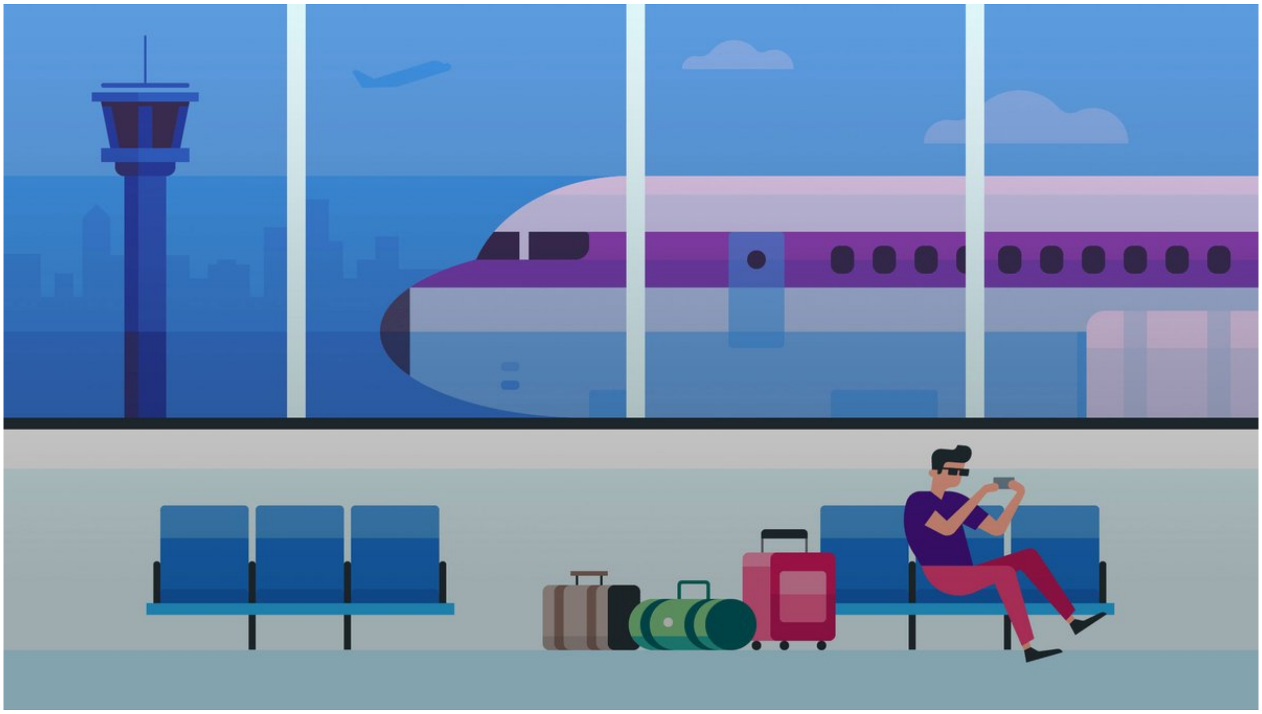

Business Traveler – Hotel Booking Agent

NUS Master of Technology
Intelligent Software Agents (ISA)

Brought to you by Group 4

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Zuo Zhen	A0215464H

18-Nov-2020

Table of Content

1 Executive Summary

According to statistics, the cost of business trip expenditure accounts for about 28% of the total corporate expenditure, and has become the second largest controllable cost of an enterprise. The following graph shows the business trip cost one day in top5 expensive Asia city, as we can see, hotel cost has occupied a significant part (over 50%) among all the main business trip costs like hotel meals and transportation. As a result, the primary task for business trip process and cost optimization is to optimize the process and management for the internal business trip hotel booking for an enterprise.

