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ISY5005 Intelligent Software Agents (Intelligent Process Automation) Group Project

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# Executive Summary

Singapore is widely regarded as a food capital due to the wide variety of cuisines available due to our multi ethnic composition. The food and beverage industry in Singapore was worth \$8.3 billion dollars in 2019 and is expected to grow 2.1% over the next five years. This growth is aligned to the exponential global food and beverages (F&B) growth, alongside the growth in urban populations worldwide. Individuals are becoming more discerning, driving demand more nutritious, healthy food.

Competition is stiff in the F&B industry, with over 6,500 establishments. An increase in the number of competitors in the market offering similar and new products that are competitively priced could have also posed a challenge for many F&B operators here, and many new F&B joints struggle to differentiate themselves and establish a following. Some of the challenges which F&B might face is high rental and food cost, but most critically the lack of manpower.<sup>1</sup>

One perpetual problem faced by diners is having to make dining choices and the numerous steps involved in ensuring an enjoyable dining experience. This process encompasses the search for restaurants, reading available reviews and opinions of restaurants and checking availability of the restaurant for reservations. On the other hand, establishments seek to minimize their marketing costs and build a customer base. Makan Buddy seeks to address both problems from a consumer and business perspective. By leveraging on process automation and machine learning, we want to be able to connect diners to new restaurants and make the process of restaurant reservation a more seamless and enjoyable experience.

## Introduction

### Business Opportunity

According to the Department of Statistics, in 2017/2018, households spent S\$1,199 on food monthly, or 24% of their average monthly expenditure, due to increased spending in restaurants, cafes and pubs.<sup>2</sup> With increasing affluence and millennials entering the workforce, there is likely to be increased spending on mass market establishments. With a plethora of dining options available to choose from, one common first world problem faced by diners is having to choose a dining location.

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<sup>1</sup> "F&B sector set to grow as mass-market segment sizzles ...." 11 Sep. 2019, <https://sbr.com.sg/food-beverage/in-focus/fb-sector-set-grow-mass-market-segment-sizzles>. Accessed 29 Mar. 2020.

<sup>2</sup> "The average Singaporean household spends S\$4,900 ...." 1 Aug. 2019, <https://www.businessinsider.sg/the-average-singaporean-household-spends-s4900-monthly-with-the-most-going-to-food-and-transport-survey>. Accessed 29 Mar. 2020.

## Proposed Solution

Makan Buddy is an intelligent software agent-based offering which consists of several agents working together to provide a seamless restaurant search and reservation service to users.

Makan Buddy offers the following key features:

- Slack Chatbot Agent, where users indicate their dining requirements
- Food Discovery where users are shown visual food images and users can indicate their preferences
- Intelligent Recommendation system which identifies an ideal candidate restaurant based on indicated preferences
- Automated Reservation service with accompanying calendar event creation

## Market Research and Business Strategy

### Consumer

A survey conducted by Sydney-based research firm BIS Shrapnel showed that the average Singaporean spends \$1,900 a year at hawker centres, restaurants, and cafes. The largest segment of the F&B sector is the mass market segment, which is characterized by spending of \$20 or less per head is worth an estimated \$6.2 billion or 75% of the overall F&B market. Based on Euromonitor's estimate, there are about 28,000 food service outlets in Singapore as of 2018, with the majority being street stalls/kiosks. Consumer food service in Singapore is dominated by independent street stalls and kiosks, which are hawker stalls and small individually owned F&B outlets. The number of independent street stalls and kiosks accounted for close to 80% of total Singapore foodservice outlets in 2016.

### Business

However, due to the availability of many close substitutes in the market and a highly challenging business environment, mass market establishments often struggle to be profitable. The low barriers of entry, high costs and faddish consumers have made it very difficult for anyone to succeed. In the F&B industry, many restaurants and cafes come and go. About 28 percent of F&B outlets in Singapore close within a year of opening.<sup>3</sup>

The rise of social media and influencers has changed the way F&B companies advertise and promote their businesses. Social media can improve brand awareness, lower marketing costs, and is able to target specific audiences. Social media and blogs are now part of how operators advertise and promote their food. The use of social influencers therefore allows food products and dining experiences to be reviewed and profiled independently via word of mouth.

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<sup>3</sup> "Commentary: F&B businesses cannot rely on fads to thrive ...." 14 Aug. 2017, <https://www.channelnewsasia.com/news/singapore/commentary-f-b-businesses-cannot-rely-on-fads-to-thrive-9085438>. Accessed 29 Mar. 2020.

## Target Customers

The target customers for Makan Buddy are:

- **Consumers:** in particular young millenials who are tech savvy and have high disposable income.
- **Businesses:** Mass Market F&B joints or new establishments who want to keep marketing costs low and are eager to leverage on technology

## Business Model

For consumers, eventually the goal would be to make Makan Buddy available as a free standalone application, downloadable to both iOS and Android users. The main source of revenue would be through Digital Advertising, displaying non intrusive banners and ads in our user interface.

For businesses, we would make available several options, for them to be ranked more favourably in our restaurant search algorithm, or restaurant similarity model. The likelihood of consumers dining in their restaurant would be higher. This tiered based approach will be based on a subscription model.

The following pricing model is proposed for the first year of operations, in order to keep pricing affordable while Makan Buddy builds a customer base.

