CZ3005: Artificial Intelligence

LAB Assignment 3

QUESTION 3 - SUBWAY SANDWICH INTERACTOR

By

Name: Datta Anusha

Matriculation Number: U1822948G

Lab Group: TS8

Date: 5th April 2021

School of Computer Science and Engineering (SCSE)

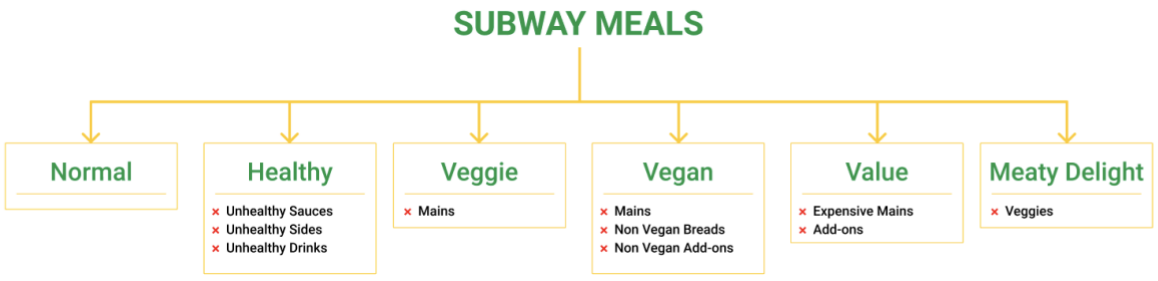
TABLE OF CONTENTS

Introduction	3
Program Flow	4
Directory Structure	5
Installation Manual	5
Prolog Implementation	7
Telegram Bot Interactions	12

INTRODUCTION

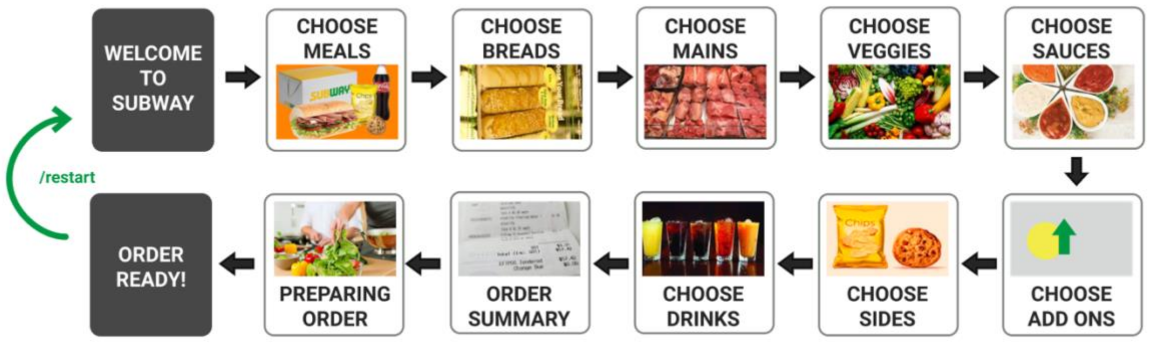
This assignment is an implementation of Question 3: Subway Sandwich Interactor. To enhance the user experience of this automated interaction, a Telegram bot has been created to interface with the Prolog script. This improves the quality of interactions as the Prolog commands are encapsulated behind the Telegram application UI.

The Prolog script offers various meal options (Normal, Healthy, Veggie, Vegan, Value, Meaty Delight) to the user, each meal with its own specific attributes which can be observed in the chart below.



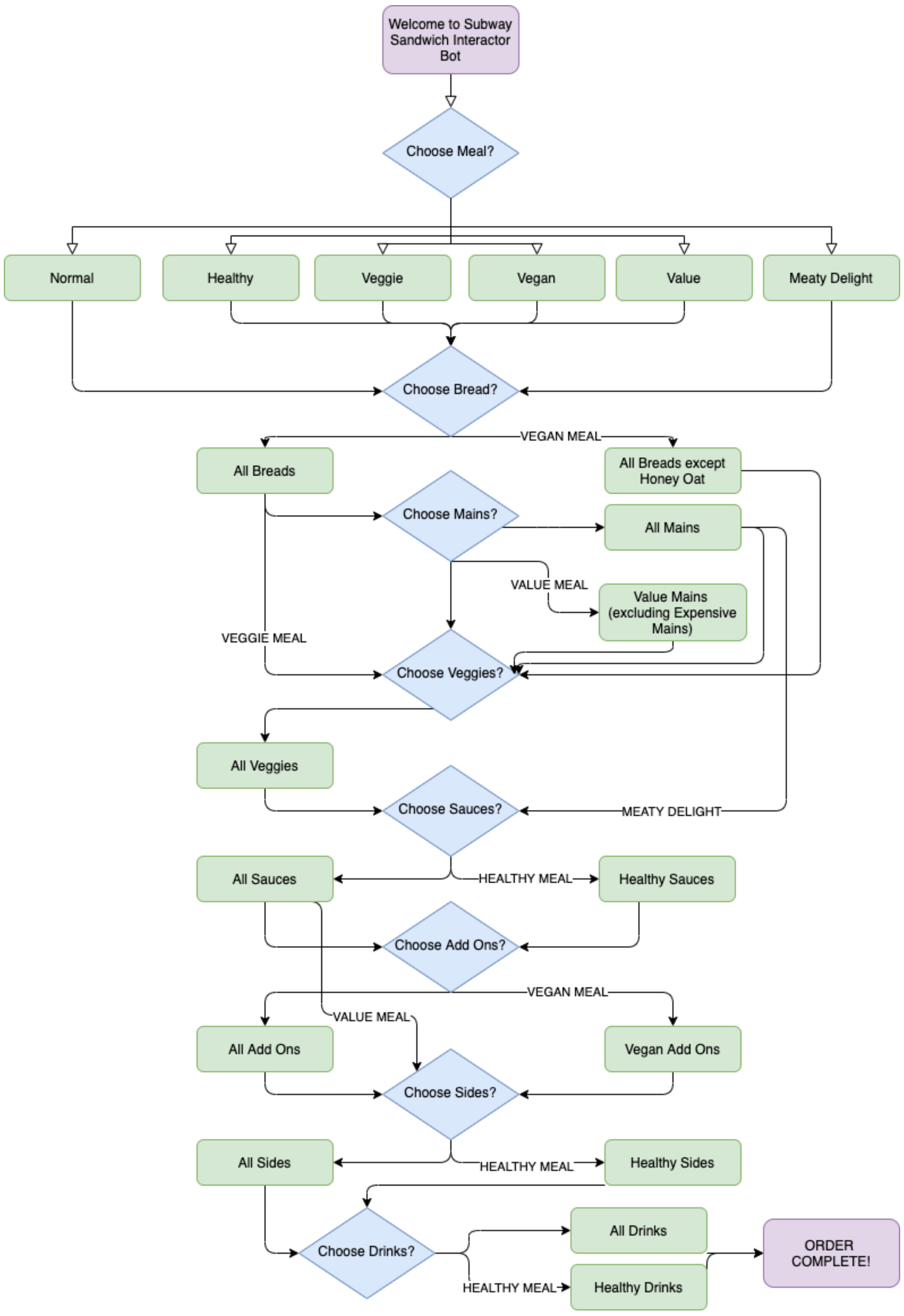
Based on these rules, and meal selection by the user, the Subway Sandwich Interactor will perform logical computations to intelligently suggest a list of recommended fillings (breads, mains, veggies, sauces, top ups, sides, drinks) to create a customized subway order.

