

COMP3074-HAI - Coursework 2: Voiceflow Prototype

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(1989 words)

Introduction

This is the second coursework of the module COMP3074 Human-AI Interaction on the topic of designing and building a task-driven conversational app. To meet the requirements of this coursework, I have designed a Voiceflow-based prototype 'SUPERFOOD' that supports food home delivery ordering. In this report, the design of the prototype, following the user-centred design process, is comprehensively delivered, including, explanations of relevant VUI design principles, followed by a description of advanced features. Lastly, self-reflective writing, as well as future directions, is presented.

Project Workspace: PY_Feng **Project Name:** HAI(COPY)
Username: Tony **Password:** 1234

Prototype Development with User-Centred Design Process

In this coursework, I have designed a task-driven prototype to support food delivery task. In addition to the main functionality, the prototype also supports user management and small talk. The development of the prototype follows the user-centred design process, which is further illustrated below.

Specifying the context of use

Currently, with the advancement of online purchase, consumers tend to buy everything delivered to their doorstep, especially during the busy period. The prototype aims to provide a solution to an interactive voice-based food delivery application. With the use of this application, people are allowed to follow the audio guidance and give corresponding voice commands to order ready-to-eat food combos online without off-line 'pick up'.

Specifying requirements

- The application provides the SUPERFOOD food delivery service.
- The application allows users to query menu information.
- The application allows users to add, remove and review meals that they have just ordered.
- The application allows users to make an online payment.
- The application allows multi-user management, such as record and update personal information.
- The application allows users to query their process.
- The application allows users to make a confirmation towards a specific decision.
- The application can be deployed on devices that support Alexa or Google Assistant.
- The application is voice-enabled to allow users to interact with.
- The application should be accessible to targeted users.
- The application should be discoverable and intuitive in terms of its functionalities.
- The application should be maintainable for long-term use.
- The application should be extensible for future directions.
- The application should be robust, especially when interacting with external resources.

Creating design solutions

The flow chart below shows the overall step-by-step workflow of the home food delivery service. As can be seen from the figure, the solid lines represent the main procedure that user must go through to purchase food delivery service, which is the core task of the prototype, while the dashed lines lead to the optional steps.

Specifically, to access this application, the user is expected to log in to the account in the first place. For new users, account registration is required. After signing in, the user is expected to make voice commands to 1) purchase food home delivery service, including ordering combo meals, confirming the order and making a payment; 2) manage his/her personal account, such as upgrading and reviewing relevant user information.

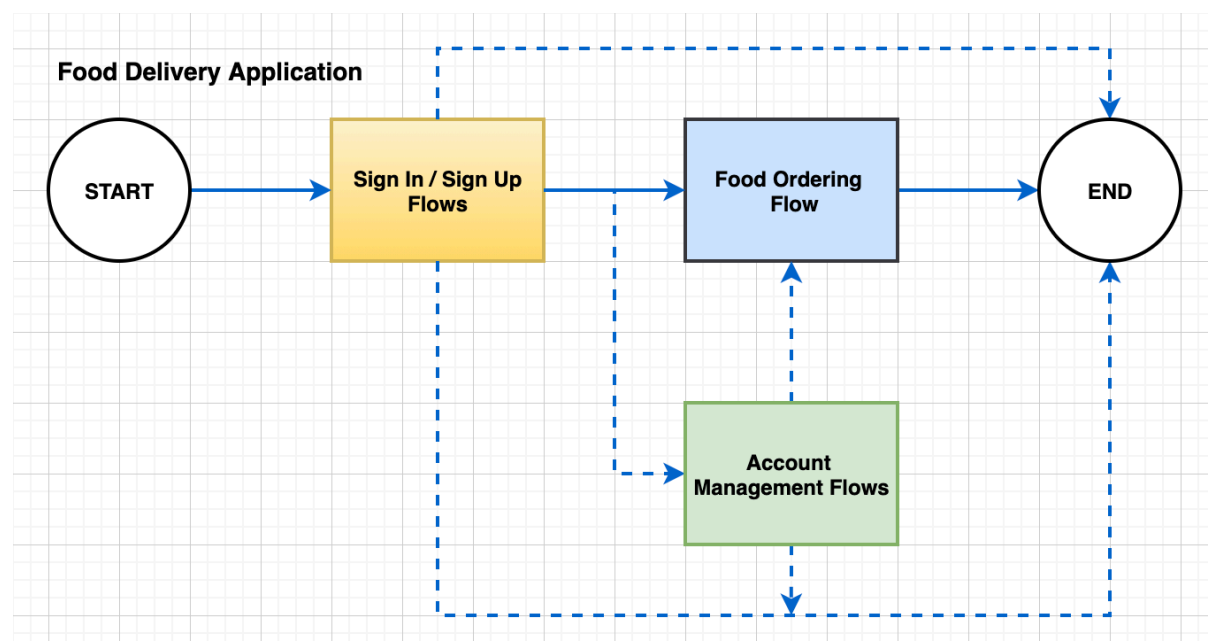


Figure 1 Main Workflow of the Food Delivery Application

Here, different intent blocks associated with 'Food Ordering Flow' and 'Account Management Flow' are created so that those flows could be non-linearly activated. The design solutions will be presented as follows:

1) Sign In/Sign Up

'Sign In' and 'Sign Up' flows are set to be in the initial stage. Registration is a compulsory step for new customers to access this application. This process requires users to create four types of basic information: username, password, the default phone number and home address. Firstly, the user needs to create a username followed by a confirmation prompt from the application. Once the username is decided, the user will not be able to change it. Then, the user is required to enter his/her own password twice to confirm the password. After that, the default phone number and home address are stored into the user database.

For old customers, they just need to log in to their account before food ordering. In this process, the system will automatically check whether the username and password entered by the user match the data in the user database. If the login is successful, the system will lead the user to the next stage. Otherwise, the system will ask the user to log in again.

The 'Sign In' and 'Sign Up' flows are not completely independent in this application. after registration, the system will automatically move to the 'Sign In' flow. Besides, if login is failed, the system will

provide another option for the user to move to 'Sign Up' flow, because the user may not register in the very beginning but accidentally step into the 'Sign In' flow.