Gold	\$500/Month
Silver	\$300/Month
Bronze	\$100/Month

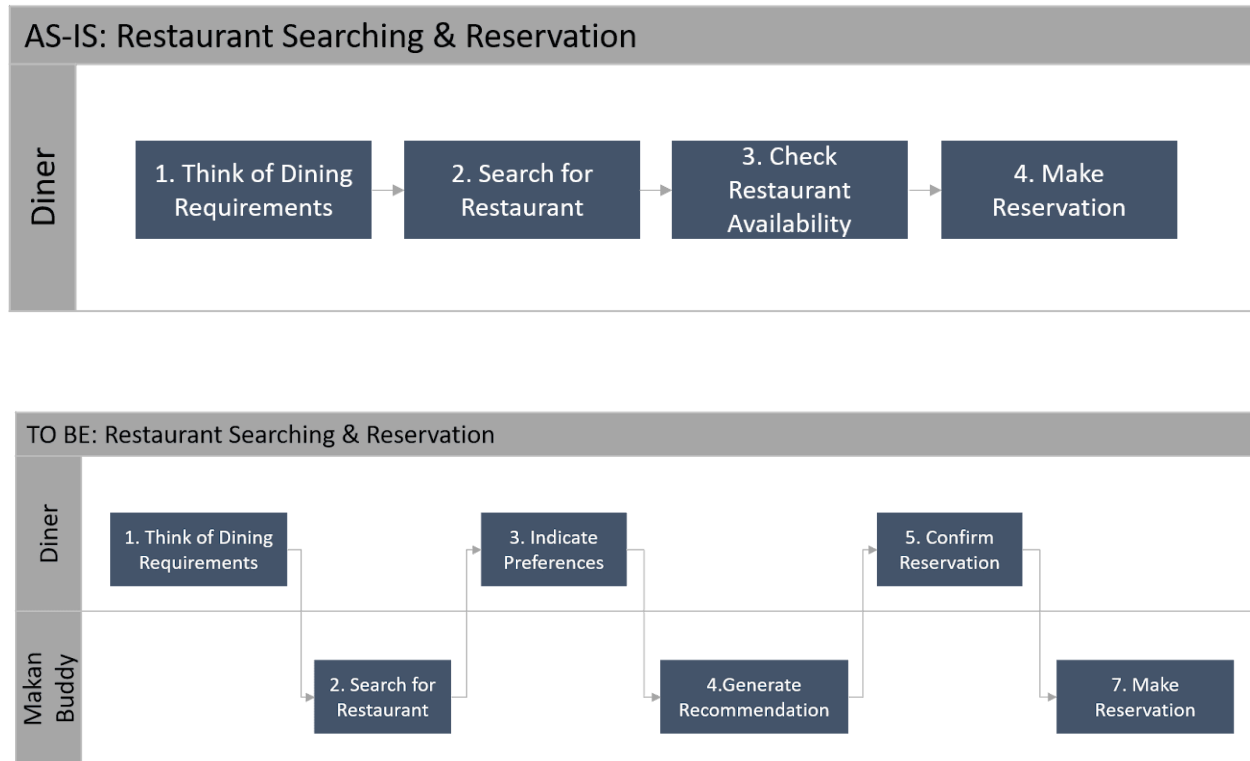
Based on a takeup rate of 3% of All F&B establishments in Singapore, the projected revenue for the first year, based on the lowest tier of the pricing model is \$1 Million. Assuming the adoption rate of Makan Buddy increases to 5% the following year, and we are able to convert half the existing client base to Silver tier, our second year projected revenue would rise to \$2.7 Million.

## Partnerships

Possible partnerships can be forged with food and restaurant review websites , such as HungryGoWhere or Burpple. The value proposition to them would be that users would be able to access their website in-app without having to navigate to a separate window. This would result in higher volume of traffic to their websites.

Offer publishers and consumer banks are also possible partners. Offer publishers, such as The Entertainer would be able to benefit from advertising their services on our platform. Financial Institutions would be able to leverage our platform to advertise their credit card promotions when there are relevant promotions.

## Business Process Overview



## Solution Overview

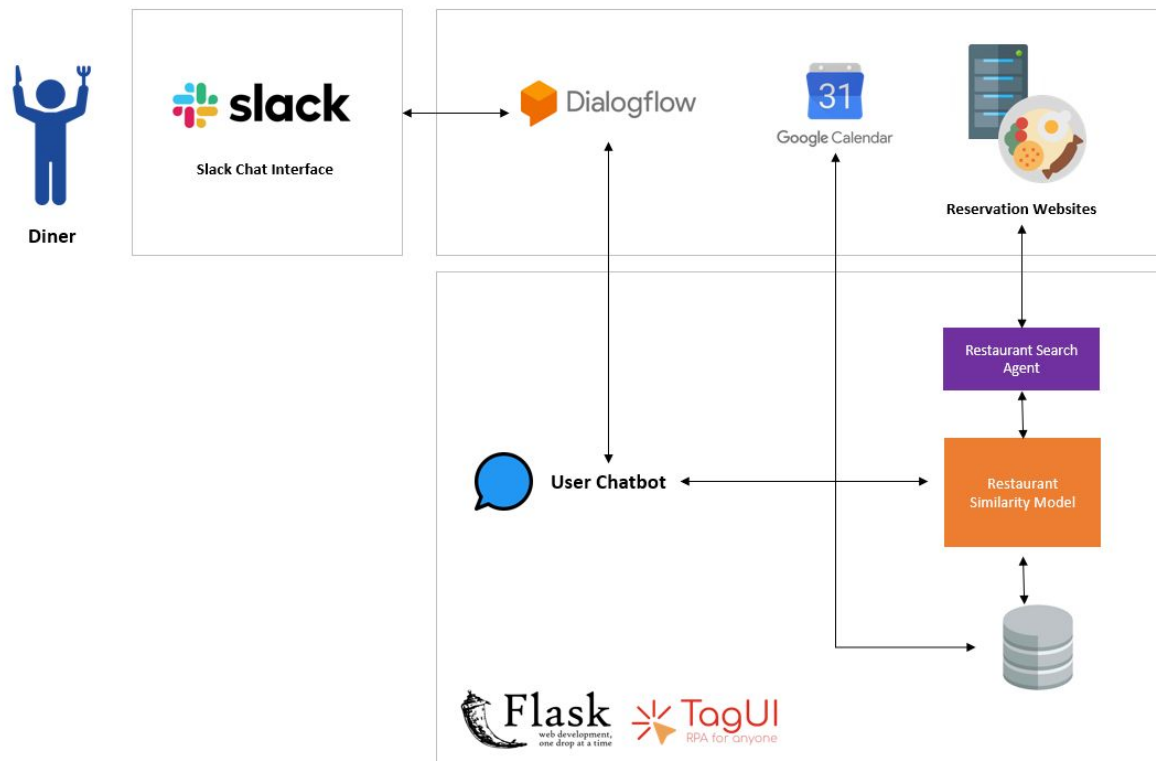
Makan Buddy consists of the following components:

Component	Description
User Fronting Chat-bot	Solicits dining requirements from user
Restaurant Search Agent	Query the restaurant database and presents list of images to users for them to provide their preference
Restaurant Similarity Model	Based on rating of images provided by users, recommend a restaurant for reservation

Reservation Agent	Make the Reservation and adds the Reservation to user's calendar
-------------------	--

## Solution Architecture

The following diagram depicts the high-level system architecture of Makan Buddy:



The User Fronting Chatbot provides a set of 5 randomly sourced food images, for users to indicate their preference. Users can rate each visual image from 1-5, the result will be fed as input to the Restaurant Similarity Model. The restaurant similarity model will then recommend a restaurant, based on similarity search. Upon indication of confirmation, the Reservation agent will make the reservation and a Google Calendar event will be created.

## User Fronting Chat-bot

The user fronting chat bot interacts with users, restaurant search agent and reservation agent to build up system flow. The chatbot is utilising Slack application integrated with Dialogflow and has been trained with 4 first level Intents and a number of follow-on Intents. Users request for restaurant info from Slack and by receiving responses from a restaurant search agent, chat bot will display a collection of 5 restaurant food images for users to provide a rating.

Once the user approves the recommendation from chatbot, the reservation agent will be triggered and chatbot will allow the user key in required data to fill up the reservation request.

*GetRestaurantInfo Intent :*

- User sends a request to find a restaurant. The Restaurant search agent will be triggered and basic restaurant information including name, image and rating box will be shown.
- User requests for restaurant information more than 5 times. The Restaurant Search agent will be triggered to provide a final result.

*GetRestaurantInfo-yes Intent :*

- Prompt for the user's name, email, phone number, party size, date and time for reservation after user's approval with follow up intents.

*ImageResponse Intent:*

- Update query with a value indicating how positive this query matches with the user's preferred restaurant.
- Continue displaying images for users to rate if there are less than five images rated.

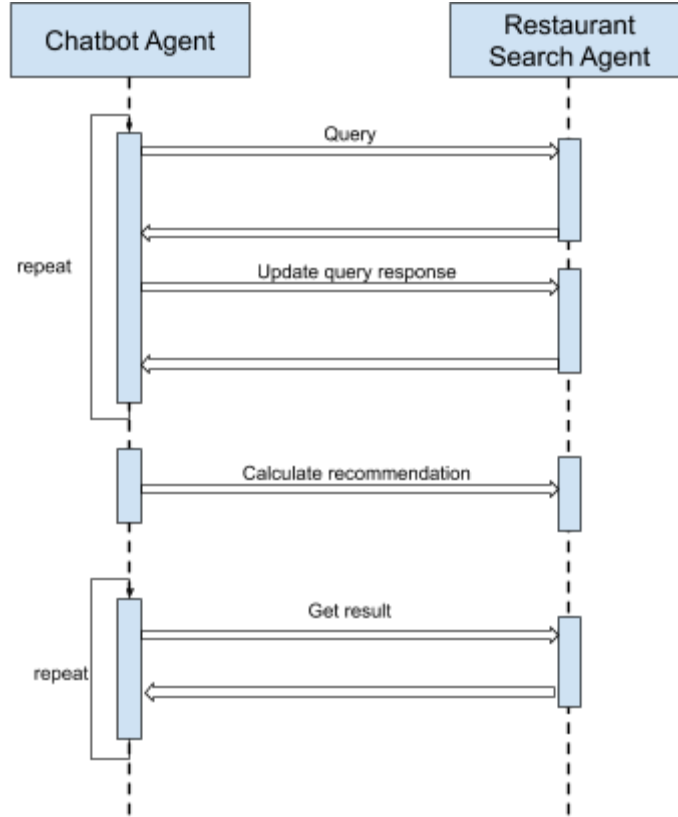
*ShowMe Intent:*

- Provide the final result to the user by detecting the keyword "Show me".

## Restaurant Search Agent

The restaurant search agent interacts with the chatbot agent by providing the functionality to query the restaurant data and evaluate the most relevant restaurant based on user queries. The diagram below shows the interaction between the chatbot agent and the restaurant search agent.





The “query” feature allows the chatbot agent to retrieve a query restaurant from the list of restaurants available. This query can then be updated with a value indicating how positive this query matches with the user's preferred restaurant. The chatbot agent can repeatedly query multiple times and each of these queries and responses are captured and forms a query set.

The “calculate recommendation” feature allows the chatbot agent to indicate that the query process is complete and this will trigger the calculation process. The agent will calculate for a list of restaurants that matches most to the query set. The next section will explain in detail the restaurant similarity model.