Moreover, the main flow of the subway order, as experienced by a user interacting with the Subway Bot, can be visualised as follows:



PROGRAM FLOW

In accordance with the subway order flow shown above, the program control logic flow has been designed to implement the same.



DIRECTORY STRUCTURE

The condensed directory structure of the program is as shown below:

```
.
├── DATTA_ANUSHA_qn_3.pl
├── __pycache__
├── assets
│   └── thank_you.gif
├── env
│   ├── bin
│   ├── lib
│   │   └── python3.7
│   └── pyvenv.cfg
├── main.py
├── prolog_interface.py
├── requirements.txt
└── telegram_api_key.py

184 directories, 1474 files
```

INSTALLATION MANUAL

PREREQUISITES

- Installed `python3` and `pip` on PC
- The Telegram Desktop Application must be installed on PC
- SWI-Prolog must be installed on PC
- `swipl` must be installed with binary available in system `PATH` (see instructions below).

ADD SWIPL TO SYSTEM PATH

Download SWI-Prolog and add it to the *`/Applications`* folder.

Then add this to the system *`.bash_profile`* `file`:

```
export PATH="/Applications/SWI-Prolog.app/Contents/MacOS:$PATH"
```

After adding `swipl` binary path to MacOS system directory, execute the following command in shell to bring it into effect:

```
~$ source ~/.bash_profile
```

Alternatively, can also just run:

```
~$ brew install swi-prolog
```

This shall automatically install Swi-Prolog and add the application binary to system path.

CREATE TELEGRAM BOT

To access my bot, please go to @anushadatta_subway_bot.

To create your own bot, please follow the steps below in the Telegram mobile application:

1. Search for BotFather (@BotFather)
2. Request for a new bot via /newbot
3. Retrieve the HTTP API key given
4. Create a file called `telegram_api_key.py` in the root directory and add the following line of code TOKEN = "XXX"
   where XXX is the HTTP API key given by BotFather

SET UP: LOCAL DEPLOYMENT

To set up and deploy the Telegram Bot on local machine, follow the steps below:

- Set up local virtual environment

```
~$ virtualenv env
```

- Activate virtual environment

```
~$ source env/bin/activate
```

- Install dependencies

```
~$ pip install -r requirements.txt
```

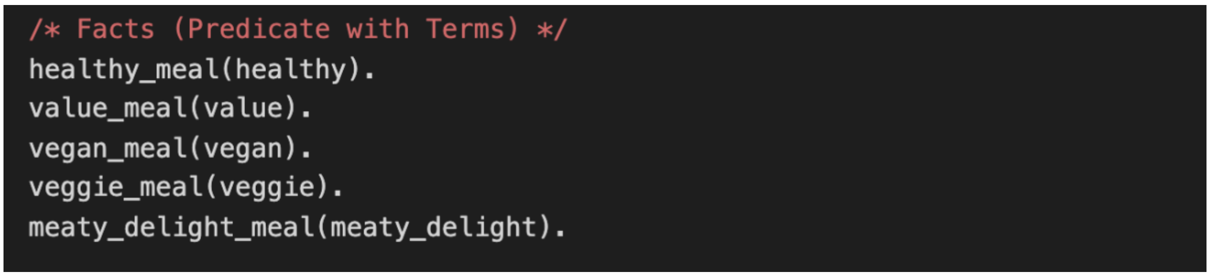
- Run server on localhost:5000

```
~$ python main.py
```

PROLOG IMPLEMENTATION

1. Defining Facts for Subway Meal Type

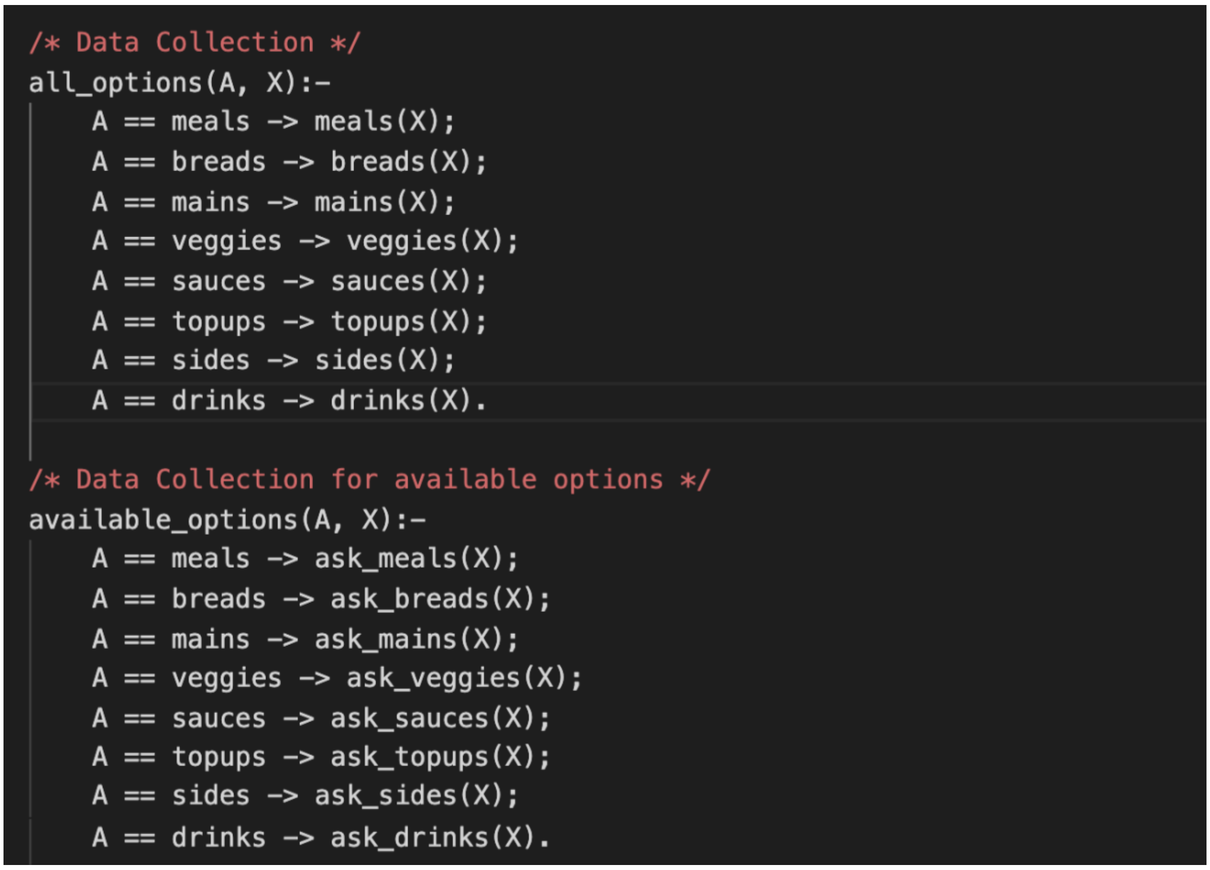
- Normal
- Healthy
- Value
- Vegan
- Veggie
- Meaty Delight