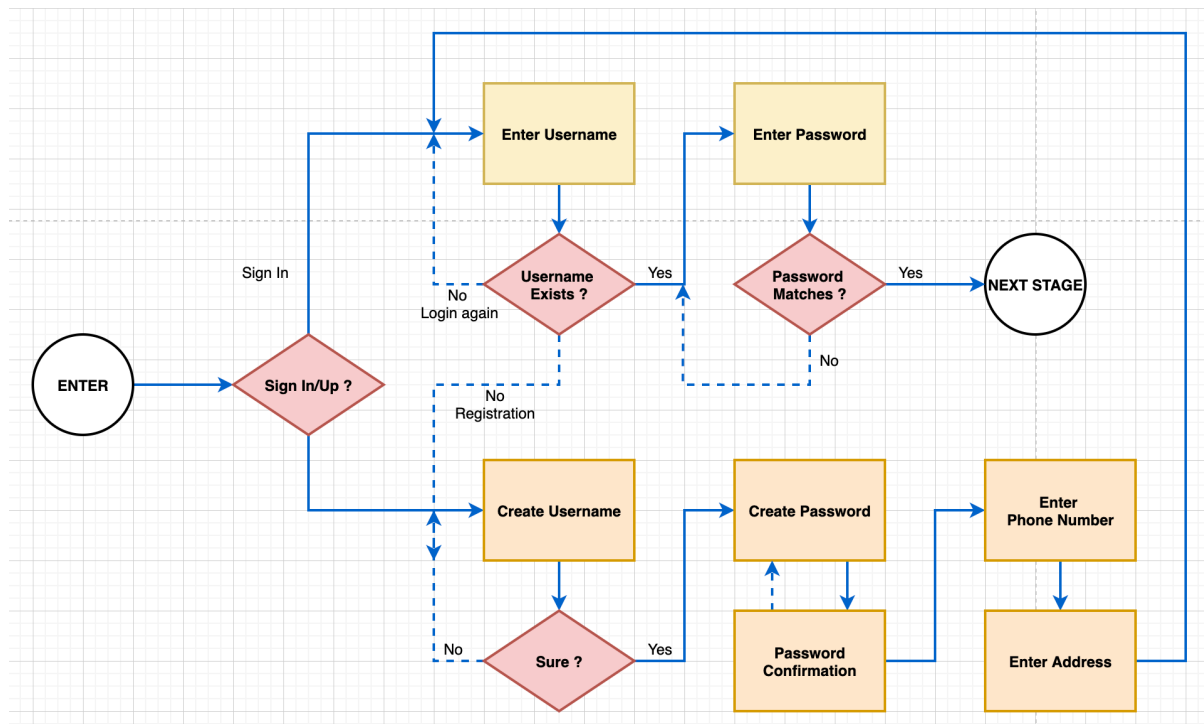


Figure 2 Sign in/Sign up Workflow

2) Task Selection

The flow chart below indicates the task selection process. Initially, a speaking block guides the user to query for more information or move to the next step. If the system cannot catch the intents, the user is supposed to repeat the commands. Also, the user will go back to the speaking block and give the next voice command after finishing the 'Account Management' part.

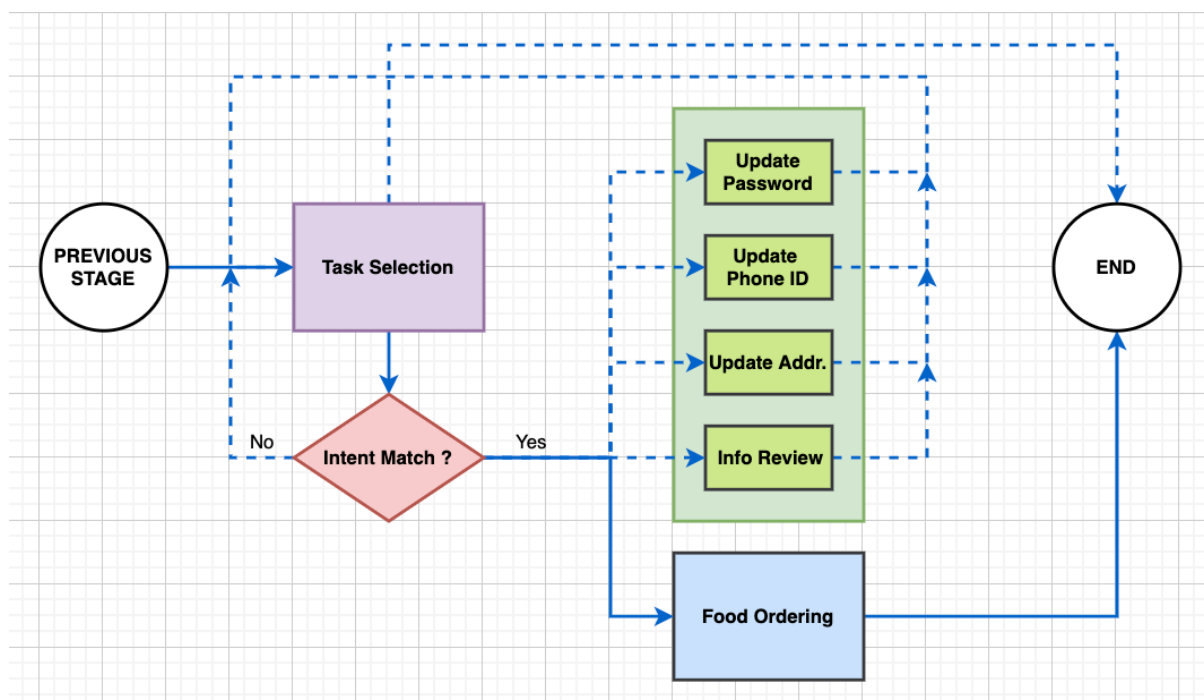


Figure 3 Task Selection Process

What should be clarified here is that there is no 'Account Management' flow. It is multiple relevant flows that consist of the 'Account Management' part. Specifically, 'Account Management' part includes 'Update Password' flow, 'Update Phone Number' flow, 'Update Address' flow, 'Information Review' flow. Those flows are in parallel with 'Food Ordering' flow, indicating that the user is allowed to freely step into those flows by triggering corresponding intents in a non-linear manner.

The user database plays an important role in the 'Account Management' part. Through the voice interaction with the system, the user is able to modify or update their personal information. Additionally, the system allows the customer to review the relevant information. Since the 'Account Management' is not the main functionality of the system, instead of directly ending the session, a loop that recovers the user status is designed to let the user order meals.

3) Food Ordering

The 'Food Ordering' flow leads the user to order meals and make an online payment. Initially, the system will show the whole menu to the user. Then, the system will ask whether the user is vegan or not. If the user is a vegan, the system will recommend vegetarian combos, which is combo-meal E and G in our menu. Otherwise, the user will move to the next step, where the system will show the user today's special set menu at a discount. The 'intent trigger' is a speaking block that asks what the user's next command. From the chart below, there are five intents in total.