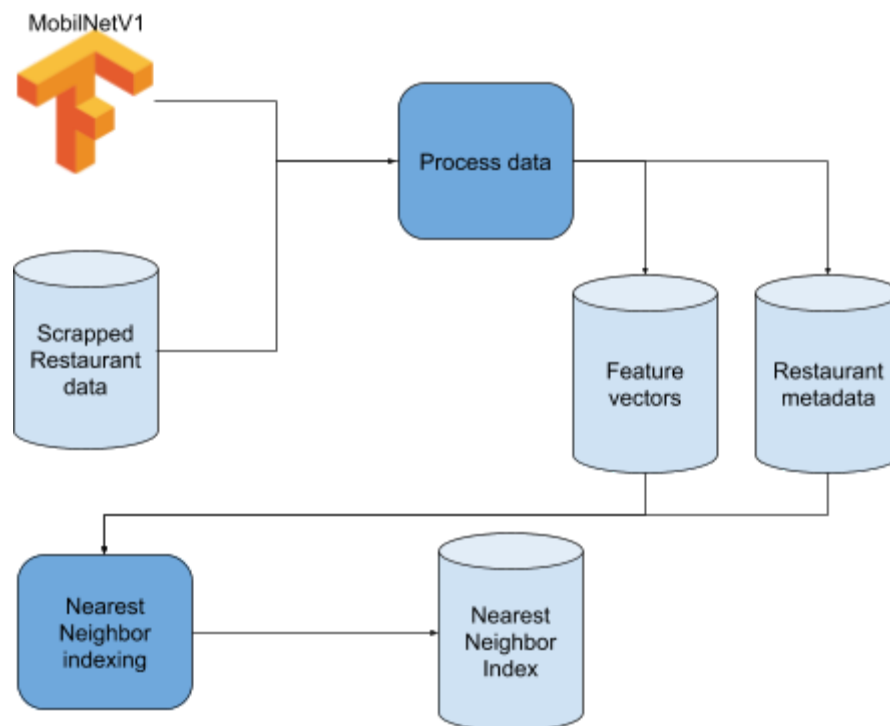
After the calculation is completed, the chatbot agent can repeatedly get a single restaurant result. Each result retrieval will return a restaurant in order of similarity score.

## Restaurant Similarity Model

The restaurant similarity model is a function which returns the similarity score of a restaurant with respect to a set of queries associated with its individual weights. Formally, let the set of all restaurants be  $X$ . Given  $x \in X$ , the query set,  $Q = \{q_1, q_2, \dots, q_m\}$ ,  $Q \subset X$  and weights,  $W = \{w_1, w_2, \dots, w_m\}$ , this model defines the function  $f(x, Q, W) = \text{similarity score}$ .

The similarity score calculation is borrowed from the idea of multi-query distance explained in A Similarity Search Approach to Solving the Multi-query Problems<sup>4</sup>.

To construct the model, the scrapped restaurant data, which contains restaurant metadata and images, have to be converted to a more structured form. The diagram below shows the data preprocessing process.



In the Process data step, images from each restaurant are converted into feature vectors using a pre-trained model (MobileNetV1) downloaded from Tensorflow Hub. The restaurant metadata maintains mappings to the converted feature vectors and original image files. The Nearest Neighbor Indexing step applies the Approximate Nearest Neighbor algorithm to construct an index of all restaurants and their  $k$  most similar restaurants, where  $k = 200$ . This nearest neighbor index is used as an optimization technique to reduce the search space to find the  $l$  most similar restaurants with respect to some unknown query set, where  $l = 5$ .

To get the  $l$  most similar restaurant with respect to a query set, first construct a set  $X$ , which is the union of all nearest neighbors of all items in the query set. For each of the element in set  $X$ , apply the model to calculate the similarity score with respect to the query set and weights, top  $l$  restaurants are returned as results.

<sup>4</sup> "A Similarity Search Approach to Solving the Multi-query ...."  
<https://ieeexplore.ieee.org/document/6211102/>. Accessed 3 May. 2020.

## Reservation Agent

The reservation agent checks the availability of the restaurant to accept the reservation, based on the proposed date, time and party size. If successful, the reservation agent makes the reservation at the restaurant and sends a confirmation email to the diner.

Once the reservation is confirmed by the restaurant, a calendar event is automatically created on the user's Google Calendar. Leveraging on Google Calendar API, the scheduling agent creates the event and the associated reminders, so that the user is reminded of the reservation beforehand.

## F&B Database

The restaurant database contains details of over 5000 F&B establishments in Singapore as well as more than 8000 images. This data was extracted through the use of TagUI web scraping. For each F&B establishment, details such as the Cuisine, Address, Number of Reviews, Ranking and Score were extracted. Images of the food served at the establishment were also extracted.

## Conclusion

Makan Buddy is a novel, fresh spin on a common daily activity. Food is one of things which Singaporeans are passionate about and we believe that Makan Buddy has the potential to change the way diners discover new food options. By providing a more intuitive and seamless way to select dining options, Makan Buddy makes new dining places more accessible to individuals.

By combining different intelligent techniques such as the usage of chat bots, Machine Learning and Robotic Process Automation, Makan Buddy presents an exciting new way for users to make reservations. Makan Buddy is just but an example how simple everyday tasks can be reimagined, with the use of data and machine learning.