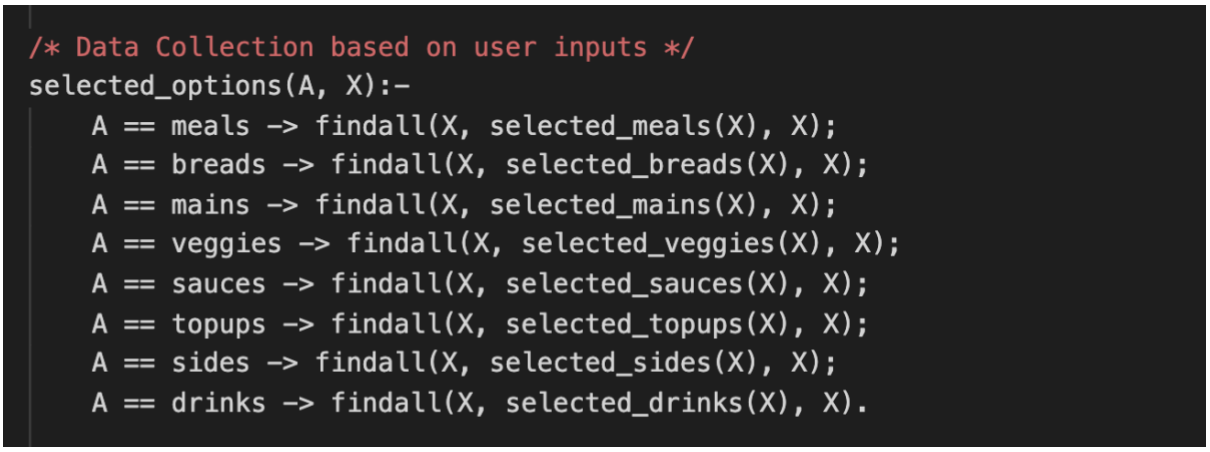
```prolog
/* Facts (Predicate with Terms) */
healthy_meal(healthy).
value_meal(value).
vegan_meal(vegan).
veggie_meal(veggie).
meaty_delight_meal(meaty_delight).
```

2. Data Methods

- *all_options()* Listing all options for a category
- *available_options()* Listing all available options for a category
- *selected_options()* Listing all user selected options for a category



```prolog
/* Data Collection */
all_options(A, X):-
    A == meals -> meals(X);
    A == breads -> breads(X);
    A == mains -> mains(X);
    A == veggies -> veggies(X);
    A == sauces -> sauces(X);
    A == topups -> topups(X);
    A == sides -> sides(X);
    A == drinks -> drinks(X).

/* Data Collection for available options */
available_options(A, X):-
    A == meals -> ask_meals(X);
    A == breads -> ask_breads(X);
    A == mains -> ask_mains(X);
    A == veggies -> ask_veggies(X);
    A == sauces -> ask_sauces(X);
    A == topups -> ask_topups(X);
    A == sides -> ask_sides(X);
    A == drinks -> ask_drinks(X).
```

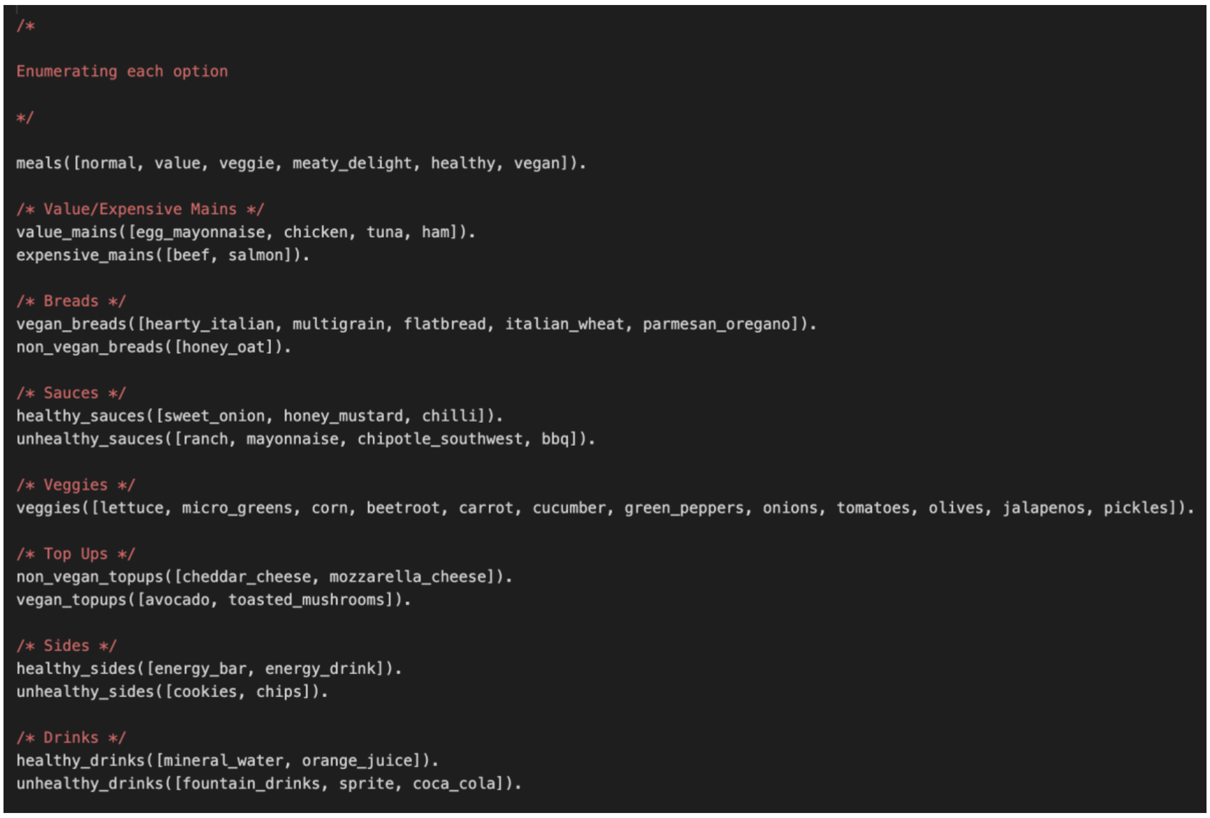


```
/* Data Collection based on user inputs */
selected_options(A, X):-
    A == meals -> findall(X, selected_meals(X), X);
    A == breads -> findall(X, selected_breads(X), X);
    A == mains -> findall(X, selected_mains(X), X);
    A == veggies -> findall(X, selected_veggies(X), X);
    A == sauces -> findall(X, selected_sauces(X), X);
    A == topups -> findall(X, selected_topups(X), X);
    A == sides -> findall(X, selected_sides(X), X);
    A == drinks -> findall(X, selected_drinks(X), X).
```

3. **Enumerating Choices for each Category**

   The categories for which the choices have been listed are as follows:

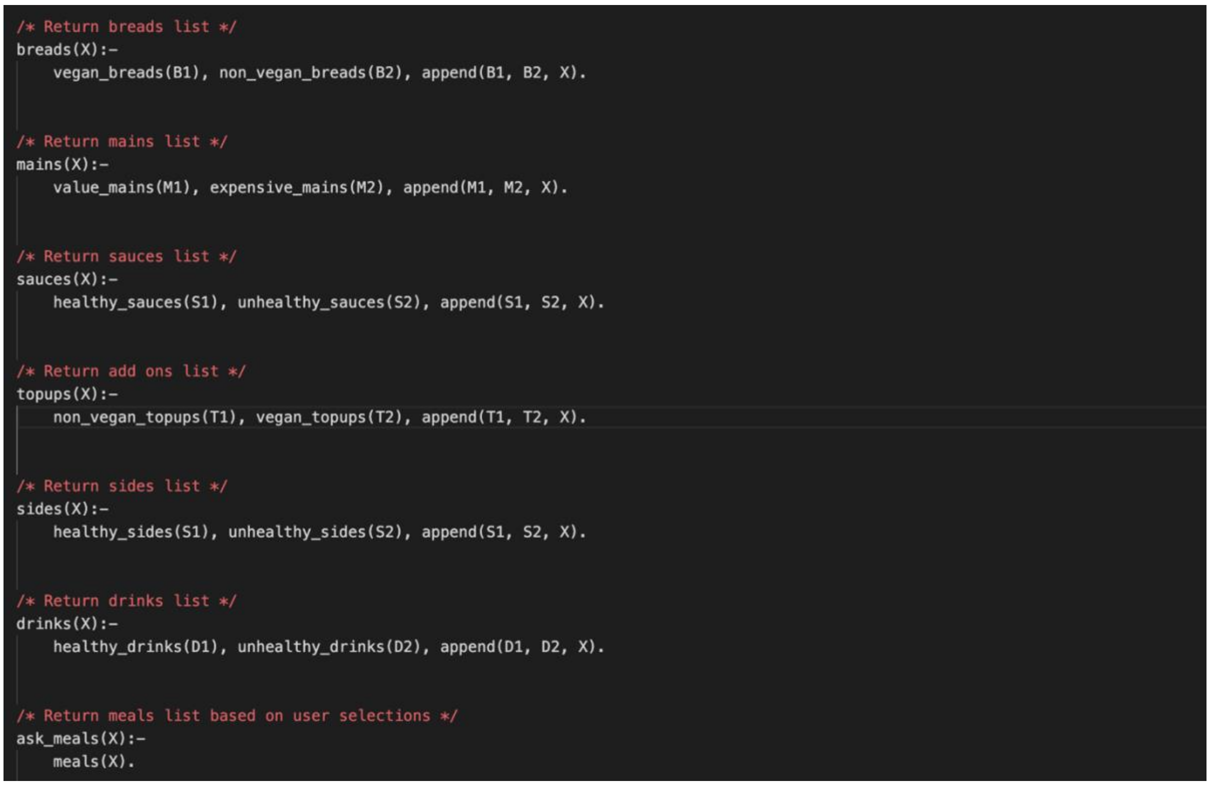
   - Meals Types
   - Value Mains/Expensive Mains
   - Breads Types
   - Sauces options
   - Veggies options
   - Add On options
   - Sides options
   - Drinks options



```
/*

Enumerating each option

*/

meals([normal, value, veggie, meaty_delight, healthy, vegan]).

/* Value/Expensive Mains */
value_mains([egg_mayonnaise, chicken, tuna, ham]).
expensive_mains([beef, salmon]).

/* Breads */
vegan_breads([hearty_italian, multigrain, flatbread, italian_wheat, parmesan_oregano]).
non_vegan_breads([honey_oat]).

/* Sauces */
healthy_sauces([sweet_onion, honey_mustard, chilli]).
unhealthy_sauces([ranch, mayonnaise, chipotle_southwest, bbq]).

/* Veggies */
veggies([lettuce, micro_greens, corn, beetroot, carrot, cucumber, green_peppers, onions, tomatoes, olives, jalapenos, pickles]).

/* Top Ups */
non_vegan_topups([cheddar_cheese, mozzarella_cheese]).
vegan_topups([avocado, toasted_mushrooms]).

/* Sides */
healthy_sides([energy_bar, energy_drink]).
unhealthy_sides([cookies, chips]).

/* Drinks */
healthy_drinks([mineral_water, orange_juice]).
unhealthy_drinks([fountain_drinks, sprite, coca_cola]).
```

4. **Full List of Options for each Category**

The complete list of options for each category have been generated by combining options listed for each subcategory as mentioned above.

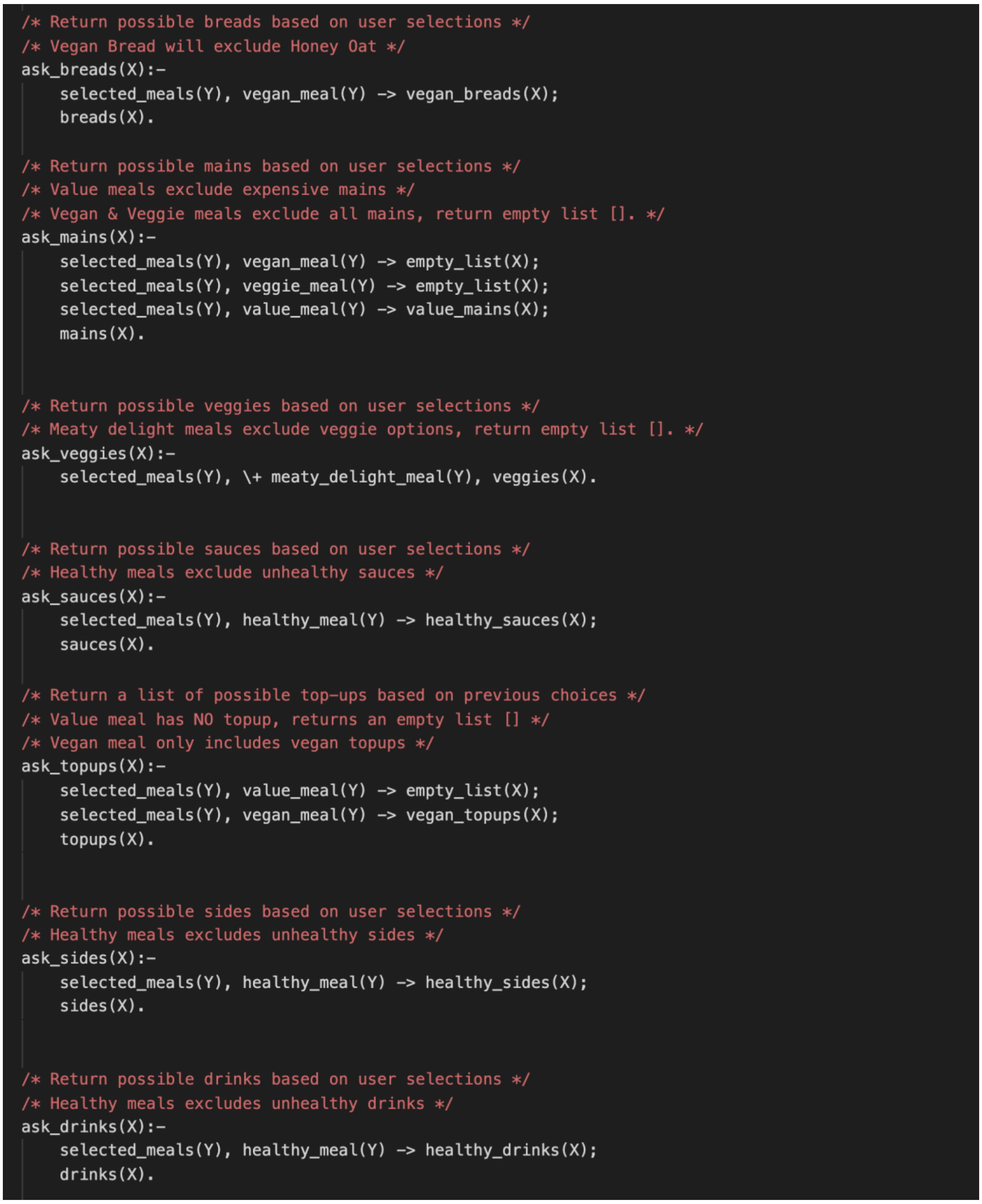


```
/* Return breads list */
breads(X):-
    vegan_breads(B1), non_vegan_breads(B2), append(B1, B2, X).


/* Return mains list */
mains(X):-
    value_mains(M1), expensive_mains(M2), append(M1, M2, X).


/* Return sauces list */
sauces(X):-
    healthy_sauces(S1), unhealthy_sauces(S2), append(S1, S2, X).


/* Return add ons list */
topups(X):-
    non_vegan_topups(T1), vegan_topups(T2), append(T1, T2, X).


/* Return sides list */
sides(X):-
    healthy_sides(S1), unhealthy_sides(S2), append(S1, S2, X).


/* Return drinks list */
drinks(X):-
    healthy_drinks(D1), unhealthy_drinks(D2), append(D1, D2, X).


/* Return meals list based on user selections */
ask_meals(X):-
    meals(X).
```