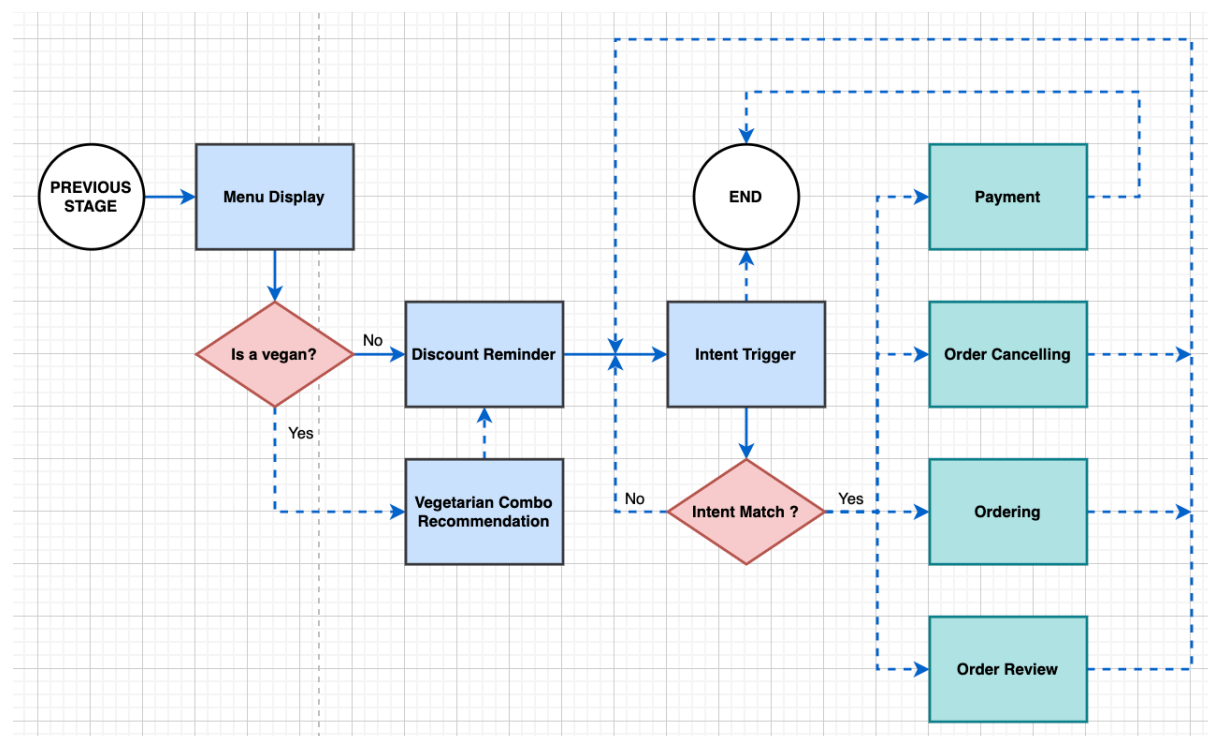


Figure 4 Food Ordering Workflow

'Menu Showing' flow allows the user to revisit the food menu, while the 'Order Review' flow provides the current ordering list and the total cost. 'Ordering' flow simply requires the user to say which set menu he/she would like to order and update the order list. The system will repeat the set menu that the user selected in order to make a confirmation. If the user has ordered a special combo-meals, the cost of that set menu will be discounted. Also, a confirmation message, which is omitted from the graph, will be prompted after triggering the 'Order Cancelling' flow. The four flows mentioned above will take the user to the 'intent trigger' waiting for the next user input.

Compared to the flows mentioned above, the 'payment' flow is more complicated. Similar to 'Order Cancelling' flow, the system will first check whether the user has made an order or not. The user will go back to 'Intent Trigger' if no order has been made. Otherwise, the system will report what is included in the order list and the total money to be paid. Here, the process of online payment is omitted because it is not in our scope of this task. If this total expense is more than 20\$, the system will add 100 credit points in the user's account. Lastly, if the user has obtained 500 points after this consumption, the user could use these bonus points to exchange a random dessert.

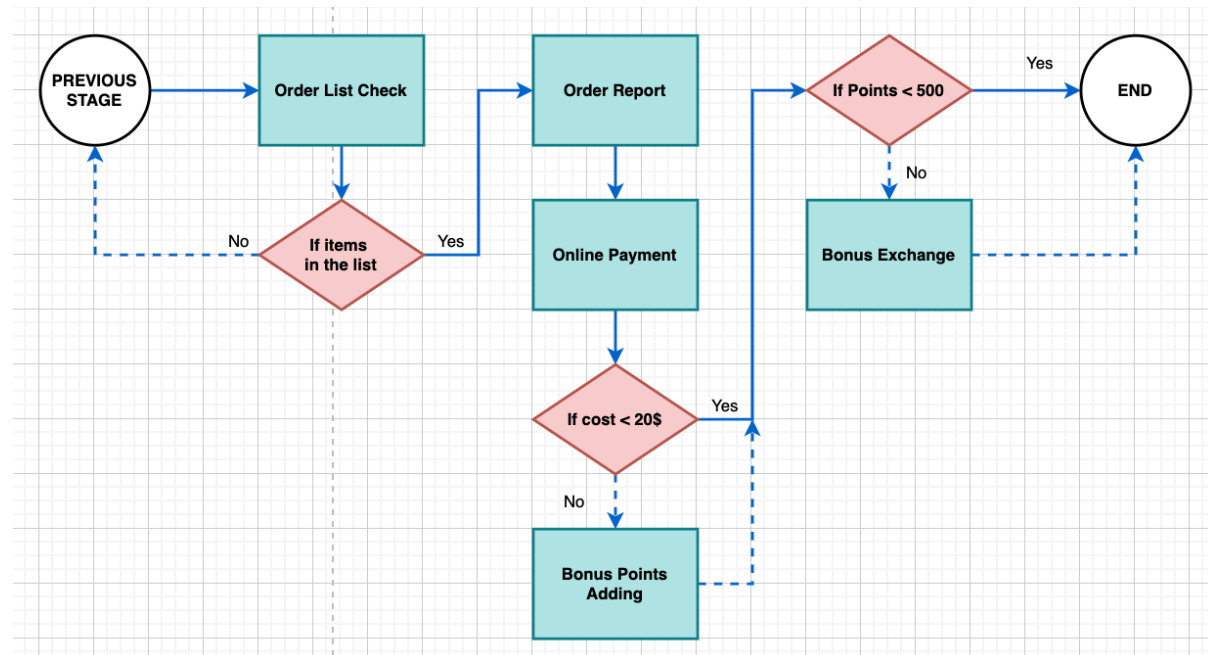


Figure 5 Online Payment Workflow

Design Evaluation

The evaluation of the design has been implemented through different approaches. Here, I will list all the evaluation approaches. And the results will be discussed in the conclusion of this report.

1) Unit Testing/Early-stage Testing

When developing the prototype, I performed unit testing to ensure individual blocks to work as expected, including variable updating, if-else statement, intent activating, etc. I observed the performance via testing console on the right side of the web page to solve problems in the early stage.

2) Integration Testing

The combination of the units should be compatible. After each unit was tested, I tested integrated flows to see the performance of the specific task, such as ordering, user management, etc.

