that revolves around three essential components. The first component involves accessing the local microphone, which posed a challenge in the Google Colab environment. To overcome this limitation, we ingeniously implemented JavaScript code within an HTML page, which was seamlessly integrated into the notebook. This workaround allows us to record audio from the user's microphone and utilize it for further processing.

The second component of our technical design revolves around speech recognition. To convert the recorded audio into text, we employed the SpeechRecognition library, a versatile tool that integrates seamlessly with our system. Leveraging the power of the Google Speech Recognition API, we were able to accurately transcribe the user's spoken commands, thereby bridging the gap between voice and text-based interactions.

Lastly, the third component harnesses the capabilities of the OpenAI API, specifically utilizing the 'gpt-3.5-turbo' model. This powerful language model empowers our application with sophisticated text-to-text chatbot functionality. By leveraging the immense language understanding and generation capabilities of GPT-3.5 Turbo, our chatbot can interpret user queries, provide insightful responses, and even handle the intricacies of order placement. This natural language processing (NLP) component enables the AI assistant to handle diverse customer interactions seamlessly. It can process natural language input to understand customer requests accurately, whether they are asking about ingredient details, making special requests for their order, or inquiring about ongoing promotions. The model's flexibility allows it to be fine-tuned with domain-specific data, ensuring that it responds appropriately to the context of a dessert shop. Furthermore, the integration of this NLP component facilitates a dynamic conversation flow that can guide customers through the ordering process, provide personalized recommendations, and manage customer feedback effectively. Future iterations will focus on enhancing the contextual understanding of the model to handle more nuanced interactions and provide an even more engaging and helpful customer experience.

In conclusion, our technical design focuses on integrating local microphone access, speech recognition, and OpenAI's powerful 'gpt-3.5-turbo' model to develop a user-friendly voice ordering system. By leveraging these technologies, we aim to rev

olutionize the way customers interact with Meetfresh, ultimately enhancing their overall dining experience and streamlining the ordering process.

Evaluation:

Offline Evaluation

Offline evaluation is a method that allows you to test and assess the effectiveness of the Personalizer Service without changing your code or affecting user experience. Offline evaluation uses past data, sent from your application to the Rank and Reward APIs, to compare how different ranks have performed.

1. Make sure the AI bot is working properly for different accents, surrounding noise, and light conditions etc.
2. Get recorded cashier data to test and refine the model.
    - Functionality
    - Compared to humans, does the machine complete the job more efficiently?
    - Reactions to different customer (attitude)
    - Answer the questions correctly

- **Offline Evaluation**: Tests the system with real user data, checking for efficiency, accuracy in handling customer queries, and overall task completion.
- **User Evaluation**: Measures key performance indicators (KPIs) such as user satisfaction, revenue increase, and labor cost savings to assess the system's impact.

User evaluation of the solution and business value

Experiment Design:

1. Functionality for online users, follow the user experience/route to see if there's any bug, monitor the drop-off rate and the funnel.
2. **Causal Inference:** To test if the changes caused by the new AI bot. with KPI below:
    - Number of users
    - Accomplish rate
    - Revenue
    - Participation rate
    - User satisfaction/NPS
    - Retention
    - User engagement
    - Labor save
    - Cost save

○ Efficiency improvement from ordering to giving the food to users

Next Iteration Based on Technical Analysis and User Feedback:

Based on the technical analysis, the next iteration of the application's design will focus on addressing the following key points:

Improving the audio recording process:

The current implementation for audio recording has been identified as messy, primarily due to limitations within the Google Colab environment. To overcome this challenge, the development team will explore alternative online cloud platforms that offer more user-friendly and efficient solutions for audio recording. This change aims to streamline the recording process and enhance the overall user experience. The next version will focus on improving the audio recording process, which was challenging in the current setup.

Enhancing product information:

Currently, the product information, including details such as food nutrition and allergy information, is stored within the prompt. However, it has been identified that this approach has limitations. In the next iteration, the team plans to create an external database specifically dedicated to storing all relevant information related to the food products. By utilizing this external database, the application's prompt can access and retrieve comprehensive product information, enriching the user's experience and providing them with detailed insights about the menu offerings. An external database will be created to store detailed product information, improving the chatbot's ability to answer customer questions about menu items.

Support for multiple languages:

The current version of the application only supports English-English conversations. However, recognizing the diverse customer base, with many customers speaking Chinese or other Asian languages, it has become evident that incorporating support for multiple languages is crucial. In the upcoming iteration, the team will prioritize the implementation of multi-language support, enabling the chatbot to handle customer interactions in various languages such as Mandarin, Cantonese, Spanish, and more. This will involve integrating language translation APIs and leveraging multilingual natural language processing models capable of understanding and generating responses in different languages. Additionally, the user interface will be adapted to support these languages, allowing customers to select their preferred language at the beginning of their interaction. The system will also account for cultural differences in customer preferences and responses, ensuring a more personalized

and comfortable user experience for all customers. The integration of multiple languages aims to make the AI assistant more accessible and user-friendly for a diverse customer base, thereby enhancing customer satisfaction and loyalty. Expanding language capabilities to meet the needs of non-English-speaking customers.