CS 410/510: Voice Assistants

Final Project - Dialogflow

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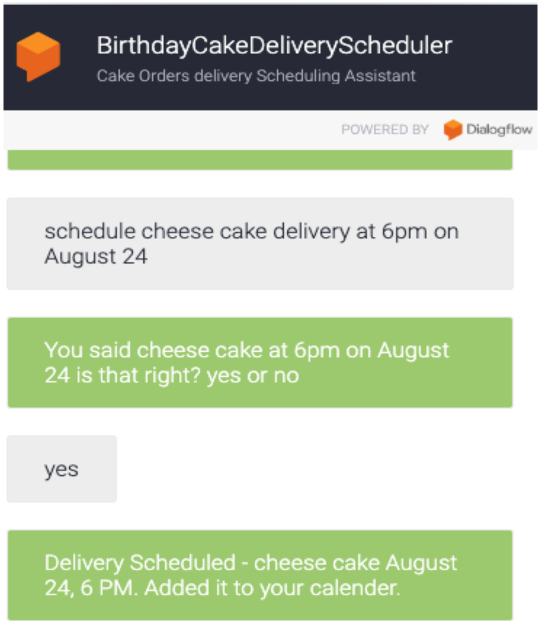
Step 1 - Describe the Application

What application do you plan to build? Please describe the application in detail and explain why you are planning to build it.

Answer : I have built an agent in DialogFlow (BirthdayCakeDeliveryScheduler), which is like an assistant to a birthday cake shop owner, who can schedule a new order of cake of 3 varieties like *cheese, chocolate and vanilla* (custom entity) to deliver for a given date ex. 14 August and time ex. 4pm. If the user has no preference, the store owner/user of the agent can also say any cake if there is no preference for a cake preference. This agent makes profuse use of contexts to remember what has been already said to it in multiple conversation turns and save the data by creating an event on Google Calendar using its API. So that It can be fetched later.

I have implemented all the crud operations like create, update, delete and get :-

1. **Creating a new order** (***New Order Intent***)
    a. Create a new order and edit it if there is any correction in order before saving, by saying no (*No Intent*), followed by details like *type of cake*, *time* or *date* based on which data needs to be updated.
    b. Right from the new order intent followed by editing any information till the confirmation, an order context is transferred from one to another intent passing the current context parameters to the next. So that it feels like until an order is confirmed the agent never forgets any order details which are currently being discussed and we can edit as many times and we want because I have given a *lifespan of 50* which is fairly a large number.
    c. Finally when the order is confirmed, save it to google calendar on a *1 hour* slot. The cake type is the summary/title of the event saved. The active contexts are deleted after this action. Orders are currently updated in my calendar, as the service account key json client email has the permission to edit my calendar events. Images of calendar events are attached in the next page.
    d. Failure message in new order saving if there already exists an order for the same slot

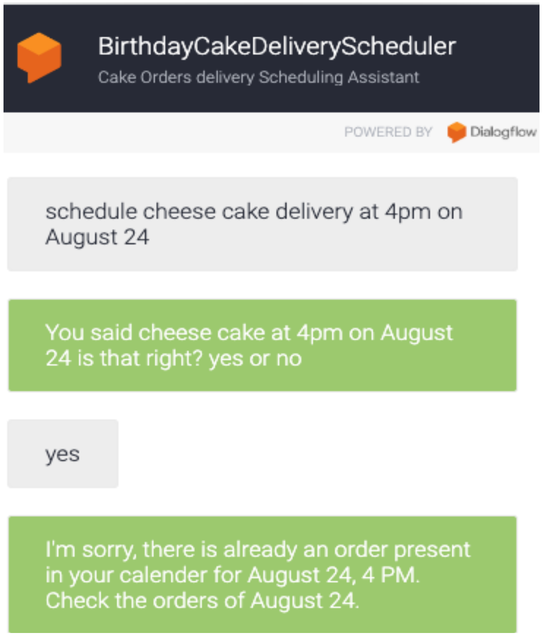

BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

schedule cheese cake delivery at 6pm on August 24

You said cheese cake at 6pm on August 24 is that right? yes or no

yes

Delivery Scheduled - cheese cake August 24, 6 PM. Added it to your calender.

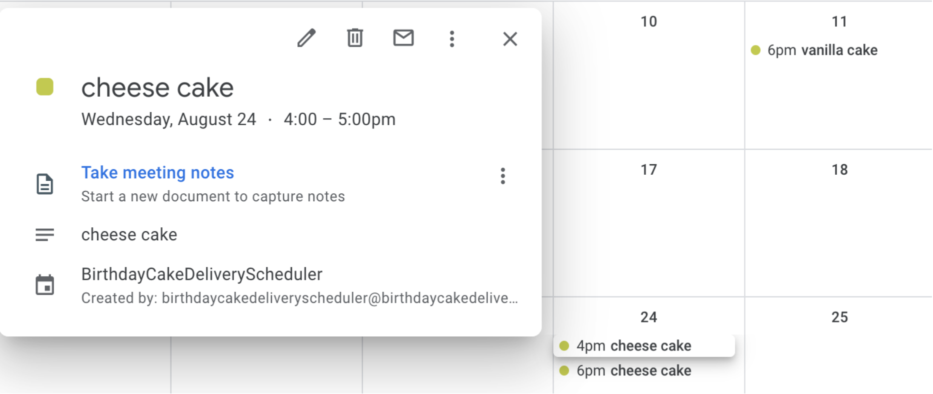

BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

schedule cheese cake delivery at 4pm on August 24

You said cheese cake at 4pm on August 24 is that right? yes or no

yes

I'm sorry, there is already an order present in your calender for August 24, 4 PM. Check the orders of August 24.