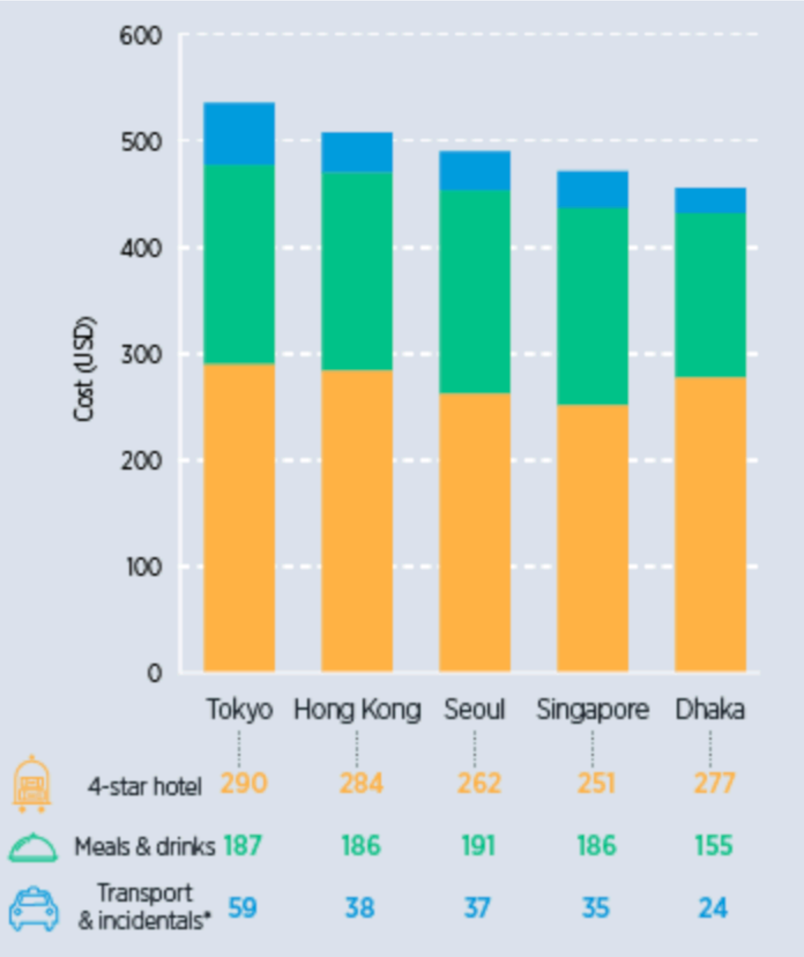


Fig 1-1: Business Trip Cost composition in major Asia Cities

Nowadays, there are three main types of business trip hotel booking process in different companies according to their different scale and business trip management of an enterprise.

Firstly, for most of the large company, with adequate budget in business trip management system/ platform, the employee can search and book hotel directly by their own through internal business trip management system/platform. employees don't need to advance payment for their business trip expense, therefore the financial process is also optimized by reducing the reimbursement processing and invoice processing. In addition, such big company usually have signed cooperation agreement with travel agent so that they can get a discount on the price.

However, for many SME, without enough budget and human resources to implement and maintain a business trip management system/platform, will adopt the following methods to do hotel booking management for employees. One method is employee do advance payment by themselves when booking business trip hotel, then claim reimbursable expense on invoice to the finance, thus the employee gets the reimbursement. Another one is booking business trip hotel through internal booking operator. Employees who are going for a business trip will provide his/her hotel reservation information to the booking operator, then booking operator will find out target hotel booking information, send back structured booking information to the requester, finally make a reservation for the hotel after the booking request is approved and confirmed.

The pros of the last process are employee don't need to do advance payment for hotel booking, which can simplify the finance reimbursement process. While the cons is the booking operator need handling large quantities of booking request, reading hundreds of emails, collecting and arranging booking information manually, which are high frequency and repetitive tasks. Manually performing this work is prone to inefficiency and errors.

Our project team is dedicated in assisting booking operator get rid of the monotonous repetitive task and improving the efficiency and accuracy for the hotel booking process. The solution called Business Traveler – Hotel Booking Agent, introducing robotic process automation (RPA) to process extracting semi-structured data from email, collecting and formatting data into csv file, searching hotel information via different travel agents, comparing the price and writing email for booking confirmation. What's more, we further use google natural language process API to do name entity recognition from the email text to improve the accuracy of information extraction.

In this solution, we use RPA to process these high frequency and repetitive tasks, significantly improve work efficiency of booking operator, and by comparing hotel prices among different travel agent we can get a relatively favorable price, further reduce the business trip cost.

2 Project Description

2.1 Project Objective

Main objective of this group project is to develop a light and easy to deploy business trip hotel booking process automation system for many SME that without enough budget and human resource to implement an integrated business trip management system, helping such enterprise improving the process efficiency in booking hotel for business trip and reducing cost. This business traveler is capable of extracting key information from email text, comparing hotel price among different travel agents based on booking request, sending confirmation email automatically instead of manually.