3) System Testing

After the whole integration, the application is tested thoroughly, hoping to find and solve problems from the end-to-user perspective. For example, the context should be unchanged when moving from one flow to another. Also, non-linear intent activation should be effective.

4) Usability Testing

To ensure the usability of the application, I invited several friends to test the whole system and improve the system based on their feedback. Typically, the user-system dialogue helped me review the functions, making sure they are intuitive to use.



Implementation with VUI Design Principles

The development of the prototype has adhered to VUI principles. In this section, how these design principles are revealed in my design will be illustrated with some typical sample dialogs. A more integral user-system dialog will be displayed in the Appendix.

Prompt Design

1) Timelines

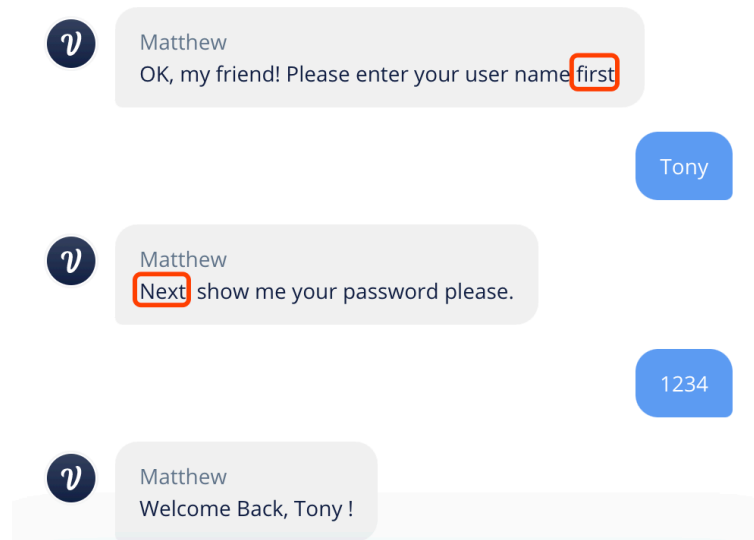


Figure 6 Timelines are shown when the user is signing into the account

2) Acknowledgements

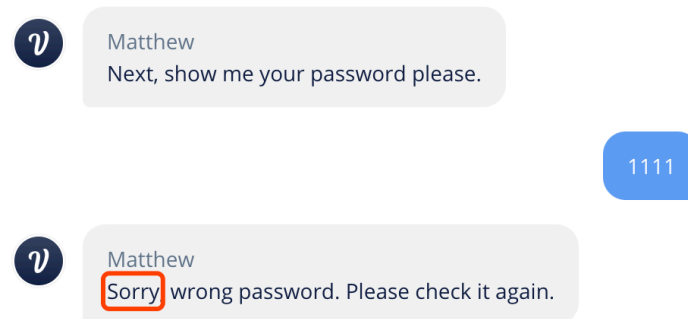


Figure 7 Incorrect Password

3) Positive Feedback

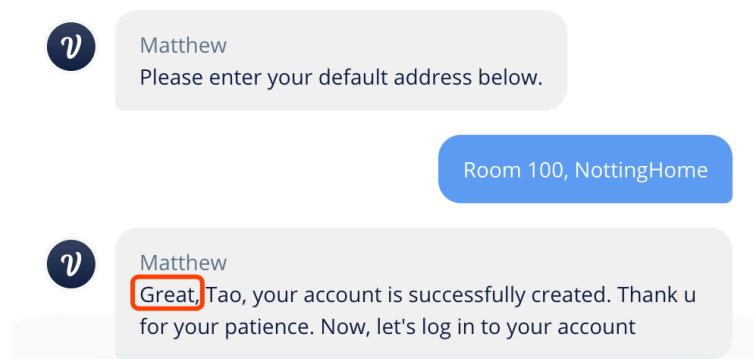


Figure 8 Account is created with a positive feedback

4) Greetings

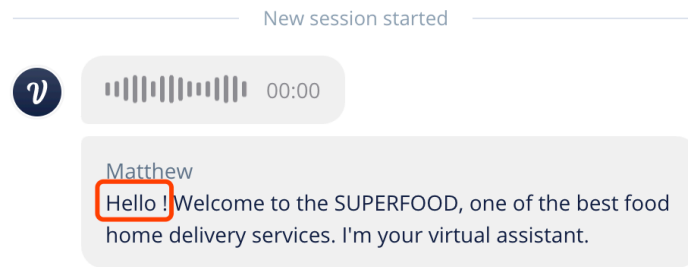


Figure 9 System starts with a greeting expression.

Discoverability

1) Automatic Strategy

Automatic Strategy is adopted to reduce 'turns' between the user and the system. I try to make the questions stick to the point when designing requests. Typically, some key words and phrases relevant to the task may be of great help in initiating the interaction.

2) Response Design

Response design is considered to improve the user experience. For example, the system can say what goes wrong in user registration; the system can prompt what is not understandable when the user gives commands; the system can provide options to guide the user to trigger intents.

Error Handling

1) Asking for repeat

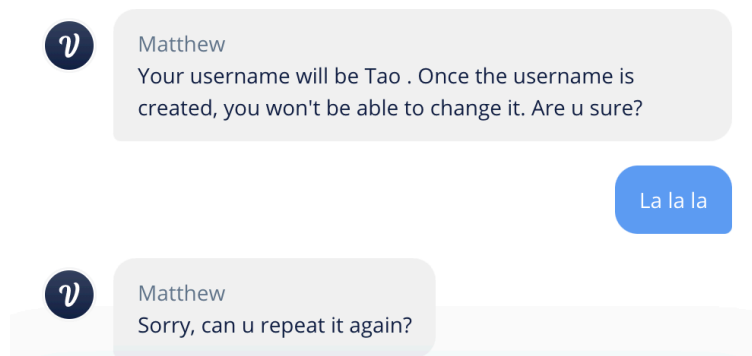


Figure 10 The system will ask the user to repeat if the previous answer is ambiguous.

2) Prompt with expected answers

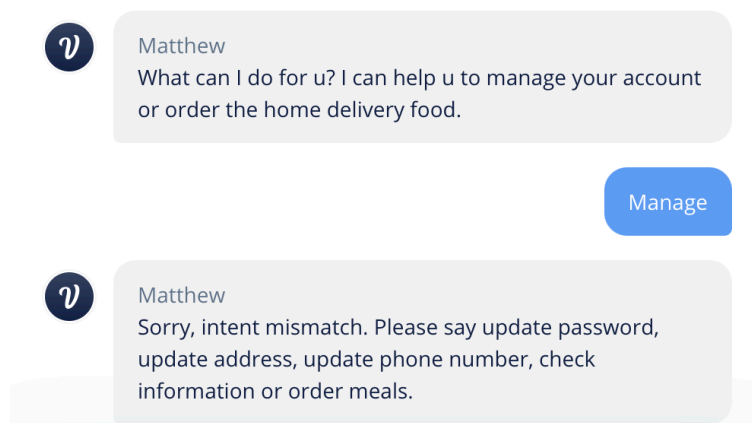


Figure 11 If the system cannot find the intent, the system will report an error with expected input.