cheese cake

Wednesday, August 24 · 4:00 – 5:00pm

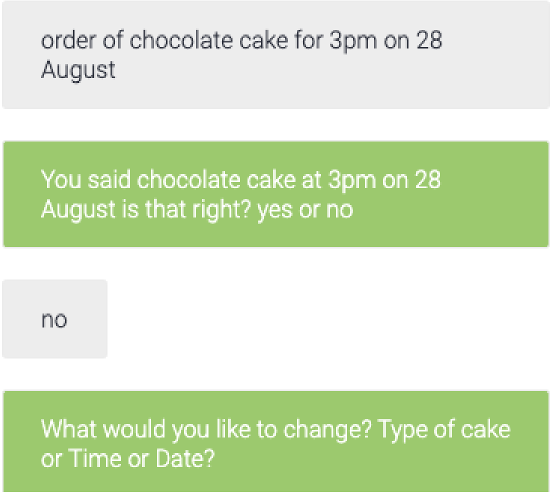
Take meeting notes

Start a new document to capture notes

cheese cake

BirthdayCakeDeliveryScheduler

Created by: birthdaycakedeliveryscheduler@birthdaycakedelive…

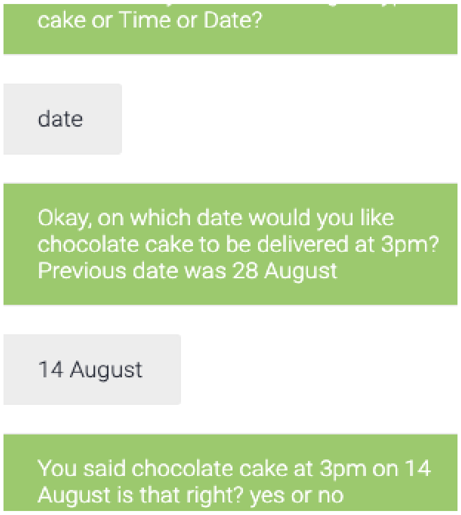


order of chocolate cake for 3pm on 28 August

You said chocolate cake at 3pm on 28 August is that right? yes or no

no

What would you like to change? Type of cake or Time or Date?



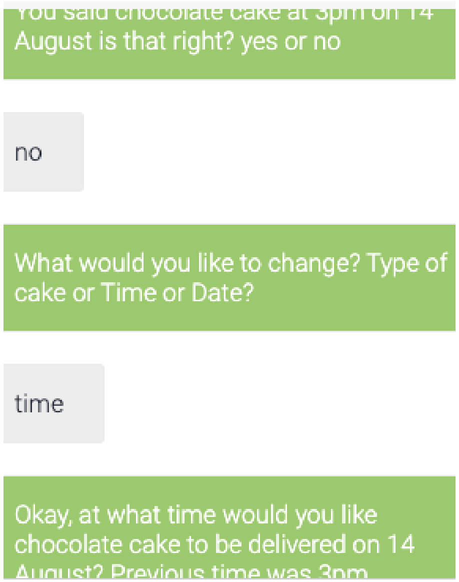
cake or Time or Date?

date

Okay, on which date would you like chocolate cake to be delivered at 3pm? Previous date was 28 August

14 August

You said chocolate cake at 3pm on 14 August is that right? yes or no



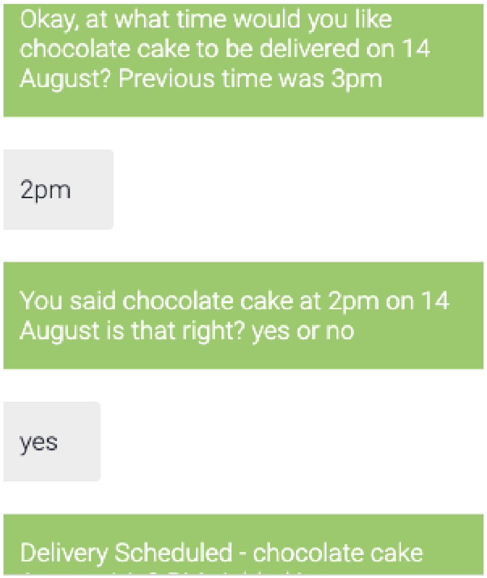
You said chocolate cake at 3pm on 14 August is that right? yes or no

no

What would you like to change? Type of cake or Time or Date?