2.2 Project Team

Full Name	**Work Items (Who Did What)**
Li JiaYi	• Data preprocessing after extracting information from business travelers' email application • Use web automation to crawl hotel information according to travel needs of business travelers • RPA Development – develop RPA2- Compare Hotel Price in different Travel Agents • Provide Travel Agent URL and hotel information that offer the most favorable price for different Travelers. • Integrate all the lowest hotel price information provided according to different needs into one Excel form for use in subsequent work automation processes • Project report writing – RPA2, Challenge & Recommendation
Lin Xi	• Project idea generation • Product prototype design – product solution, business flow design • System architecture design – system/data flow design, system modules design, database structure design • RPA Development – develop RPA1- Email Automation, data structured automation • Cloud AI Development – Implement google natural language process API • Project management • Debug & troubleshooting • Project report writing – Executive Summary, Business Process Solution, RPA1
Zuo Zhen	• System construction implement • UI design & UI implement

	• System control logic build • implement of RPA3 for sending email • User guide construction • System integration • System test

3 Project Solution

3.1 Business Process Solution

3.1.1 As Is Process

The current manual process of business trip hotel booking is as follows:

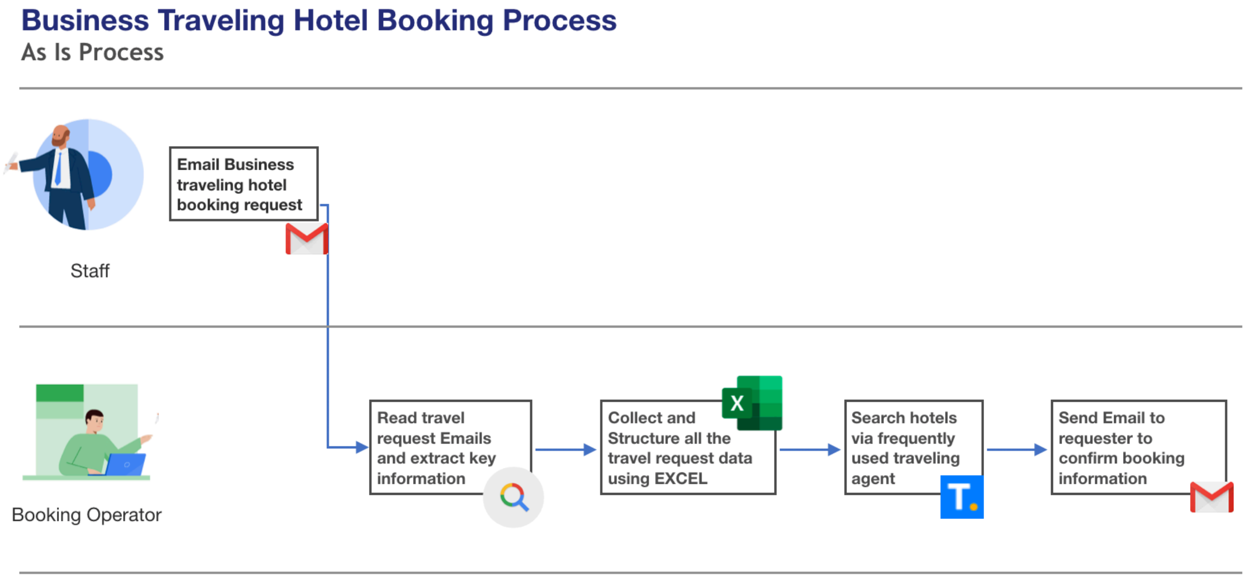

Business Traveling Hotel Booking Process
As Is Process
Staff
Email Business traveling hotel booking request
Booking Operator
Read travel request Emails and extract key information
Collect and Structure all the travel request data using EXCEL
Search hotels via frequently used traveling agent
Send Email to requester to confirm booking information

Fig 3-1: Business Traveling Hotel Booking As Is Process

1: When a staff is going for a business traveling. He will submit a business travelling hotel booking request in advance to the booking operator via email titled with “travel request”, including his employee ID, personal ID number, hotel name, destination, check-in/checkout date information.

2: Everyday booking operator will search for the unread email titled with “travel request”. Read these emails and extract related information from email text one by one manually.