# References

[F&B sector set to grow as mass-market segment sizzles](#)

[Commentary: F&B businesses cannot rely on fads to thrive](#)

[The average Singaporean household spends S\\$4,900 monthly, with the most going to food and transport: Survey](#)

Makan Buddy Icon courtesy of Eucalyp: [Free icons designed by Eucalyp](#)

[A Similarity Search Approach to Solving the Multi-query Problems - IEEE Conference Publication](#)

## Annex A – User Guide

### Set up Dialogflow:

1. Import ISS-MAKANBUDDY in Dialogflow
2. Download project data from <https://drive.google.com/file/d/1jeFjC2Z-uo9ddXoMFJ4w31I0rEesYpE/view?usp=sharing>
3. Unzip project-data.zip into the project source root folder, there should be 3 folders (data, json, npz) and 1 json file (nearest\_neighbors.json) added to the project root folder
4. In the project source directory/
  - a. Install required python library using the following command:  
pip install -r requirements.txt
  - b. Run main.py in Spyder
  - c. Download ngrok, run ./ngrok http 8080 in terminal, get forwarding url(e.g: <https://043ef1bf.ngrok.io>)
  - d. In GetRestaurantInfo.py replace server\_url with url from step b

```
from pydialogflow_fulfillment import DialogflowResponse
from pydialogflow_fulfillment import SimpleResponse, Confirmation, OutputContexts, Suggestions
import json
import intelligence
import MakeReservation
from multiprocessing import Pool

server_url = "https://043ef1bf.ngrok.io"

CONTEXT_ASK_PROGRAMME = "getrestaurantinfo-followup"
CONTEXT_ASK_PROGRAMME_YES = "getrestaurantinfo-yes-followup"

def has_params(theKey, params):
    return theKey in params and params[theKey] != ""

def askDate(req):
    res = DialogflowResponse("What is the date you are looking at? (e.g. Date: dd/mm/yyyy)")
```

5. Go to Dialogflow console, replace fulfillment url with url from step 2b



## Webhook

ENABLED 

Your web service will receive a POST request from Dialogflow in the form of the response to a user query matched by intents with webhook enabled. Be sure that your web service meets all the [webhook requirements](#) specific to the API version enabled in this agent.

URL*	<input type="text" value="https://043ef1bf.ngrok.io"/>	
BASIC AUTH	<input type="text" value="Enter username"/>	<input type="text" value="Enter password"/>
HEADERS	<input type="text" value="Enter key"/>	<input type="text" value="Enter value"/>

6. In the Dialogflow console, go to 'Integration' section, enable Slack and take note of the OAuth Url and Events request Url.

 Slack 

Slack Verification Token \*


Success page (Optional)

☒ Process all messages


☐ Show URLs for legacy Slack workflow

Slack has released a new OAuth workflow. You can check [this documentation](#) for more information. If you are still using their legacy workflow, please switch to our V1 authentication endpoint.

OAuth URL:



Events Request URL:



[CLOSE](#) [STOP](#)

7. Copy the 'Client ID', 'Client Secret' and 'Verification Token' from 'Set up Slack application' step 9 and paste their values into the respective fields below.



button.

- To use [rich messages](#), copy the 'Events Request URL' value below and paste it into the 'Request URL' field from the Interactive Messages section of your Slack app settings.

More in the [documentation](#).

Slack Client ID \*

1067563323249.1057290567939

Slack Client Secret \*

20621c9e4780961b2fa1727986abdaf8

Slack Verification Token \*

f4oBnF0nwakU52xF6KH1bEuH

Success page (Optional)



Process all messages

[CLOSE](#)

[STOP](#)

## 8. Start the bot

## Set up Slack Application:

1. Create slack application in <https://api.slack.com/apps?new>
2. In the Slack app, go to the 'App Home' section and click the 'Review scope to Add' button.

slack api

Search

Docume

testtest

## App Home

**Settings**

- Basic Information
- Collaborators
- Install App
- Manage Distribution

**Features**

- App Home
- Incoming Webhooks
- Interactivity & Shortcuts
- Slash Commands
- OAuth & Permissions
- Event Subscriptions
- User ID Translation
- Where's Bot User

Slack ♥

Help

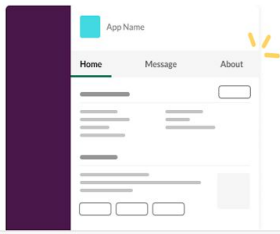
Contact

Policies

**Where people find your app on Slack**

Your app's home includes three tabs (Home, Messages and About) that help people have richer interactions with your app and better understand its functionality.

[Learn more](#)



**First, assign a scope to your bot token**

A [bot token](#) makes it possible for users to interact with your app. A bot token lets users at-mention it, and add it to channels and conversations. It also allows you to turn on tabs in your app's home.

[Scopes](#) govern an app's capabilities and permissions. You'll need to add at least one to your bot token to show the Home or Message tab in your app home. You can review and add the appropriate scopes under **Scopes** section in [OAuth & Permissions](#).

[Review Scopes to Add](#)

- Copy the 'OAuth URL' value from 'Set up Dialogflow' step 4 and paste it into the 'Redirect URL(s)' field from the 'OAuth & Permissions' section of your Slack app settings. Save URLs.

OAuth & Permissions

Event Subscriptions

User ID Translation

Where's Bot User

[App Directory Page](#)

Slack ♥

Help

Contact

Policies

Our Blog

[Reinstall App](#)

## Redirect URLs

You will need to configure redirect URLs in order to automatically generate the Add to Slack button or to distribute your app. If you pass a URL in an OAuth request, it must (partially) match one of the URLs you enter here. [Learn more](#).

**Redirect URLs**

<https://dialogflow.cloud.google.com/v2/integrat>

[Add New Redirect URL](#)

[Save URLs](#)

Need to set up directly installing your app from the App Directory? That's in [Basic Information](#).

- Enable events in the 'Event Subscriptions' section.
- Copy Events Request URL from got from 'Set up Dialogflow' step 4 and paste it to Request URL in the 'Events Subscription' section of your Slack app. Save URLs.

IPA-project

Settings

Basic Information

Collaborators

Install App

Security & Compliance

Manage Distribution

Features

App Home

Incoming Webhooks

Interactivity & Short...