time

Okay, at what time would you like chocolate cake to be delivered on 14 August? Previous time was 3pm



Okay, at what time would you like chocolate cake to be delivered on 14 August? Previous time was 3pm

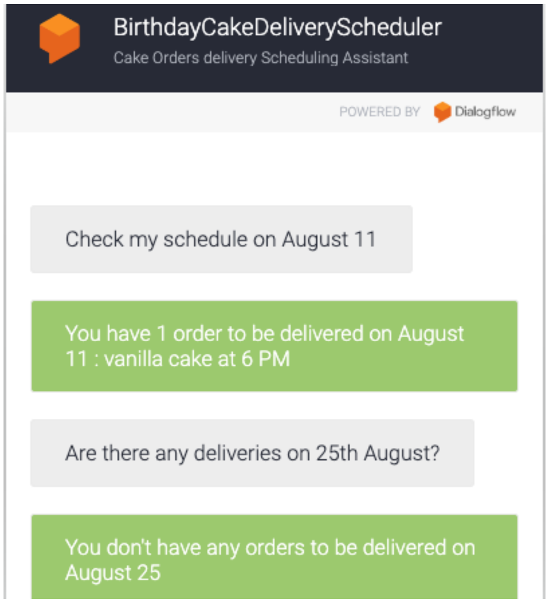
2pm

You said chocolate cake at 2pm on 14 August is that right? yes or no

yes

Delivery Scheduled - chocolate cake

2. **See all orders to be delivered on a date ex.** 24 August **(*Get Orders Intent*)**
    a. For this intent the agent shows all our scheduled orders for a day starting from 12 am to midnight. I haven't limited the number of orders to be shown, but it also can be done very easily.
    b. Only one required parameter here is the date. Based on the date a time slot of *24 hours* is searched in the calendar for any events and a list of events is returned in response if it exists in the calendar or a message is displayed.



BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

Check my schedule on August 11

You have 1 order to be delivered on August 11 : vanilla cake at 6 PM

Are there any deliveries on 25th August?

You don't have any orders to be delivered on August 25

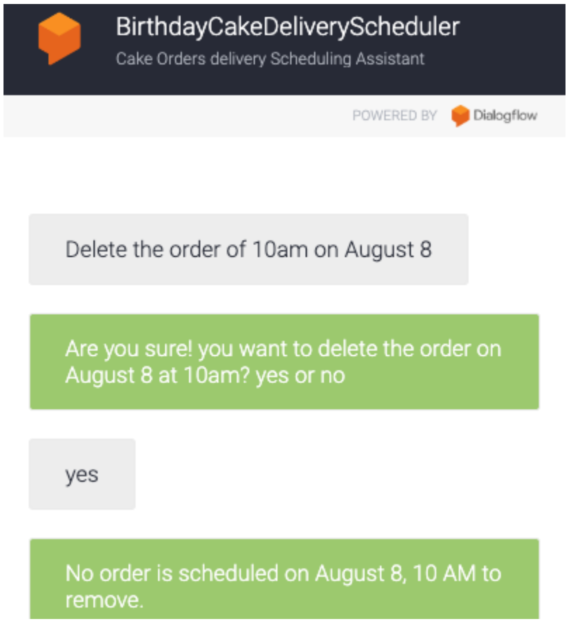
3. Delete an existing order from calendar (*Delete Order Intent*)

a. This intent removes the order scheduled in the calendar. The required parameters are *date* and *time*. Depending on the time which is the start time plus *1 hour* is the end time for the event slot which is to be deleted. I have purposefully not taken the cake type as there can be a lot of chocolate cake orders in a single day.

b. As delete is an irreversible process, i.e once deleted cannot be retrieved, so I have added a confirmation for details given, which are to be confirmed by follow up intents yes/no. Once confirmed with a yes then only request is sent to webhook fulfillment.

c. Naturally a context is sent between follow up events so, after yes intent, I get all the details from delete context required for deleting an order in the calendar. When the request reaches the delete intent handler, is it required to close the delete context for the purpose of not initiating a new delete intent by mistake by saying yes again.

d. If No is said, then no request is sent to fulfillment and delete request context is closed.

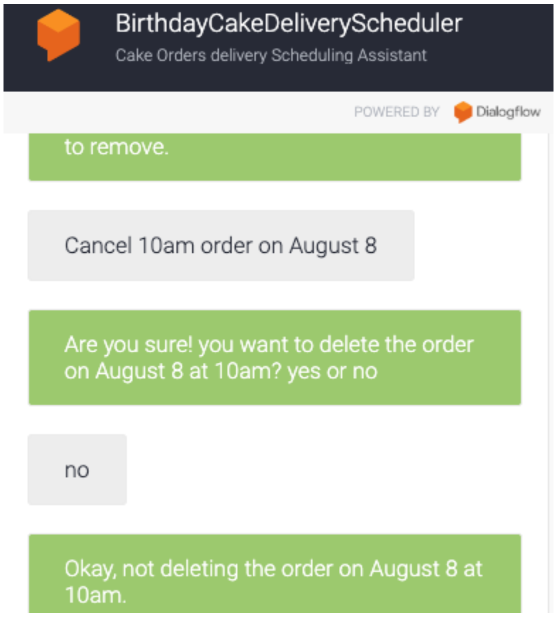

BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

Delete the order of 10am on August 8

Are you sure! you want to delete the order on August 8 at 10am? yes or no

yes

No order is scheduled on August 8, 10 AM to remove.


BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

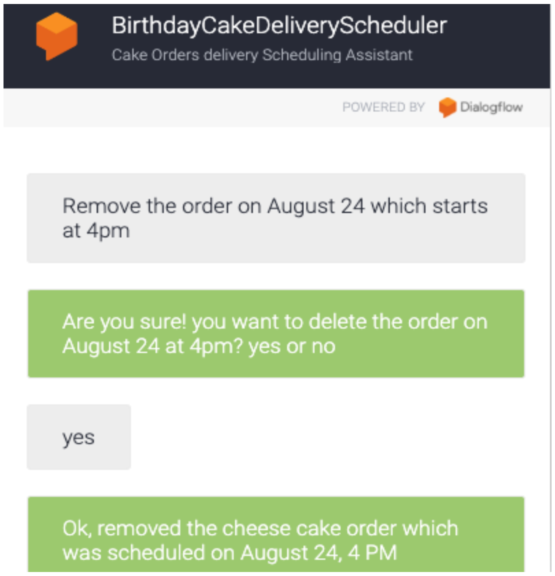
to remove.

Cancel 10am order on August 8

Are you sure! you want to delete the order on August 8 at 10am? yes or no

no

Okay, not deleting the order on August 8 at 10am.


BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

Remove the order on August 24 which starts at 4pm

Are you sure! you want to delete the order on August 24 at 4pm? yes or no

yes

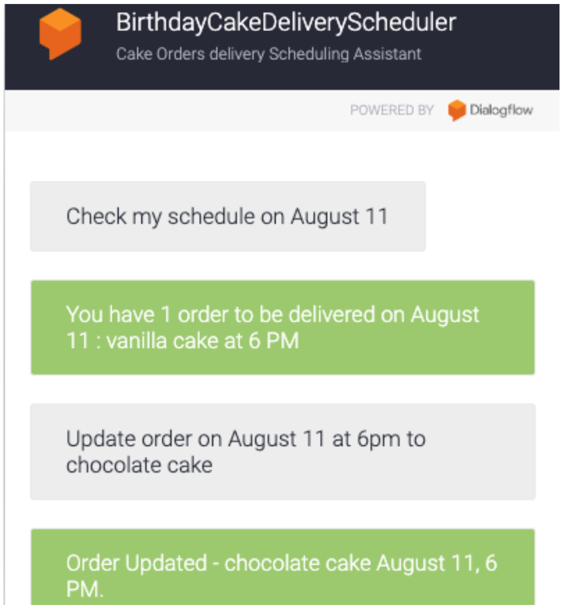
Ok, removed the cheese cake order which was scheduled on August 24, 4 PM

4. Update the cake type of an existing order (*Update Cake Type Intent*)

a. Using this intent we have the option to change the cake type for an existing order. The required parameters are *type of cake*, *time* or *date* same as create new order intent required parameters.

b. The agent searches the calendar based on *time* as start time plus 1 hour as end time on the given *date* and updates the summary/ title of the event to the updated new cake type.

c. Update operation is one turn operation if all parameters are given in one go. As this operation is safe and can be performed multiple times so I have not added any confirmation. But if it is required it is not such a big task.


BirthdayCakeDeliveryScheduler
Cake Orders delivery Scheduling Assistant
POWERED BY Dialogflow