3: Booking operator collect and format all the booking request data into excel.

4: Booking operator search each target hotel information on the travel agent websites to collect the price and other related information.

5: Send email to the requestor with hotel information for confirmation or further approval processing.

3.1.2 To Be Process

Business Traveler are using RPA to handle the high frequency repetitive tasks in business trip hotel booking, the optimized process is as follows:

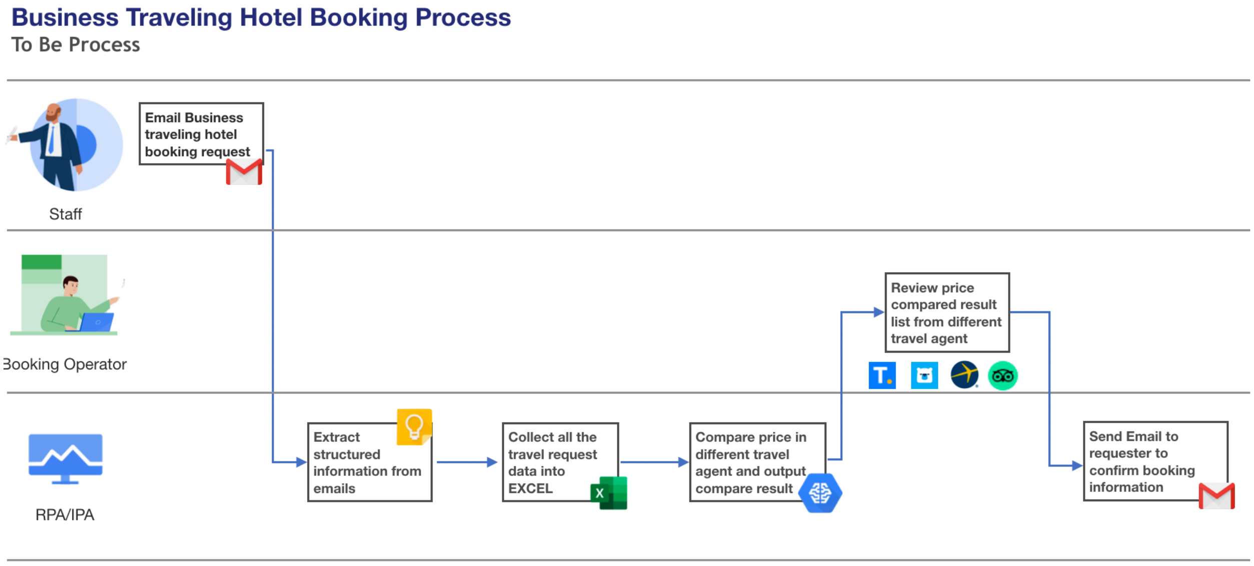

Business Traveling Hotel Booking Process
To Be Process
Staff
Email Business traveling hotel booking request
Booking Operator
Review price compared result list from different travel agent
RPA/IPA
Extract structured information from emails
Collect all the travel request data into EXCEL
Compare price in different travel agent and output compare result
Send Email to requester to confirm booking information

Fig 3-2: Business Traveling Hotel Booking To Be Process

1: When a staff is going for a business traveling. He will submit a business travelling hotel booking request in advance to the booking operator via email titled with "travel request", including his employee ID, personal ID number, hotel name, destination, check-in/checkout date information.

2: Business traveler will find out all the unread email titled with "travel request". Read these emails and extract related information from email text automatically.

3: Business traveler collect and format all the booking request data into excel.

4: Business traveler search each target hotel information on different travel agents' to collect the price and other related information, compare price among all the travel agents find a favorable choice for each booking requests.

5: Booking operator review the hotel information collected by business traveler.

6: business traveler send email to all requestors automatically with structured hotel information for confirmation or further approval processing.

3.2 System Architecture

The following figure illustrate our system architecture briefly.