Slash Commands

OAuth & Permissions

Event Subscriptions

User ID Translation

## Event Subscriptions

Enable Events

On

Your app can subscribe to be notified of events in Slack (for example, when a user adds a reaction or creates a file) at a URL you choose. [Learn more.](#)

Request URL

https://dialogflow.cloud.google.com/v1/integrations/slack/v

Change

We'll send HTTP POST requests to this URL when events occur. As soon as you enter a URL, we'll send a request with a `challenge` parameter, and your endpoint must respond with the challenge value. [Learn more.](#)

Subscribe to bot events

- Select necessary events in "Subscribe to Bot Events" section for example message.im, message.group, message.channel, im\_created. These events will define which message types (direct, in channel, etc.) your bot will react to. Save changes.

Slash Commands

OAuth & Permissions

Event Subscriptions

User ID Translation

Where's Bot User

App Directory Page

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## Subscribe to bot events

Apps can subscribe to receive events the bot user has access to (like new messages in a channel). If you add an event here, we'll add the necessary OAuth scope for you.

Event Name	Description	Required Scope	
im_created	A DM was created	im:read	
message.channels	A message was posted to a channel	channels:history	
message.groups	A message was posted to a private channel	groups:history	
message.im	A message was posted in a direct message channel	im:history	

- In the Slack app settings, go to 'Manage Distribution' and add the bot to your Slack team using the 'Add to Slack' button.
- To use rich messages, copy the 'Events Request URL' value below and paste it into the 'Request URL' field from the Interactive Messages section of your Slack app settings.

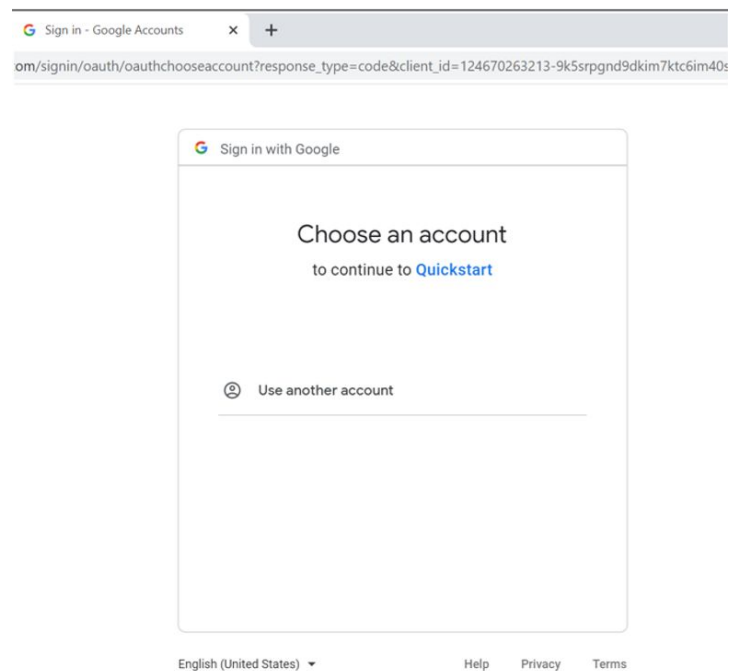


9. Go to 'Basic Information' section, take note of the 'Client ID', 'Client Secret' and 'Verification Token'

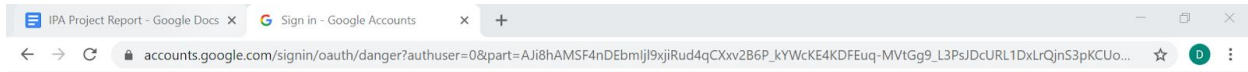
## Set up Google Calendar

The first time you run the code,, it prompts you to authorize access:

1. If you're not already logged in to your Google account, the window prompts you to log in. If you are logged in to multiple Google accounts, you must select one account to use for the authorization.



2. Click *Advanced*



### This app isn't verified

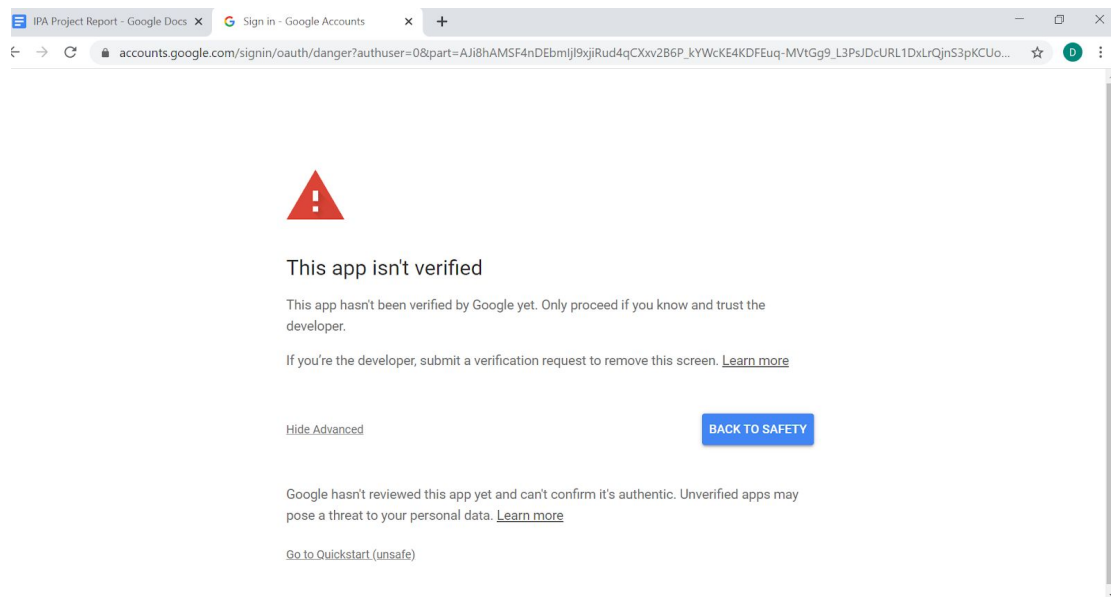
This app hasn't been verified by Google yet. Only proceed if you know and trust the developer.