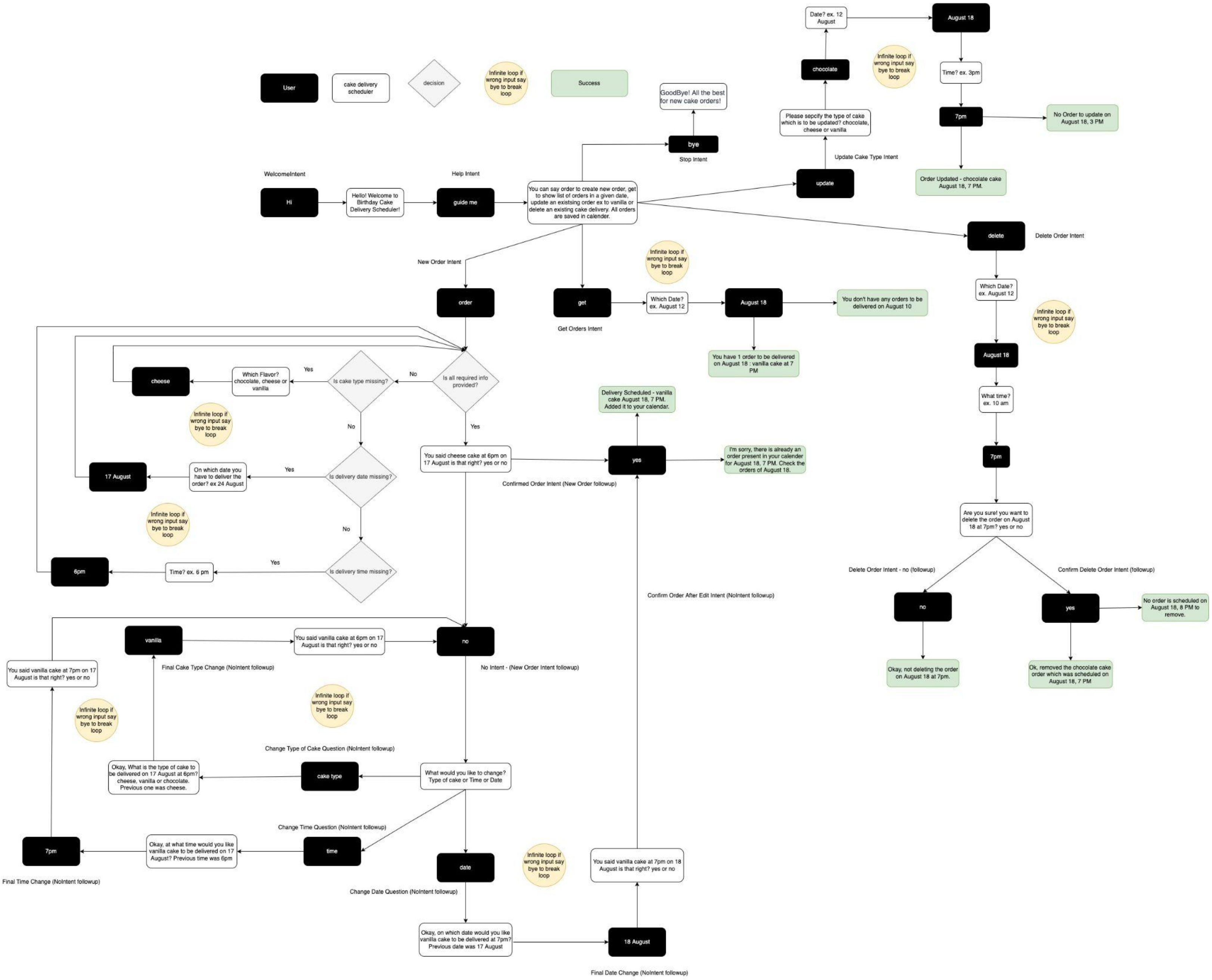
Check my schedule on August 11

You have 1 order to be delivered on August 11 : vanilla cake at 6 PM

Update order on August 11 at 6pm to chocolate cake

Order Updated - chocolate cake August 11, 6 PM.

Conversational Flow Diagram


User
cake delivery scheduler
decision
Infinite loop if wrong input say bye to break loop
Success
WelcomeIntent
Hi
Hello! Welcome to Birthday Cake Delivery Scheduler!
Help Intent
guide me
You can say order to create new order, get to show list of orders in a given date, update an existsing order ex to vanilla or delete an existing cake delivery. All orders are saved in calender.
bye
Stop Intent
GoodBye! All the best for new cake orders!
update
Update Cake Type Intent
Please sepcify the type of cake which is to be updated? chocolate, cheese or vanilla
chocolate
Date? ex. 12 August
August 18
Infinite loop if wrong input say bye to break loop
Time? ex. 3pm
7pm
No Order to update on August 18, 3 PM
Order Updated - chocolate cake August 18, 7 PM.
delete
Delete Order Intent
Which Date? ex. August 12
Infinite loop if wrong input say bye to break loop
August 18
What time? ex. 10 am
7pm
Are you sure! you want to delete the order on August 18 at 7pm? yes or no
Delete Order Intent - no (followup)
Confirm Delete Order Intent (followup)
no
yes
No order is scheduled on August 18, 8 PM to remove.
Okay, not deleting the order on August 18 at 7pm.
Ok, removed the chocolate cake order which was scheduled on August 18, 7 PM
New Order Intent
order
get
Get Orders Intent
Infinite loop if wrong input say bye to break loop
Which Date? ex. August 12
August 18
You don't have any orders to be delivered on August 10
You have 1 order to be delivered on August 18 : vanilla cake at 7 PM
Is all required info provided?
No
Is cake type missing?
Yes
Which Flavor? chocolate, cheese or vanilla
cheese
Infinite loop if wrong input say bye to break loop
No
Is delivery date missing?
Yes
On which date you have to deliver the order? ex 24 August
17 August
Infinite loop if wrong input say bye to break loop
No
Is delivery time missing?
Yes
Time? ex. 6 pm
6pm
Yes
You said cheese cake at 6pm on 17 August is that right? yes or no
Confirmed Order Intent (New Order followup)
yes
Delivery Scheduled - vanilla cake August 18, 7 PM. Added it to your calendar.
I'm sorry, there is already an order present in your calender for August 18, 7 PM. Check the orders of August 18.
Confirm Order After Edit Intent (NoIntent followup)
vanilla
Final Cake Type Change (NoIntent followup)
You said vanilla cake at 6pm on 17 August is that right? yes or no
no
No Intent - (New Order Intent followup)
You said vanilla cake at 7pm on 17 August is that right? yes or no
Infinite loop if wrong input say bye to break loop
Infinite loop if wrong input say bye to break loop
Change Type of Cake Question (NoIntent followup)
Okay, What is the type of cake to be delivered on 17 August at 6pm? cheese, vanilla or chocolate. Previous one was cheese.
cake type
What would you like to change? Type of cake or Time or Date
Change Time Question (NoIntent followup)
7pm
Okay, at what time would you like vanilla cake to be delivered on 17 August? Previous time was 6pm
time
Final Time Change (NoIntent followup)
date
Change Date Question (NoIntent followup)
Infinite loop if wrong input say bye to break loop
You said vanilla cake at 7pm on 18 August is that right? yes or no
Okay, on which date would you like vanilla cake to be delivered at 7pm? Previous date was 17 August
18 August
Final Date Change (NoIntent followup)