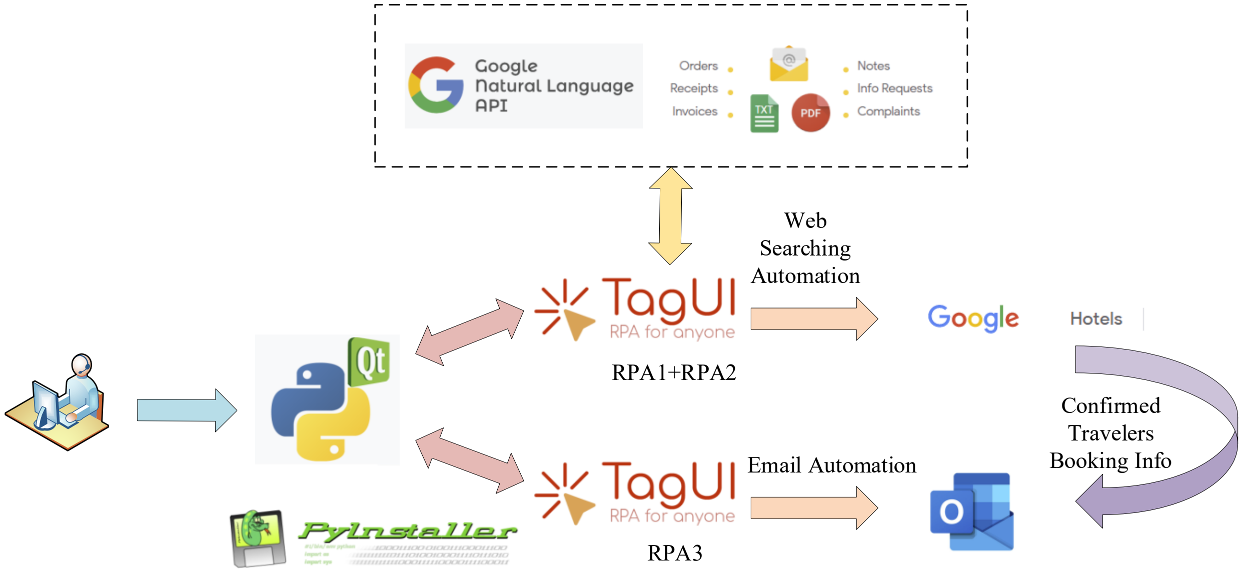


Fig 3-3: System Architecture

To make the system easy to use, we design a user interface using PyQt5 to interact with users. On the interface, the users can do some self-customized operation like choosing the certain workspace to store the output files. More importantly, with PyQt5 plus Pyinstaller(a tool to pack python file to executable file) the system can run on a windows 10 device without installing python.

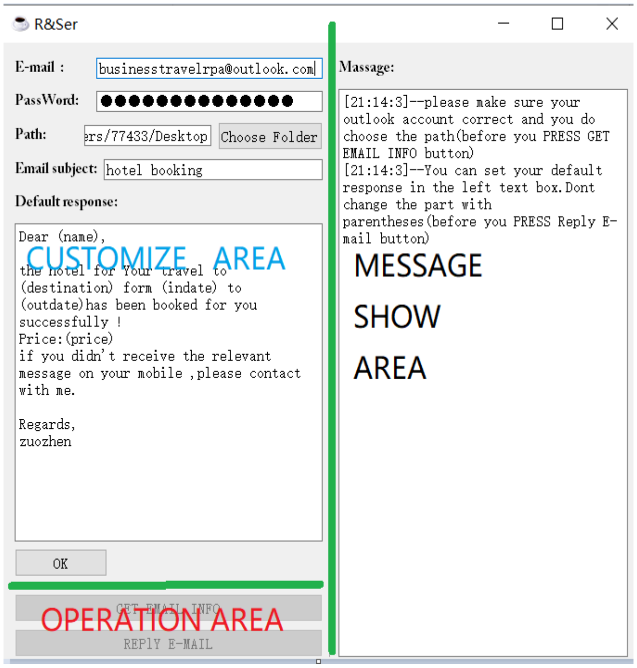
There are three software robots in the system, which are specially designed for different tasks. Which will be describe in detail in chapter 4. But here briefly, the robot1 will interact with GOOGLE CLOUD (AI) mainly. And the second robot will crawl information using GOOGLE SEARCH. And the robot 3 will do the auto reply task after users have completed some certain work. The work process will be informed on the user interface.

There is only one button for Software Robot1 and Robot2. Because the work of these two robots can be execute in a sequence without human interrupting. But human should do a decision work before Robot3 doing its task. And there is a button for Robot3 on interface.