5. **Generate Available Options**

The available options for each category are generated based on certain rules, which have been implemented in the Prolog logic:

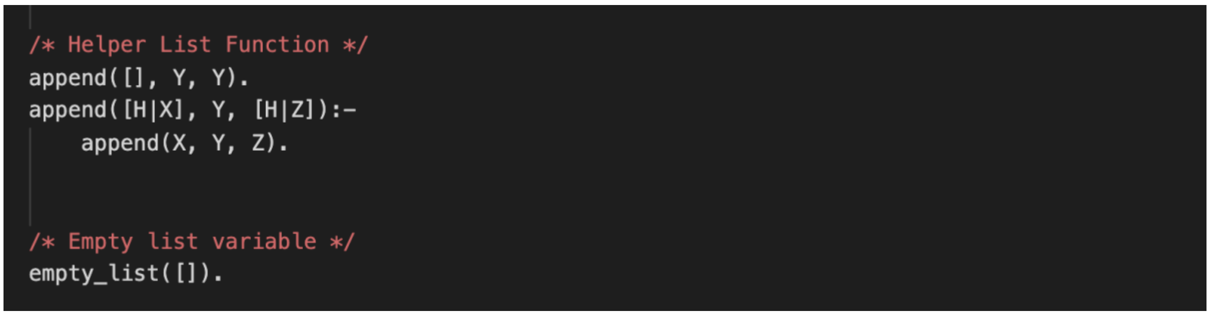
- Value Meals
    - Exclude Expensive Mains (e.g. beef, salmon)
    - Only show value Add On options
- Vegan Meals
    - All breads, except Honey Oat
    - Exclude Mains (e.g. chicken, tuna)
    - Only show vegan Add On options (e.g. avocado, toasted mushrooms)
- Veggie Meals
    - Exclude Mains
- Meaty Delight Meals
    - Exclude Veggies
- Healthy Meals
    - Exclude Unhealthy Sauces (e.g. mayonnaise)
    - Exclude Unhealthy Sides (e.g. cookies)
    - Exclude Unhealthy Drinks (e.g. coca cola)



```
/* Return possible breads based on user selections */
/* Vegan Bread will exclude Honey Oat */
ask_breads(X):-
    selected_meals(Y), vegan_meal(Y) -> vegan_breads(X);
    breads(X).

/* Return possible mains based on user selections */
/* Value meals exclude expensive mains */
/* Vegan & Veggie meals exclude all mains, return empty list []. */
ask_mains(X):-
    selected_meals(Y), vegan_meal(Y) -> empty_list(X);
    selected_meals(Y), veggie_meal(Y) -> empty_list(X);
    selected_meals(Y), value_meal(Y) -> value_mains(X);
    mains(X).


/* Return possible veggies based on user selections */
/* Meaty delight meals exclude veggie options, return empty list []. */
ask_veggies(X):-
    selected_meals(Y), \+ meaty_delight_meal(Y), veggies(X).


/* Return possible sauces based on user selections */
/* Healthy meals exclude unhealthy sauces */
ask_sauces(X):-
    selected_meals(Y), healthy_meal(Y) -> healthy_sauces(X);
    sauces(X).

/* Return a list of possible top-ups based on previous choices */
/* Value meal has NO topup, returns an empty list [] */
/* Vegan meal only includes vegan topups */
ask_topups(X):-
    selected_meals(Y), value_meal(Y) -> empty_list(X);
    selected_meals(Y), vegan_meal(Y) -> vegan_topups(X);
    topups(X).


/* Return possible sides based on user selections */
/* Healthy meals excludes unhealthy sides */
ask_sides(X):-
    selected_meals(Y), healthy_meal(Y) -> healthy_sides(X);
    sides(X).


/* Return possible drinks based on user selections */
/* Healthy meals excludes unhealthy drinks */
ask_drinks(X):-
    selected_meals(Y), healthy_meal(Y) -> healthy_drinks(X);
    drinks(X).
```

List Helper Functions

- Append to List
- Initialise empty list variable

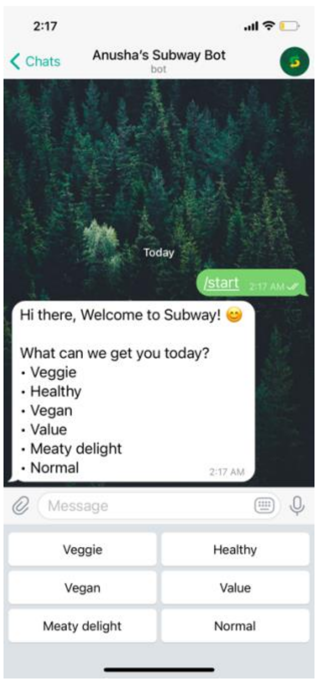


```
/* Helper List Function */
append([], Y, Y).
append([H|X], Y, [H|Z]):-
    append(X, Y, Z).


/* Empty list variable */
empty_list([]).
```

TELEGRAM BOT INTERACTIONS

1. Normal

All options for each category are offered by the Subway Sandwich Interactor Bot.