If you're the developer, submit a verification request to remove this screen. [Learn more](#)

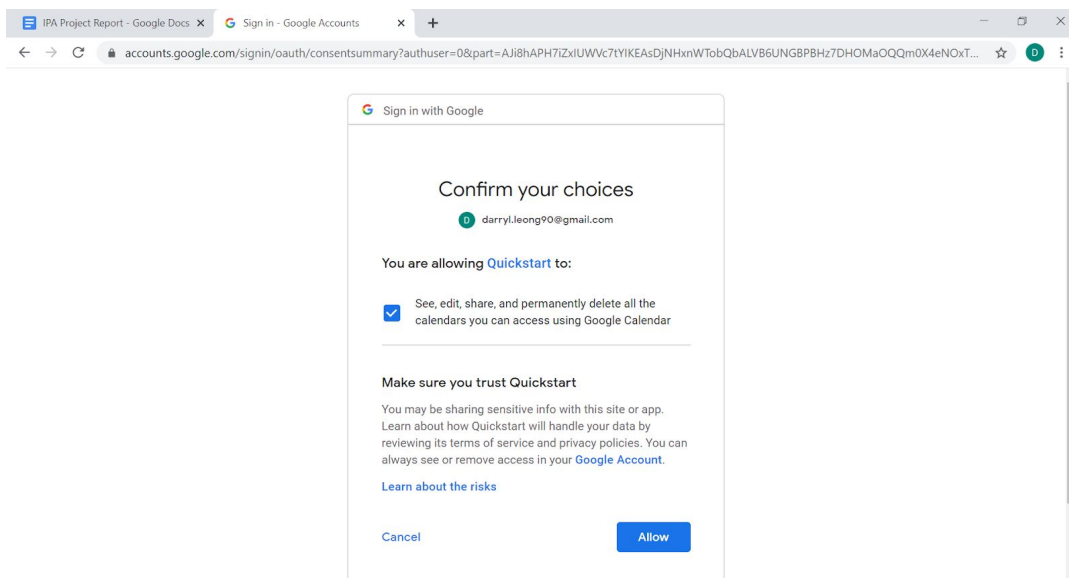
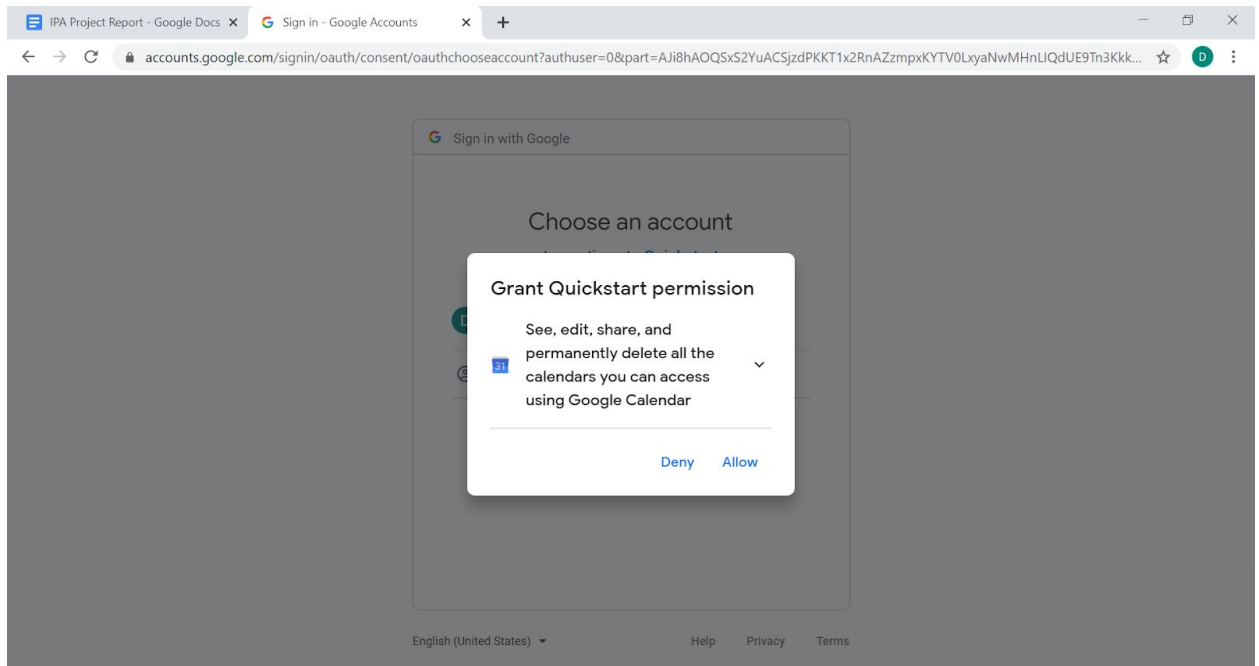
Advanced

BACK TO SAFETY

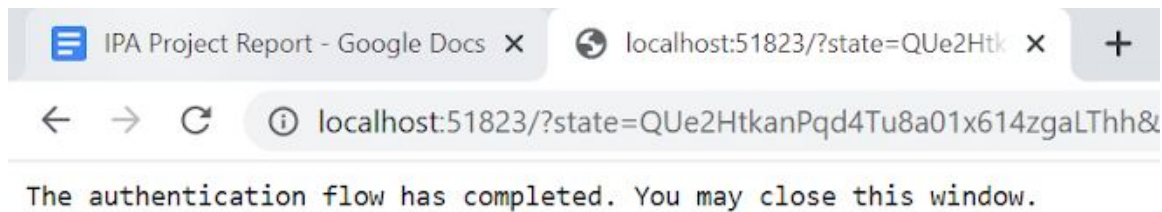
### 3. Click *Go to Quickstart (unsafe)*.