4 Project Implementation

4.1 User Interface

To make the system easy to use, we design a user interface to command the whole system. Because our system is quite straightforward, the UI is very neat and easy to understand. Firstly, we draft three part, they are CUSTOMIZE AREA, MESSAGE SHOW AREA&OPERATION AREA. Showing below image.



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●●

Path: ers/77433/Desktop

Email subject: hotel booking

Default response:

```
Dear (name),
the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully !
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

Massage:

```
[21:14:3]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[21:14:3]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
```

Fig 4-1: User Interface Layout

After we get blueprint, using QTdesigner(a tool for ui design) to 'draw' it.

Fig 4-2: QTdesigner

Once we get .ui file, we choose dynamic loading method. Compare to static loading method, dynamic loading method can be easily tuned. It would be very convenient if we want to change our ui during the development using this method.

The last step we had to make the interface live--link all the robots with the elements on the interface. Here we used multi-threaded method. Because every robot takes maybe a few minutes to complete their own tasks. During this period, the UI will be stuck if we don't implement multi threads.

4.2 Robotic Process Automation

4.2.1 RPA1 Extract Structured Booking Info from Email

The implementation for RPA1 is as follows:

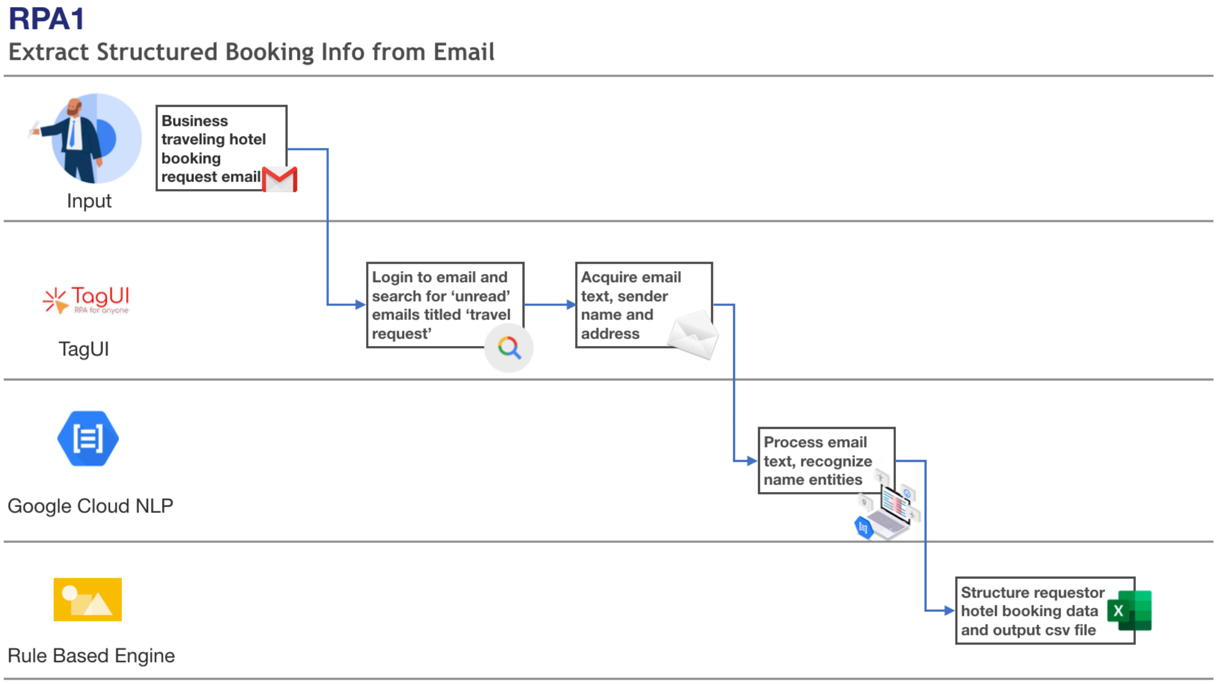
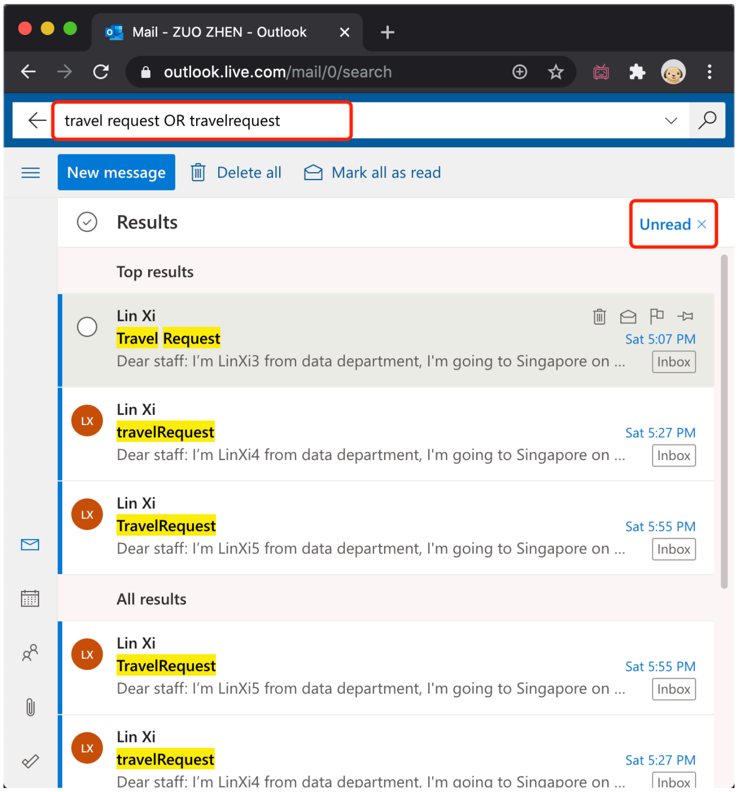

RPA1
Extract Structured Booking Info from Email
Input
Business traveling hotel booking request email
TagUI
Login to email and search for 'unread' emails titled 'travel request'
Acquire email text, sender name and address
Google Cloud NLP
Process email text, recognize name entities
Rule Based Engine
Structure requestor hotel booking data and output csv file

Fig 4-3: RPA1-Extract Structured Booking Info from Email Process

1. Staff send 'travel request' email as input.
2. Login to email and search for 'unread' emails titled 'travel request'.



travel request OR travelrequest

Lin Xi
Travel Request — Sat 5:07 PM
Dear staff: I'm LinXi3 from data department, I'm going to Singapore on ...

Lin Xi
travelRequest — Sat 5:27 PM
Dear staff: I'm LinXi4 from data department, I'm going to Singapore on ...

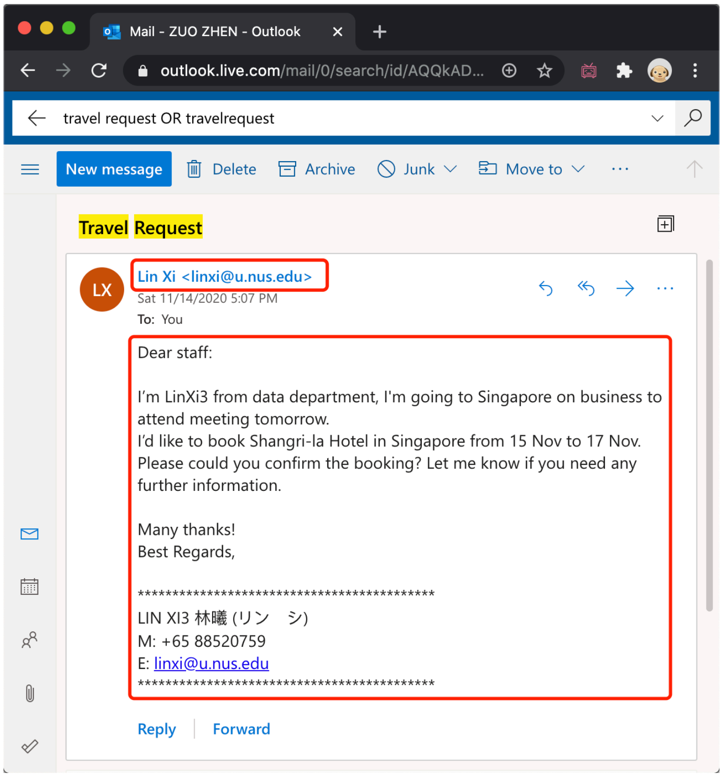
Lin Xi
TravelRequest — Sat 5:55 PM
Dear staff: I'm LinXi5 from data department, I'm going to Singapore on ...

Lin Xi
TravelRequest — Sat 5:55 PM
Dear staff: I'm LinXi5 from data department, I'm going to Singapore on ...

Lin Xi
travelRequest — Sat 5:27 PM
Dear staff: I'm LinXi4 from data department, I'm going to Singapore on ...

Fig 4-4: RPA1-Search Unread "travel request" Email