2:17

Chats · Anusha's Subway Bot · bot

Today

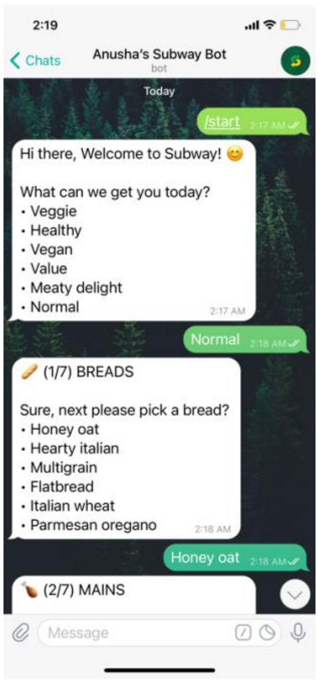
/start 2:17 AM

Hi there, Welcome to Subway! 😊

What can we get you today?
• Veggie
• Healthy
• Vegan
• Value
• Meaty delight
• Normal 2:17 AM

Message

Veggie	Healthy
Vegan	Value
Meaty delight	Normal


2:19

Chats · Anusha's Subway Bot · bot

Today

/start 2:17 AM

Hi there, Welcome to Subway! 😊

What can we get you today?
• Veggie
• Healthy
• Vegan
• Value
• Meaty delight
• Normal 2:17 AM

Normal 2:18 AM

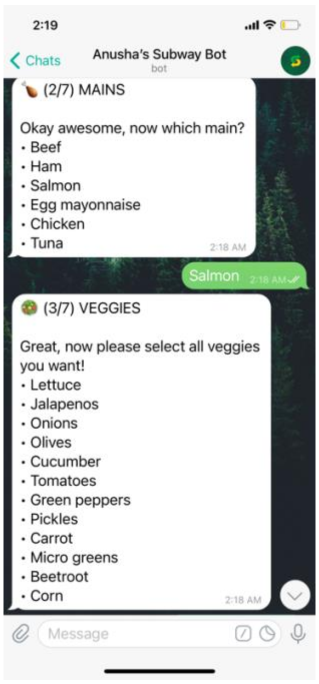
(1/7) BREADS

Sure, next please pick a bread?
• Honey oat
• Hearty italian
• Multigrain
• Flatbread
• Italian wheat
• Parmesan oregano 2:18 AM

Honey oat 2:18 AM

(2/7) MAINS

Message


2:19

Chats · Anusha's Subway Bot · bot

(2/7) MAINS

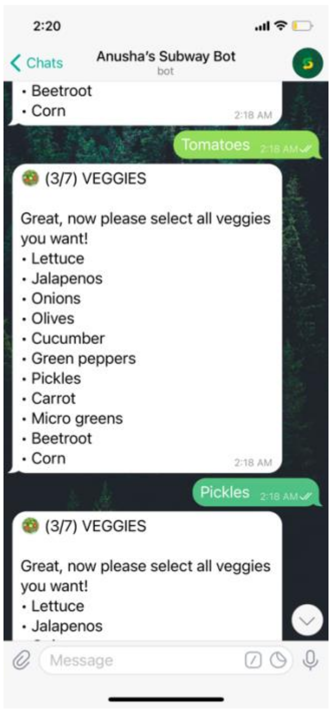
Okay awesome, now which main?
• Beef
• Ham
• Salmon
• Egg mayonnaise
• Chicken
• Tuna 2:18 AM

Salmon 2:18 AM

(3/7) VEGGIES

Great, now please select all veggies you want!
• Lettuce
• Jalapenos
• Onions
• Olives
• Cucumber
• Tomatoes
• Green peppers
• Pickles
• Carrot
• Micro greens
• Beetroot
• Corn 2:18 AM

Message


2:20

Chats · Anusha's Subway Bot · bot

• Beetroot
• Corn 2:18 AM

Tomatoes 2:18 AM

(3/7) VEGGIES

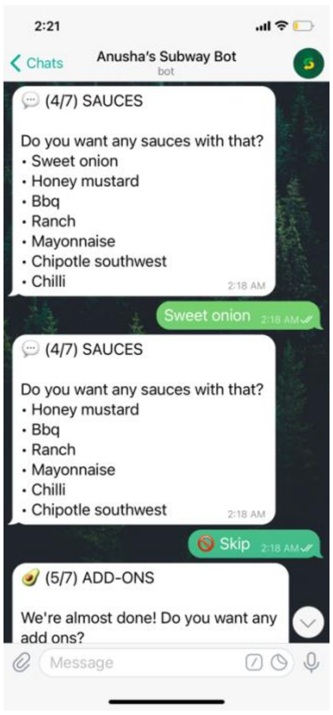
Great, now please select all veggies you want!
• Lettuce
• Jalapenos
• Onions
• Olives
• Cucumber
• Green peppers
• Pickles
• Carrot
• Micro greens
• Beetroot
• Corn 2:18 AM

Pickles 2:18 AM

(3/7) VEGGIES

Great, now please select all veggies you want!
• Lettuce
• Jalapenos

Message


2:21

Chats · Anusha's Subway Bot · bot

(4/7) SAUCES

Do you want any sauces with that?
• Sweet onion
• Honey mustard
• Bbq
• Ranch
• Mayonnaise
• Chipotle southwest
• Chilli 2:18 AM

Sweet onion 2:18 AM

(4/7) SAUCES

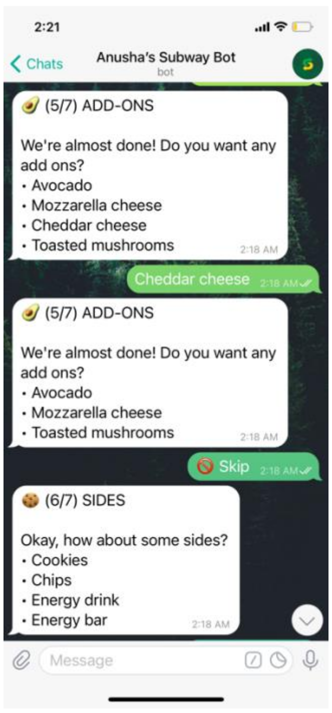
Do you want any sauces with that?
• Honey mustard
• Bbq
• Ranch
• Mayonnaise
• Chilli
• Chipotle southwest 2:18 AM

🚫 Skip 2:18 AM

(5/7) ADD-ONS

We're almost done! Do you want any add ons?