3) Remedial Measures

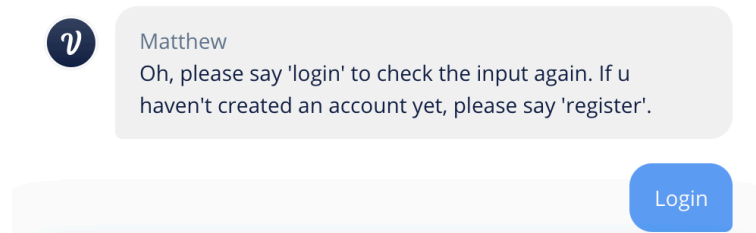


Figure 12 If the user accidentally steps into the Login session without registration, the system will take actions to lead the user to registration step.

Disambiguation

1) Request for Accurate Input

Expressions with “Slot” may result in low recognition performance in some cases. Using “Capture” blocks could obtain more accurate input from the user, e.g. entering username, password. Besides, the system will avoid asking general questions to receive more specific response.

2) Disambiguation with Options

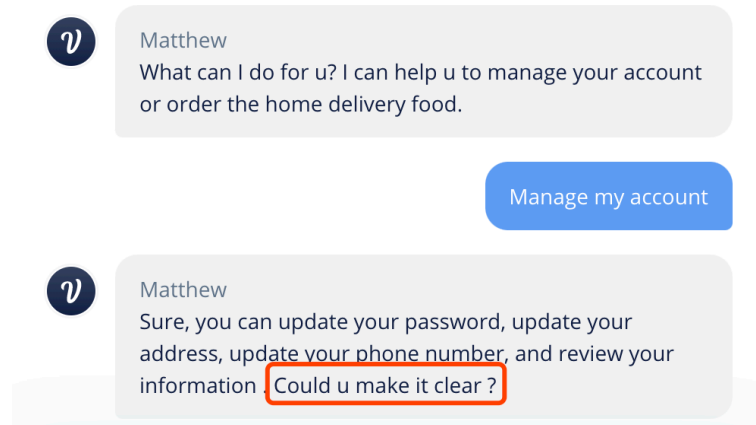


Figure 13 “Manage my account” is ambiguous in our case, so the system provides more specific options.

Confirmation

1) Explicit Confirmation

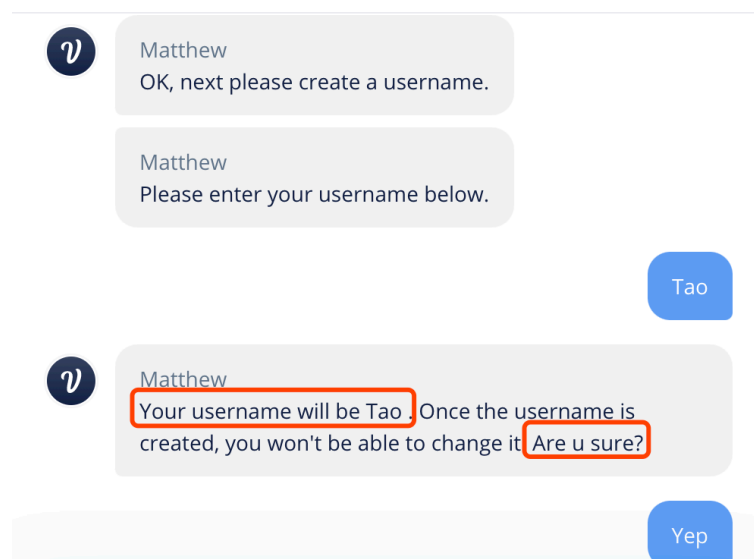


Figure 14 The system confirms the username with a further check when registration.



2) Implicit Confirmation

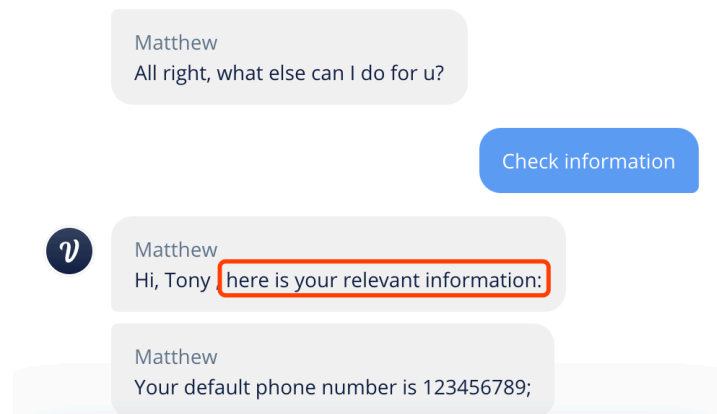


Figure 15 When requesting for personal information, the system shows the supposed answer.

Personalisation

1) Delivery Service

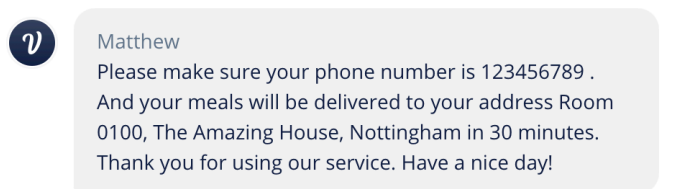


Figure 16 The system will provide food delivery service based on personal information

2) Veganism Check

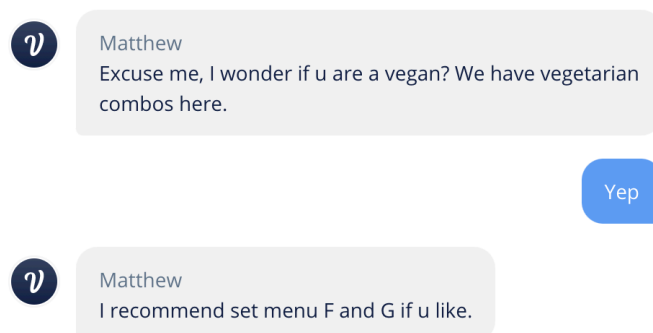


Figure 17 The system will recommend vegetarian combo-meals for vegans.