### 4. Click *Allow*, then *Allow* again



5. You will see the following message displayed when the authorization has been granted.



## Annex B – Supporting Files

No.	Filename	Description
1	feature_vector.py	Convert image to feature vector and save to file
2	process_data.py	Process scrapped restaurant data, convert to image data and extract metadata and links between restaurant and images
3	annoy_clustering.py	Create nearest neighbor index (nearest_neighbors.json) file

## Annex C – Individual Project Report

### Tang Meng

#### 1: Personal Contribution to group project

Research on integration Dialogflow with third party software(Slack). Implement User Fronting Chat-bot agent. Perform System Integration and Testing. Writing of the report for the relevant sections, based on the contributions mentioned above. Create video to introduce system solution.

#### 2: What you have learnt

Through this project, I have learnt how to utilise RPA and IPA designing strategy and implementation techniques and had more hands-on experience on building an automation chatbot with Dialogflow and Slack. Chatbot can reach out to a large audience on messaging apps and be more effective. A chatbot provides a speedy and quick response and is available around the clock.

From the practice, I have also learnt that as the real situation or configuration might be different, we shouldn't all along rely on testing bot/software. It's a must for us to set up environment based on real credentials and authentication.

### **3: How you can apply the knowledge and skills in other situations**

The whole experience of creating automation bot with RPA and IPA strategy is quite useful for my current full time job. As for each application our platform requires users to fill up at least 5 forms. For the testing purpose, our testers have to sign up around 3 accounts and for each account do the same process to submit the application. I think after this project we can use automation bot and IPA techniques to help testers cover manual work like filling up information in different forms. This will save more time and reduce more human errors.

## **Tan Wei Lian**

### **1: Personal Contribution to group project**

Research on content-based recommendation, in particular, the image similarity techniques and similarity techniques which involves multiple queries and takes into account the different query weights. Implemented the Restaurant Search Agent and Restaurant Similarity Model, which includes generating image feature vectors using Tensorflow Hub, approximate nearest neighbor using annoy library, translating multi-query similarity distance measure explained in paper into working code.

### **2: What you have learnt**

From the initial project discussion, I have learnt the different potential applications of IPA. Automation bot is very suitable for long running or repetitive tasks in that it reduces human errors, it is cheap and does not become fatigued. And combined with an intelligent system, the bot can be smarter in making decisions.

From my contributions, I have learnt and tried out various methods for image representation learning, such as autoencoder and different pretrained models. I have also gained more hands-on experience on data preparation and become more familiar with the challenges of applying algorithms on high dimensional image data.

From the contributions of my teammates, I have learnt more about how to build a Dialogflow chatbot, in particular, how to design intents, context and parameters. I have also learnt how to build automation bot using tagui.

### **3: How you can apply the knowledge and skills in other situations**

With the knowledge and skills I learnt, I will be able to analyze business processes, identify steps which can be automated and implement the automation bot. I can also apply what I learnt building the Restaurant Search Agent to other recommendation systems, such as the recommendation component in CMS (Content management system) I am currently building in

my full time job. I will be able to design and build other chatbots using Dialogflow.

## Leong Jun Hun Darryl

### **1: Personal Contribution to group project**

Conduct Market Research to understand the F & B landscape in Singapore. Model As-Is and To-Be Process. Perform Web Scraping to gather information and images for more than 5,000 F&B establishments in Singapore. Implemented Reservation Agent, leveraging on TagUI capabilities to automate the process of scheduling a restaurant reservation. Implemented the Calendar Agent which leverages the Google Calendar API to automate the creation of a calendar event. Writing of the report for the relevant sections, based on the contributions mentioned above.

### **2: What you have learnt**

Through this project, I've learnt how to apply RPA & IPA to a project and realized that there are many potential uses for Automation. I've learnt the RPA has the ability to significantly increase the efficiency and accuracy of certain tasks. High volume tasks, which have well defined processes are ideal candidates for RPA. The use of RPA is especially suited to repetitive tasks which are better off performed by Bots.

In addition, I've also learnt that websites interfaces are regularly being refreshed and there is a need to maintain RPA code. This is especially so for popular, public facing websites which are constantly improving their user experience. This learning came about when a week before project submission, the team realized that the TagUI code for Reservation Agent was no longer working because the user interface for the reservation website had changed and the previously used Xpath selectors were no longer valid.

In terms of technical skills, I've become more familiar with the functions and features of Automation libraries such as TagUI, as well as how to utilize publicly available APIs such as Google Calendar. I've also learnt more about the F&B landscape in Singapore and consumer behaviour. Through the implementation of a Chatbot, Machine Learning & Automation, I have some experience seeing multiple techniques can be infused.

### **3: How you can apply the knowledge and skills in other situations**

The biggest takeaway from this project is an understanding of how RPA/IPA can be applied in the real world, to everyday tasks such as finding a new restaurant and simplifying the reservation process. Beyond automating daily consumer tasks, I believe RPA/IPA has the potential to do much more, in more complex situations. I think that when RPA/IPA is applied in a business setting and is widely adopted, will the company be able to reap significant cost and time saving benefits. Furthermore, the exploitation of multiple techniques and tools, such as Chatbots, Machine Learning and IPA/RPA provides for many exciting new ways of doing things.

With some experience in implementing IPA/RPA, I can look to automating menial tasks, should there be opportunities. Also, I would also be constantly asking myself whether the work I do is a suitable candidate.