Message


2:21

Chats · Anusha's Subway Bot · bot

(5/7) ADD-ONS

We're almost done! Do you want any add ons?
• Avocado
• Mozzarella cheese
• Cheddar cheese
• Toasted mushrooms 2:18 AM

Cheddar cheese 2:18 AM

(5/7) ADD-ONS

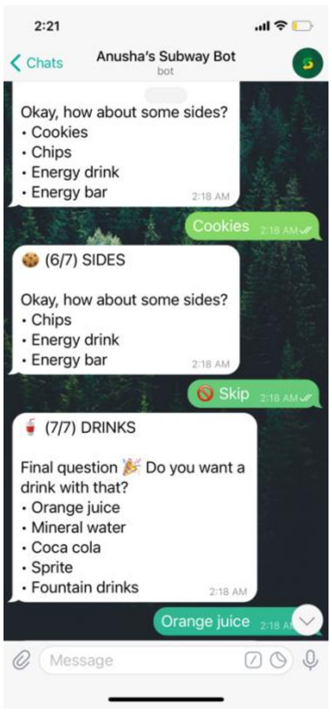
We're almost done! Do you want any add ons?
• Avocado
• Mozzarella cheese
• Toasted mushrooms 2:18 AM

🚫 Skip 2:18 AM

(6/7) SIDES

Okay, how about some sides?
• Cookies
• Chips
• Energy drink
• Energy bar 2:18 AM

Message


2:21

Chats Anusha's Subway Bot
bot

Okay, how about some sides?
• Cookies
• Chips
• Energy drink
• Energy bar 2:18 AM

Cookies 2:18 AM

🍪 (6/7) SIDES

Okay, how about some sides?
• Chips
• Energy drink
• Energy bar 2:18 AM

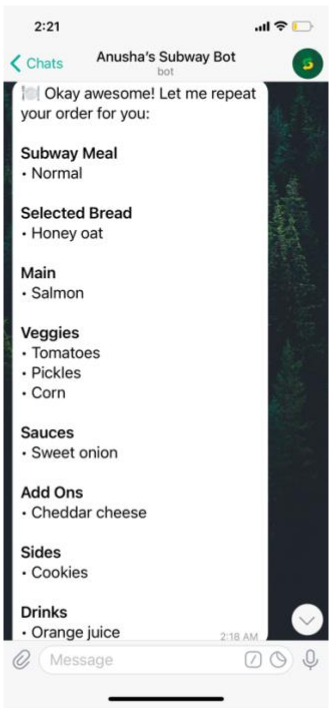
🚫 Skip 2:18 AM

🥤 (7/7) DRINKS

Final question 🎉 Do you want a drink with that?
• Orange juice
• Mineral water
• Coca cola
• Sprite
• Fountain drinks 2:18 AM

Orange juice 2:18 AM

Message


2:21

Chats Anusha's Subway Bot
bot

🍽️ Okay awesome! Let me repeat your order for you:

Subway Meal
• Normal

Selected Bread
• Honey oat

Main
• Salmon

Veggies
• Tomatoes
• Pickles
• Corn

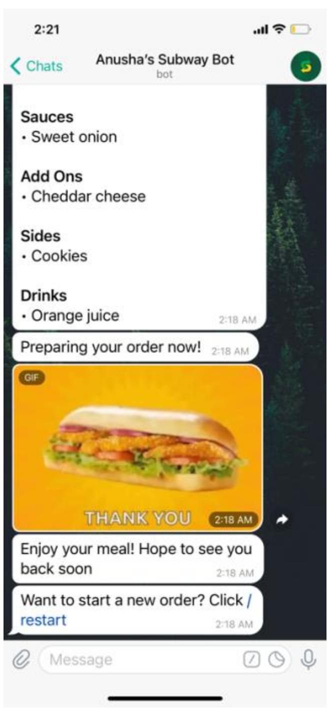
Sauces
• Sweet onion

Add Ons
• Cheddar cheese

Sides
• Cookies

Drinks
• Orange juice 2:18 AM

Message


2:21

Chats Anusha's Subway Bot
bot

Sauces
• Sweet onion

Add Ons
• Cheddar cheese

Sides
• Cookies

Drinks
• Orange juice 2:18 AM

Preparing your order now! 2:18 AM

GIF
THANK YOU 2:18 AM

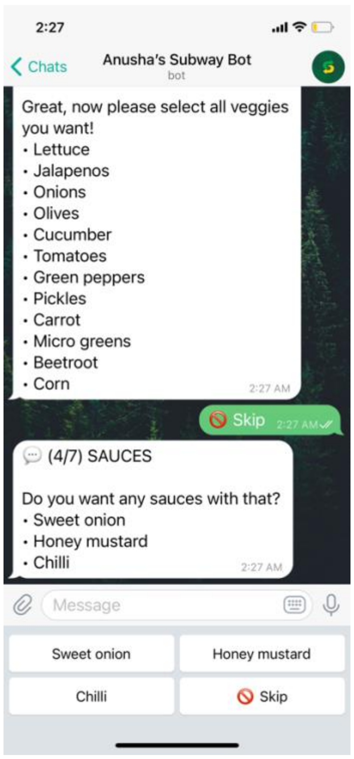
Enjoy your meal! Hope to see you back soon 2:18 AM

Want to start a new order? Click /restart 2:18 AM

Message

2. Healthy

Except Unhealthy Sauces, Unhealthy Sides and Unhealthy Drinks, all options for each category are offered by the Subway Sandwich Interactor Bot.


2:27

Chats Anusha's Subway Bot
bot

Great, now please select all veggies you want!
• Lettuce
• Jalapenos
• Onions
• Olives
• Cucumber
• Tomatoes
• Green peppers
• Pickles
• Carrot
• Micro greens
• Beetroot
• Corn 2:27 AM

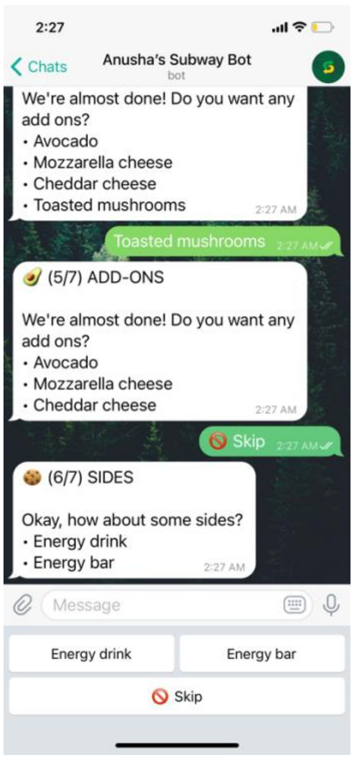
🚫 Skip 2:27 AM

💬 (4/7) SAUCES

Do you want any sauces with that?
• Sweet onion
• Honey mustard
• Chilli 2:27 AM

Message

Sweet onion | Honey mustard
Chilli | 🚫 Skip


2:27

Chats Anusha's Subway Bot
bot

We're almost done! Do you want any add ons?
• Avocado
• Mozzarella cheese
• Cheddar cheese
• Toasted mushrooms 2:27 AM

Toasted mushrooms 2:27 AM

🥑 (5/7) ADD-ONS

We're almost done! Do you want any add ons?
• Avocado
• Mozzarella cheese
• Cheddar cheese 2:27 AM

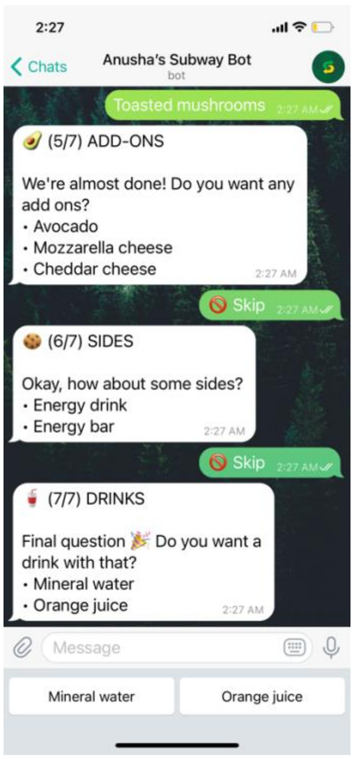
🚫 Skip 2:27 AM

🍪 (6/7) SIDES

Okay, how about some sides?
• Energy drink
• Energy bar 2:27 AM

Message

Energy drink | Energy bar
🚫 Skip


2:27

Chats Anusha's Subway Bot
bot

Toasted mushrooms 2:27 AM

🥑 (5/7) ADD-ONS

We're almost done! Do you want any add ons?
• Avocado
• Mozzarella cheese
• Cheddar cheese 2:27 AM