3) Customer Credit Points

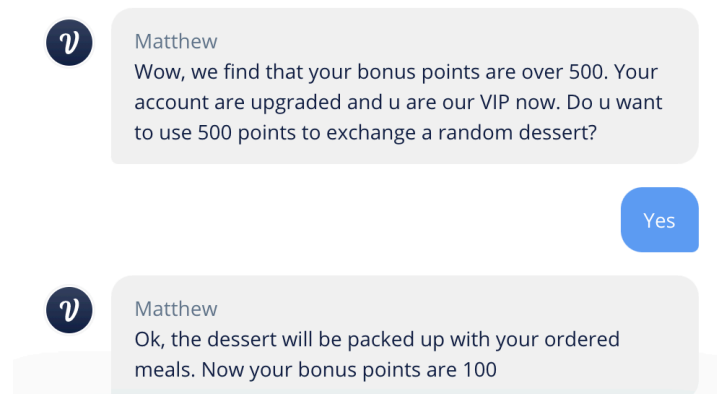


Figure 18 Customer' account is upgraded if the historical consumption meets the requirements

Context Tracking

1) "Status" Checking

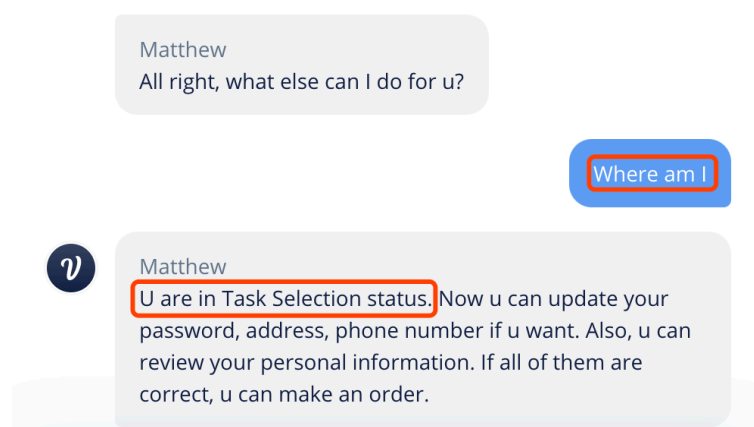


Figure 19 The user can check his/her status to acquire hints.

2) Variables to record order list

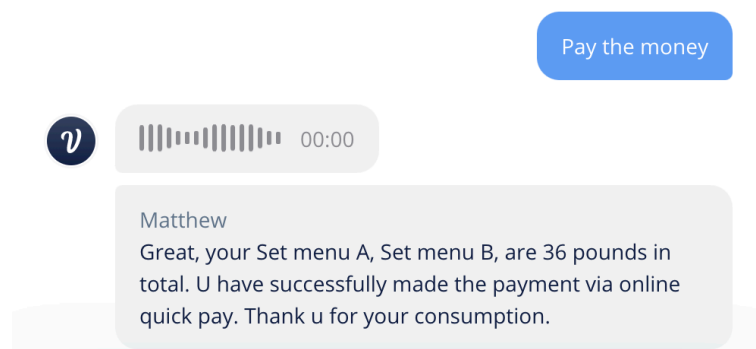


Figure 20 When the user wants to make a payment, the system will report what meals have been ordered.

Integration

1) Google Sheet

Google Sheet is integrated into the system to serve as a database, which stores user information and food menu information. I used the Google Sheet to implement sign in/sign up functionalities, food ordering, payment, etc.

name	pwd	tele.	addr.	Bonus Point
Tony	1234	123456789	Room 0100, The	100

Figure 21 User information

Starter	Main Course	Soup	Beverage	Dessert	Set Menu	Price_Total	Discount Date
White Beans	SUPER Pizza	Cheesy Potato	S Coke	Pie	A	18	Monday

Figure 22 Combo-meals Menu

2) JavaScript Code Block

Some functionalities are implemented with JavaScript Code Block, such as acquiring current date and time, variable assignment, etc. Compared to other blocks, the use of the code block can simplify the Voiceflow interface and avoid massive connections between blocks.

Advanced Features

Audio

To add sound effect, multiple audio files are collected from the Web. For example, starting the application, an audio will be played to indicate the launch of the application; When making the payment, there will be a sound to indicate the success of the payment.

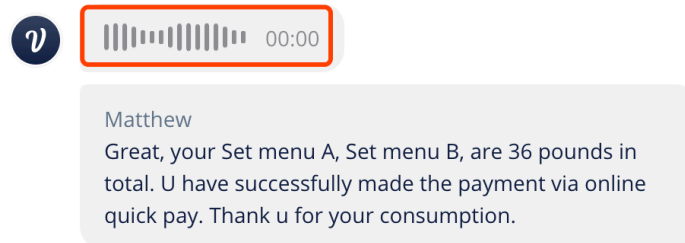


Figure 23 Payment

Speech Synthesis Mark-up Language (SSML)

SSML, a mark-up language to support voice customisation, are added to each speaking block to enrich the sound effect. Tuning the tone, rhythm, speed, emphasis under the specific scenarios makes the dialog more natural and closer to life.

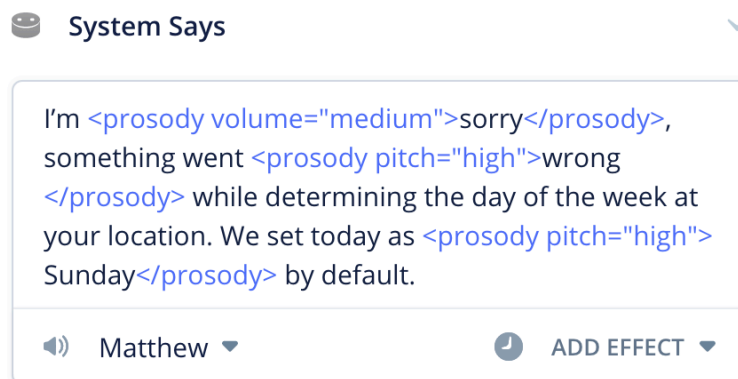


Figure 24

Small Talk

Small Talk is implemented through Commands Block to support simple conversation. Greetings are randomised to support multiple response. In addition, with the use of JavaScript Code Block, the user can ask current date/time, and the system will give adaptive answers in terms the date/time.

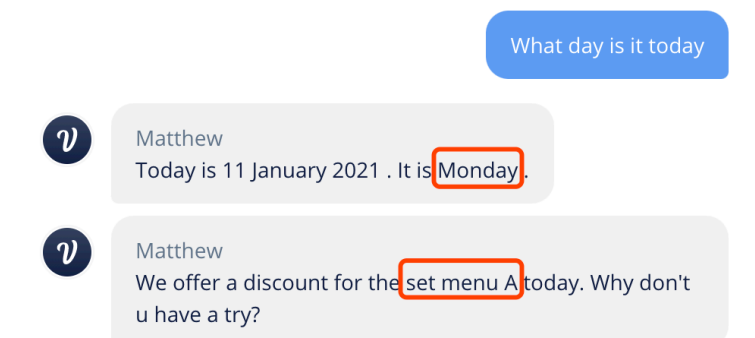


Figure 25 The system will recommend today's discounted combo-meals after telling the user the date.