Step 2 - Interaction Model

Intents

1. *New Order Intent*
2. *Get Orders Intent*
3. *Update Cake Type Intent*
4. *Delete Order Intent*

Note : Some explanation details of each intent is present in the previous section.

Training phrases

New Order Intent

1. new order of any cake by 10 pm tomorrow
2. vanilla cake at 6pm today
3. order of chocolate cake for 3pm on 28 August
4. deliver order by 7pm tonight of cheese cake
5. schedule a delivery of chocolate cake by 10 pm on Wednesday
6. new order of vanilla cake for tomorrow at 9am
7. order of vanilla cake delivery by 9pm today
8. schedule cheese cake delivery at 4pm on August 24
9. any cake on 23 August at 10 am
10. chocolate cake at 8 pm on 22 August
11. order to deliver by 5pm on 22 August of chocolate cake
12. New cake order
13. Schedule cake delivery
14. Set the delivery time of chocolate cake at 8pm tomorrow
15. cake delivery order
16. new order
17. book 2pm tomorrow for chocolate cake
18. cheese cake delivery
19. cake at 10 pm
20. vanilla cake order
21. new delivery
22. order of cake on 25 August
23. delivery of cake by 10 pm
24. schedule a cake delivery on 28 August
25. schedule a cake delivery at 7pm
26. what my day like on August 12
27. schedule a new order

Get Orders Intent

1. what is scheduled on Tuesday
2. show the list of orders on Monday
3. show the list of orders
4. Show me all the orders
5. Are there any deliveries on 2nd September?
6. Are there any orders tomorrow?
7. What is my schedule today?
8. show my schedule
9. get deliveries of August 28
10. get orders of September 10
11. show list of orders on August 12.
12. Check orders on August 19.
13. Check orders for August 18th.
14. Is there any order on August 13?
15. Any deliveries on August 12?
16. What is scheduled on August 5?
17. Check my schedule for today
18. Check my schedule on August 13.
19. Do I have any orders on Monday?
20. Do I have any deliveries on Monday?
21. What are the deliveries scheduled on Tuesday?
22. What are the deliveries scheduled on August 12?
23. What are the deliveries for today?
24. How many orders for tomorrow to be delivered?
25. How many deliveries for tomorrow?
26. How many deliveries on August12?
27. How many deliveries are scheduled on August 13?
28. get
29. List
30. Get order
31. Get orders

Update Cake Type Intent

1. Update order on August 8 at 3pm to vanilla cake
2. Update existing order on August 8 at 3pm to vanilla cake
3. Change the type of cake to chocolate on Wednesday 12am
4. Update the type of cake to vanilla on August 12 at 10am
5. Change the cake type to cheese
6. Change the cake icing to chocolate
7. Change tomorrow’s order to vanilla cake
8. Change
9. Update
10. Change the order scheduled on Wednesday

11. I need to update an existing order
12. Need to update the cake type to cheese
13. Makes changes in cake type
14. Update the cake type to chocolate
15. Update the cake type
16. Update icing
17. Change order
18. Update an order
19. Type of cake needs to change
20. Makes changes to an order scheduled on August 15
21. Update an order scheduled on August 15
22. Change the type of cake scheduled on Tuesday
23. Change cake type
24. Update cake type to cheese for an order
25. Need to make an update

Delete Order Intent

1. Delete the order of 10am on August 8
2. Cancel the order of 10am on August 8
3. Remove the order of 10am on August 8
4. Drop the order of 10am on August 8
5. Delete the delivery of 10am on August 8
6. Cancel the delivery of 10am on August 8
7. Drop the delivery of 10am on August 8
8. Drop order
9. Delete order
10. Cancel order
11. Remove order
12. Drop delivery
13. Delete the cake order
14. Cancel a cake delivery
15. Remove delivery
16. Delete 10am order on August 8
17. Cancel 10am order of tomorrow
18. Remove 10am order of Sunday
19. Drop 10am order on August 8
20. Delete 10am delivery on August 8
21. Cancel 10pm delivery of today
22. Drop 11pm delivery on August 8
23. Delete the delivery on August 10 which starts at 10am
24. Remove the order on August 10 which starts at 10am
25. Cancel the delivery on August 10 which starts at 7am