🚫 Skip 2:27 AM

🍪 (6/7) SIDES

Okay, how about some sides?
• Energy drink
• Energy bar 2:27 AM

🚫 Skip 2:27 AM

🥤 (7/7) DRINKS

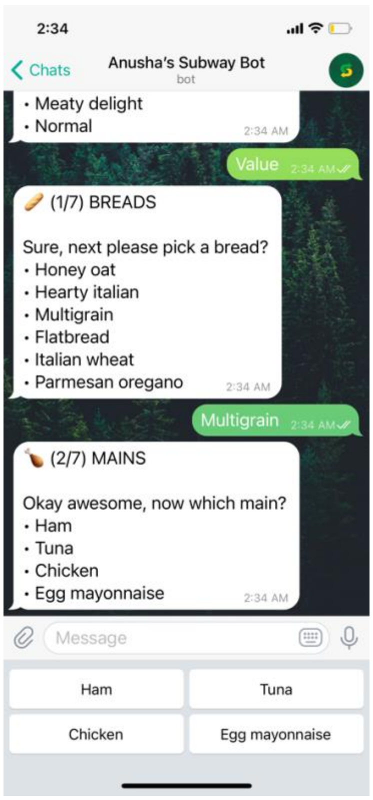
Final question 🎉 Do you want a drink with that?
• Mineral water
• Orange juice 2:27 AM

Message

Mineral water | Orange juice

3. Value

Except Expensive Mains, and Add On options, all options for each category are offered by the Subway Sandwich Interactor Bot.



• Meaty delight
• Normal 2:34 AM

Value 2:34 AM

🥖 (1/7) BREADS

Sure, next please pick a bread?
• Honey oat
• Hearty italian
• Multigrain
• Flatbread
• Italian wheat
• Parmesan oregano 2:34 AM

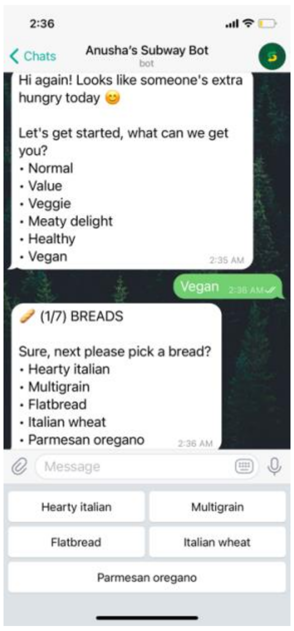
Multigrain 2:34 AM

🍗 (2/7) MAINS

Okay awesome, now which main?
• Ham
• Tuna
• Chicken
• Egg mayonnaise 2:34 AM

4. Vegan

Except Honey Oat Bread (non-vegan bread), All Mains and non-vegan Add On options, all options for each category are offered by the Subway Sandwich Interactor Bot.



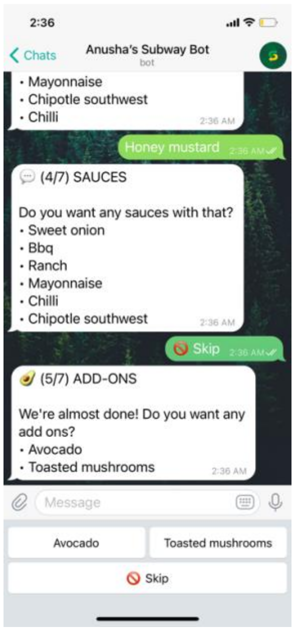
Hi again! Looks like someone's extra hungry today 😋

Let's get started, what can we get you?
• Normal
• Value
• Veggie
• Meaty delight
• Healthy
• Vegan 2:35 AM

Vegan 2:36 AM

🥖 (1/7) BREADS

Sure, next please pick a bread?
• Hearty italian
• Multigrain
• Flatbread
• Italian wheat
• Parmesan oregano 2:36 AM



• Mayonnaise
• Chipotle southwest
• Chilli 2:36 AM

Honey mustard 2:36 AM

💬 (4/7) SAUCES

Do you want any sauces with that?
• Sweet onion
• Bbq
• Ranch
• Mayonnaise
• Chilli
• Chipotle southwest 2:36 AM

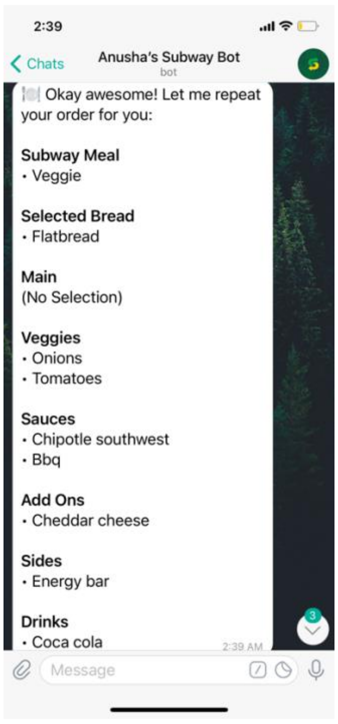
🚫 Skip 2:36 AM

🥑 (5/7) ADD-ONS

We're almost done! Do you want any add ons?
• Avocado
• Toasted mushrooms 2:36 AM

5. Veggie

Except All Mains, all options for each category are offered by the Subway Sandwich Interactor Bot.



Okay awesome! Let me repeat your order for you:

Subway Meal
• Veggie

Selected Bread
• Flatbread

Main
(No Selection)

Veggies
• Onions
• Tomatoes

Sauces
• Chipotle southwest
• Bbq

Add Ons
• Cheddar cheese

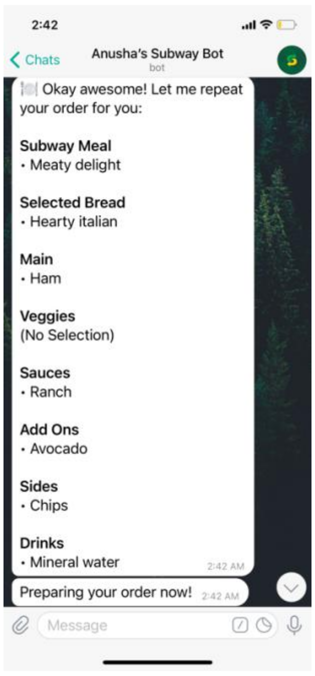
Sides
• Energy bar

Drinks
• Coca cola

2:39 AM

6. Meaty Delight

Except All Veggies, all options for each category are offered by the Subway Sandwich Interactor Bot.



Okay awesome! Let me repeat your order for you:

Subway Meal
• Meaty delight

Selected Bread
• Hearty italian

Main
• Ham

Veggies
(No Selection)

Sauces
• Ranch

Add Ons
• Avocado

Sides
• Chips

Drinks
• Mineral water

2:42 AM

Preparing your order now! 2:42 AM