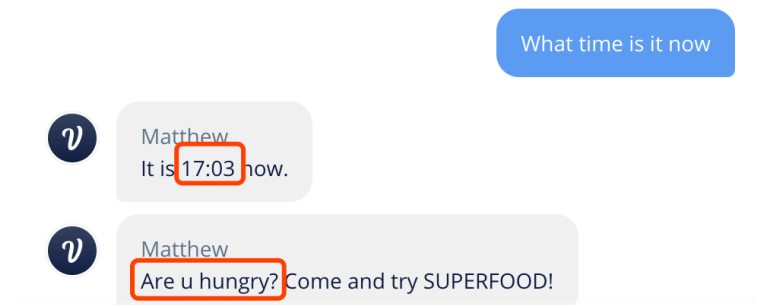


Figure 26 The system will advertise their food when it's time for dinner.

User Management

User management is implemented to ensure the personalisation so that the system can provide different services according to the personal information. Apart from registration and login, the user also can update personal information or review account.

Discounting Mechanism

The food ordering service provides daily discount based on the weekday. Customers will benefit from it when they order the combo on the specific date. For example, Ordering set menu A on Monday will receive a small discount.

Membership Credit Rules

Customers have the opportunity to upgrade their accounts. If the user spends more than 20\$ at a time, the system will add 100 points to the account. If the credit points are over 500, the user has the option to exchange a random dissert. The system will remind the user of this bonus in the payment process when his/her account meets the requirement.

Conclusion and Future Direction

Following the user-centred design process, I have developed a food home delivery prototype with Voiceflow. In this part, I will present the evaluation results as well as the future direction.

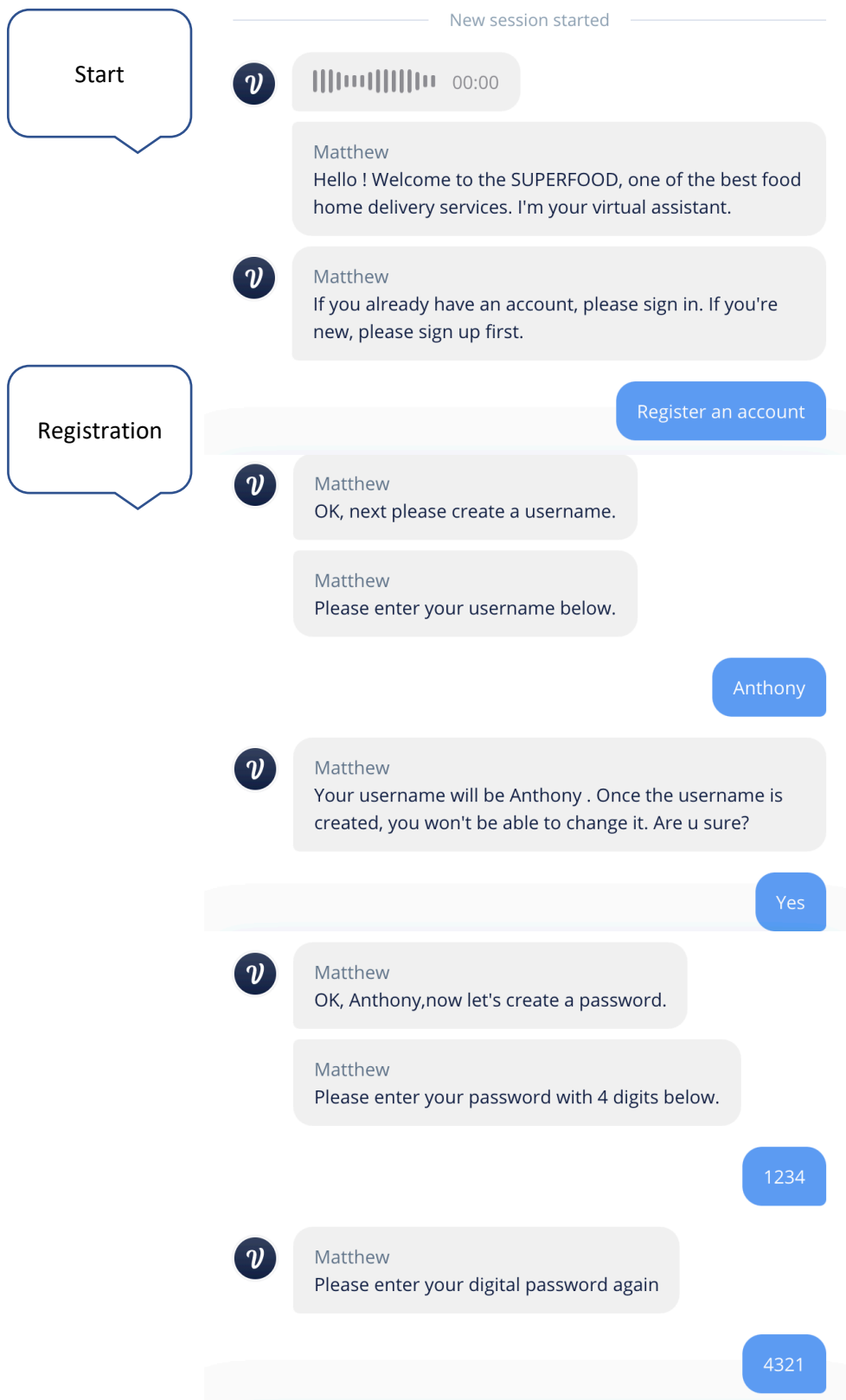
I am really satisfied with the advanced features of my design: 1) Adding data and time in small talk enriches the conversation; 2) Audio and SSML contribute to emotional expressions, making the conversation more natural and engaging; 3) User management, discount mechanism, customer credit rules not only lead to the diverse functionalities but provide customers with a unique experience. In addition to the advanced features, the user-centred design process, including context, requirements, solutions, evaluation, makes the design of this prototype more logical and reasonable, enhancing the interaction between the user and the system.

However, the use of Voiceflow has some limitations: 1) The platform is not powerful enough to support natural small talks, since the related resources, such as small talk database, small talk API, are deficient. 2) The integration of Google Sheet is not stable so that data transmission always faces the connection issue. 3) Voiceflow doesn't support input type checking, such as strings, digits, etc. 4) There is no similarity retrieval in Utterances, resulting in low input recognition performance.

There are some works to be improved in the future: 1) I will add more expression in Utterance to alleviate input identification. 2) I will enrich the conversation by adding different responses. 3) I will improve the process of query information about the food menu. Due to the restriction of Display Block, some images couldn't be shown without Alexa-based devices. Therefore, the complete food menu is not accessible. 4) I want to find a way to delete item separately. Currently, if the user, who has ordered set menu A and B, wants to delete combo A, the whole order will be removed.



Appendix A: User-System Dialog





Matthew
Passwords mismatch. Please check your password again.