Parameters

Custom Entity

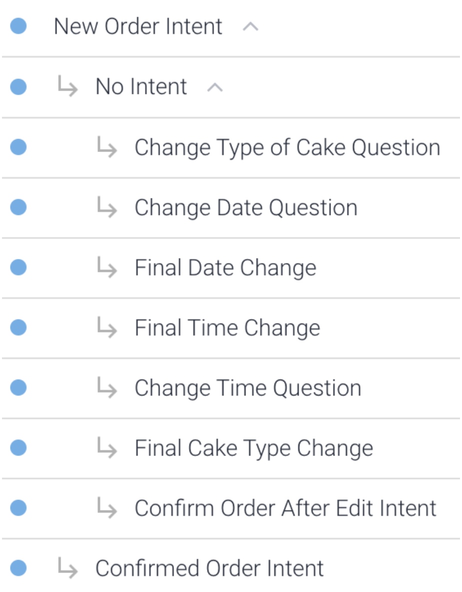
Entity Name	Values
TypeOfCake	chocolate, cheese, vanilla, any

System Entities

Parameter Name	Entity
date	@sys.date
time	@sys.time

Step 3 - Fulfillment

1. *New Order Intent*



- New Order Intent
  - ↳ No Intent
    - ↳ Change Type of Cake Question
    - ↳ Change Date Question
    - ↳ Final Date Change
    - ↳ Final Time Change
    - ↳ Change Time Question
    - ↳ Final Cake Type Change
    - ↳ Confirm Order After Edit Intent
  - ↳ Confirmed Order Intent

New Order Intent takes three **required** parameters from the user which are **type of cake, date and time**. Confirms whether all details given by the user and understood by system are correct before adding it to their calendar. If the order is correctly understood by the system at the first attempt, *Confirm Order Intent* is called and delivery order is scheduled in the calendar using *googleapis*. At this stage if the user wants to change some or all of the given details among type of cake, date and time. He/She can do it by using the *No Intent* and its six follow up intents, once the user finally agrees with the order after updating some parameter value, *Confirm Order After Edit Intent* is called to save the data. In code *Confirm Order Intent* and *Confirm Order After Edit* calls the same handler method to save the new order. I had to create two separate intents for saving correct data, especially *Confirm Order After Edit* because, while I was updating data under *No Intent* and if I say yes, some of the updated data was lost. Flow explained in Conversational Flow Diagram and more details present in 1st section.

2. *Get Orders Intent*

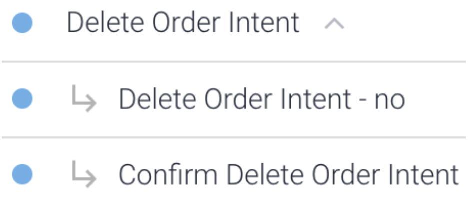
Get Orders Intent, fetches the existing orders of a particular date ex 24 August. Therefore the only required parameter here is date. Based on the date a time slot of 24 hours is searched in the calendar for any events and a list of events is returned in response if it exists in the calendar or a message is displayed. Currently no limit or sorting has been applied on the returned list. The length of the event list is shown as count to the user.

3. *Update Cake Type Intent*

Update Cake Type Intent, only update the type of cake, which is the summary of a calendar event for particular date and time ex 12 August 8pm respectively. Therefore two required parameters here date and time. Time here is the start time of an event. I am allocating an hour for each delivery order event scheduled. First, we fetch a list of events from the calendar for the given date and time. Only one event should be there if order exists for that 1 hour slot, get the id of the event and update the summary using that event id.

4. *Delete Order Intent*

Delete Order Intent, deletes an existing order. It is a danger zone so confirmation is required before actual removal of data from the calendar. Therefore it has yes and no followup intents. It takes two required parameters: date and time for searching which event to delete, same logic for searching as in update, but in this case we call the delete api using the event id. If no event is found, no event is removed, just a message is given back to the user. The messages have been shown in the Conversational Flow Diagram.



- Delete Order Intent
  - ↳ Delete Order Intent - no
  - ↳ Confirm Delete Order Intent

Step 4 - User Testing

5 tasks

Sr No.	Task	Time to Complete	User 1	User 2
1	Create new order	24 secs	35 secs	39 secs
2	Edit Order	48 secs	56 secs	67 secs
3	Get orders	22 secs	23 secs	27 secs
4	Update Cake Type	17 secs	20 secs	23 secs
5	Delete Order	14 secs	26 secs	29 secs

Likert Scale 10 questions

Sr No.	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	It is fun to play around with the system					😃
2	It feels like I am having a conversation with someone					😃
3	I find the system entertaining					😃
4	I will try to avoid using this system in the future	😃				
5	I like the idea of being able to interact with this					😃
6	The system is confusing		😃			
7	I would be happy to use this system again				😃	
8	The conversation feels very restricted to me		😃			
9	I am happy with the help offered					😃
10	The system is easy to use					😃

3 open-ended questions

1. Among all the intents, which is the hardest to execute?
2. What do you think could be improved to provide a better experience?
3. Did you ever felt lost or confused in any step, stuck in a loop, not knowing how to proceed?