Matthew
Please enter your password with 4 digits below.

1234



Matthew
Please enter your digital password again

1234



Matthew
Good, now let's enter your default phone number,
Anthony.

Matthew
Please enter your phone number below.

123454321



Matthew
Please enter your default address below.

Room 0909, NottingHome

Login



Matthew
Great, Anthony, your account is successfully created.
Thank u for your patience. Now, let's log in to your
account



Matthew
Great, my friend! Please enter your user name first.

Anthony



Matthew
Next, show me your password please.

1234



Matthew
Welcome Back, Anthony !



Matthew
What can I do for u? I can help u to manage your account
or order the home delivery food.

Manage my account

Account
Management



Matthew
Sure, you can update your password, update your
address, update your phone number, and review your
information . Could u make it clear ?

Review my account



Matthew
Hi, Anthony , here is your relevant information:

Matthew
Your default phone number is 123454321;

Matthew
Your default address is Room 0909, NottingHome ;

Matthew
Now u have 0 bonus points in total.

Matthew
All right, what else can I do for u?

Where am I

Query the
process



Matthew
U are in Task Selection status. Now u can update your
password, address, phone number if u want. Also, u can
review your personal information. If all of them are
correct, u can make an order.

Matthew
All right, what else can I do for u?



Small Talk

What time is it now



Matthew
It is 06:38 now.



Matthew
It is time for lunch.

Matthew
Are u hungry? Come and try SUPERFOOD!

What day is it today



Matthew
Today is 12 January 2021 . It is Tuesday .



Matthew
We offer a discount for the set menu B today. Why don't u have a try?

Matthew
All right, what else can I do for u?

Food Ordering

Order meals



Matthew
Great, Anthony. Here is our menu. We provide seven food combos. These healthy snack pairings taste delicious and deliver a nutritional punch.

Matthew
Sorry, the Display Block may not be able to show the menu image in Voiceflow. U can just say alphabet A to G to indicate which set menu u want to have a try

00:00



Vegan
Check



Matthew
Excuse me, I wonder if u are a vegan? We have vegetarian
combos here.

Yes



Matthew
I recommend set menu F and G if u like.



Matthew
Ok, I still want to ask which one u prefer?

Add items

Set menu F please



Matthew
You have ordered the set menu F . what else do u want?

Cancel order

Cancel order



Matthew
Are u sure? The whole order will be cancelled.

Yes



Matthew
U have cancelled the order. Do u want to order or just
stop ordering?

Matthew
What else do u want?

I want to order set menu G

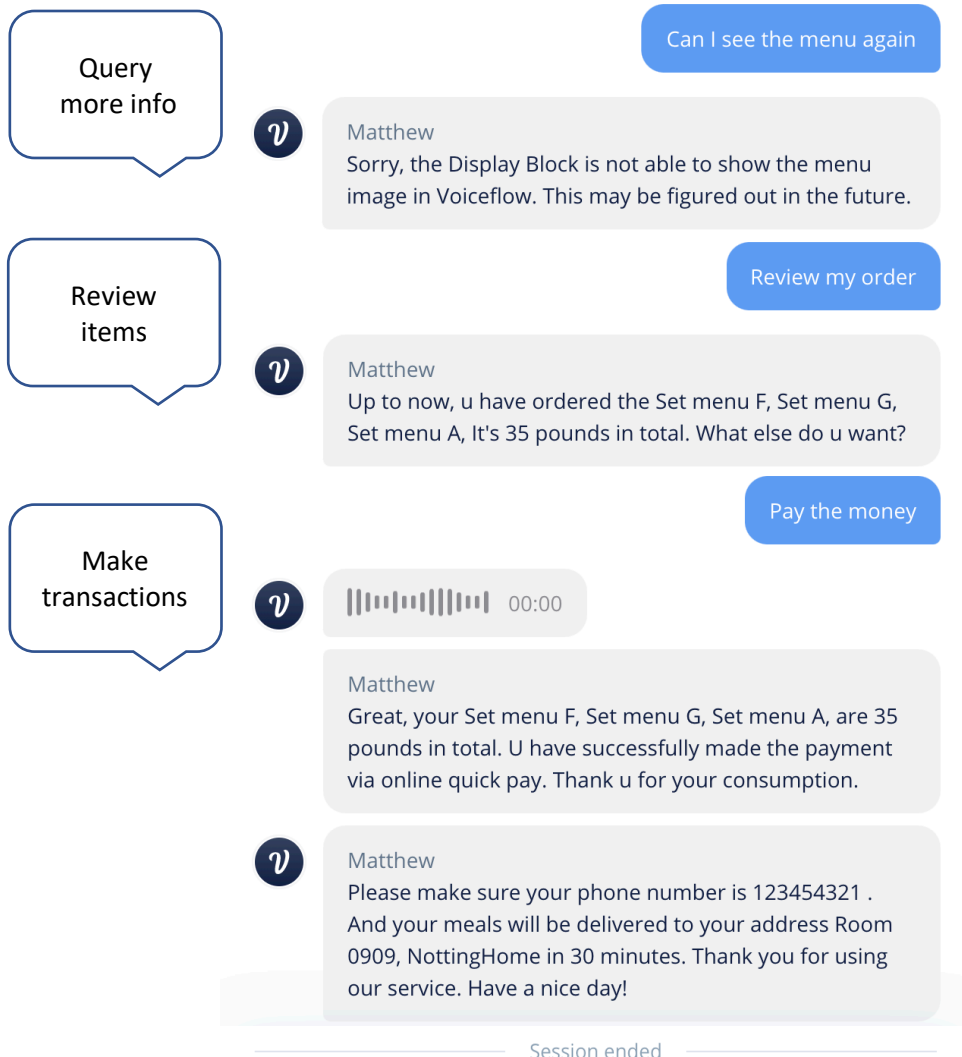


Matthew
You have ordered the set menu G . what else do u want?

A please



Matthew
You have ordered the set menu A . what else do u want?



Appendix B: Food Menu

Set Menu	Starter	Main Course	Soup	Beverage	Dessert	Price	Discount Date
A	White Beans	SUPER Pizza	Cheesy Potato Soup	Coke	Pie	18	Monday
B	Cheese Straws	SUPER Steak	Roasted Carrot Soup	Sprite	Fruit	20	Tuesday
C	Mushrooms	SUPER Burger	Smoked Sausage Soup	Fanta	Cookie	22	Wednesday
D	Salmon Spread	SUPER Rice	Seafood Gumbo	Beer	Toast	19	Thursday
E	Spiced Onions	SUPER Sandwich	Yogurt Soup	Coffee	Ice-cream	20	Friday
F	Peanuts	SUPER Pasta	White Bean Soup	Tea	Cake	21	Saturday
G	Potato	SUPER Noodles	Creamy Leek Soup	Juice	Salad	17	Sunday