Step 5 - Review and Reflection

General Impressions: **What worked well in this assignment? What did not? Are there parts of the assignment you would want to change?**

Answer : The four intents that I have built are working wonderfully well which I didn't expect I could do even after the end of HW3. I decided to do a completely different project from my previous HWs. What worked well, for the final project, was the community or the discussion group. On the day of HW3 zoom call, when I saw what others were doing, it completely blew my mind. After that demo call, I immediately started creating and building new agents which can have memory across multiple turns. I got new ideas and a new perspective only after that call. Before that I was unaware of many things necessary for building truly interactive agents.

About the parts of the assignment I would want to change, would be adding more intents and related to fetching details, currently the user can only see orders for a given date. There is no limit on the number of results to be shown to the user. The flow should be like this: first we have to see how many orders are present, if it is more than say 6, we can show 5 of them and provide the total number of results present to the user, if the user agrees to listen to some more, we should ask them how many they would like to listen to then only the agent reads further. I would like to add some display elements like Cards and Suggestions, which I couldn't do in Web Demo, as it accepts only simple text.

***Time:* How much time did you spend on this assignment? What steps took the longest to complete? Was there anything particularly difficult and time-consuming?**

Answer : I officially started to work towards this assignment from Wednesday 3rd August, at that time I haven't decided what I should build. Previously the use case I was building was to *book a flight*. In that I added a json object with city names as key and based on user input of city, it was just one turn of conversations to fetch from that json object.

However this time, I wanted to build something that can be really conversational across multiple turns. I also wanted to save the data i.e use some kind of database, so that the agent has a memory of what had happened earlier or has been said to it earlier. Therefore I built an agent, whose user is a cake shop owner, who schedules his order delivery and checks the orders before delivery. I didn’t step into creating this project from the first day, I had to try two agents before building this one. *I spent one day creating a true conversation agent using contexts.* This is the first time I was using the contexts. Later I wanted to save the data. By going through some tutorials, I saw that a calendar can be a good option for storing any events. *It took me two days to implement these four intents correctly without any errors.* I had to search through the internet for the issues, I went to stackoverflow, various blogs whenever I was stuck. So I can say till Sunday morning i.e August 7 I was correcting, testing my agent. Some of the places I got stuck was to delete a context, make its lifespan as 0, after the intent has been successfully completed. Making intent carry contexts or make it followup intents, what should the lifespan be. There is not much documentation for google calendar apis directly in node.js all in one place. There even for finding function names, and its required resource parameters for update and deleting etc, I had to struggle. *Two more days to combine the context thing along with the calendar thing.* So it took me ***five days*** to completely build this agent to run without error as expected from planning to delivery.

Managing contexts are confusing and difficult to manage, eventually I learnt how to do it. Reading documentation and scattered context across the internet for google calendar also took time.

Testing: **In terms of testing, what type of testing turned out to be the most useful? What questions and tasks gave you the most insight into issues with your application? What did you learn from your user testing? How would you continue testing this application if you had more time?**

Answer : I had given around 3 days to build and 2 days to test the agent. By the way, development and testing were going hand in hand. So I feel I have given sufficient time to the agent. In terms of testing, self testing tells you all possible corrections for a positive flow, but giving it to another user for testing after it has been tested by you also provides feedback of what got ignored. A user who doesn't have any knowledge of what to do with an app, can tell you how to improve the user experience.

My new order intent was not working correctly, sometimes even updating the order, the agent showed correct data before saving but when it saved the data it saved old non updated data, so I understood there is some issue with old contexts. Earlier some of them were not followup intents. I had to change the structure of intents many times to correctly reach this point. If I had more time, I would like to use this agent in other integrations which have visual display, card and suggestions.

Future Work: **Are there parts of the application that need more work? What about testing? Are there features you would have liked to add?**

Answer : I have added all CRUD operations, like adding, fetching, updating and deleting an order. But I have made a very basic model of a cake store because I focused on context management and google calendar api for the final project. I left that part. Otherwise, I could have added various varieties of cake, amount of cakes required, and used another database to store orders instead of google calendar. In an actual cake store, there can be multiple deliveries in the same hour, which is not possible with my agent, as in the calendar there will be conflicts if we try to save more than one event at the same time. I know order management and delivery requires different infrastructure and for the purpose of this project and my learning I choose Google Calendar. I could have added intents like “Please add three vanilla cakes, two chocolate cakes, one cake with no preference orders for tomorrow.” or “New order for pineapple cake with ‘Happy birthday John’ written on it, they want the theme to be cricket.” or “Add one pastry, to tomorrow's 3pm delivery.” or “What is the stock left in my store for the orders to be delivered tomorrow, is there anything I have to buy?”