3. Acquire email text, sender name and address.


Mail - ZUO ZHEN - Outlook
outlook.live.com/mail/0/search/id/AQQkAD...
New message
Delete
Archive
Junk
Move to
LX
Reply
Forward

travel request OR travelrequest

Travel Request

Lin Xi <linxi@u.nus.edu>
Sat 11/14/2020 5:07 PM
To: You

Dear staff:

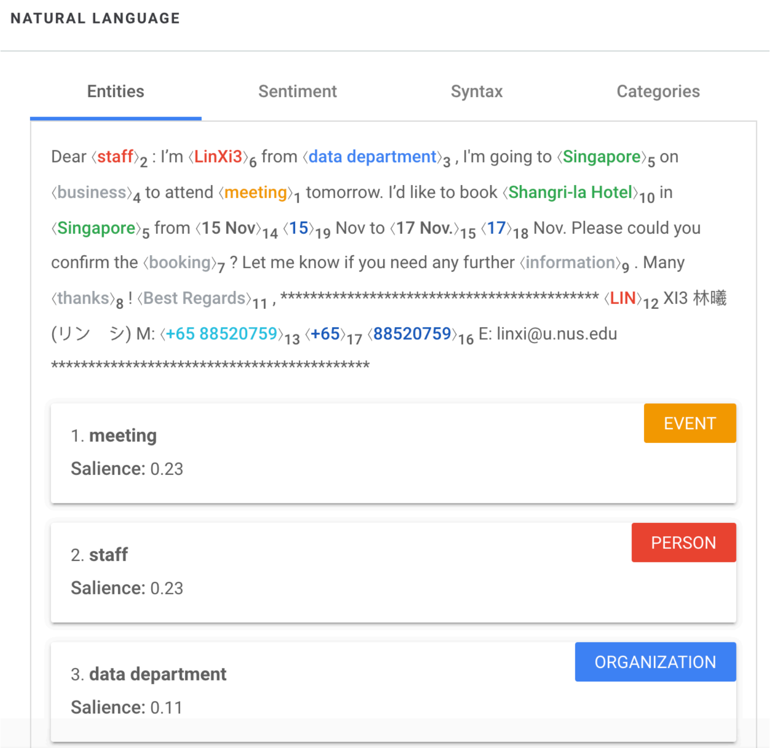
I'm LinXi3 from data department, I'm going to Singapore on business to attend meeting tomorrow.
I'd like to book Shangri-la Hotel in Singapore from 15 Nov to 17 Nov.
Please could you confirm the booking? Let me know if you need any further information.

Many thanks!
Best Regards,

****
LIN XI3 林曦 (リン　シ)
M: +65 88520759
E: linxi@u.nus.edu
****

Fig 4-5: RPA1- Extract Email Sender Info and Text

4. Process email text, recognize name entities using google natural language API.



NATURAL LANGUAGE

Dear ⟨staff⟩$_{2}$: I'm ⟨LinXi3⟩$_{6}$ from ⟨data department⟩$_{3}$, I'm going to ⟨Singapore⟩$_{5}$ on ⟨business⟩$_{4}$ to attend ⟨meeting⟩$_{1}$ tomorrow. I'd like to book ⟨Shangri-la Hotel⟩$_{10}$ in ⟨Singapore⟩$_{5}$ from ⟨15 Nov⟩$_{14}$ ⟨15⟩$_{19}$ Nov to ⟨17 Nov.⟩$_{15}$ ⟨17⟩$_{18}$ Nov. Please could you confirm the ⟨booking⟩$_{7}$? Let me know if you need any further ⟨information⟩$_{9}$. Many ⟨thanks⟩$_{8}$! ⟨Best Regards⟩$_{11}$, *** ⟨LIN⟩$_{12}$ XI3 林曦 (リン　シ) M: ⟨+65 88520759⟩$_{13}$ ⟨+65⟩$_{17}$ ⟨88520759⟩$_{16}$ E: linxi@u.nus.edu **

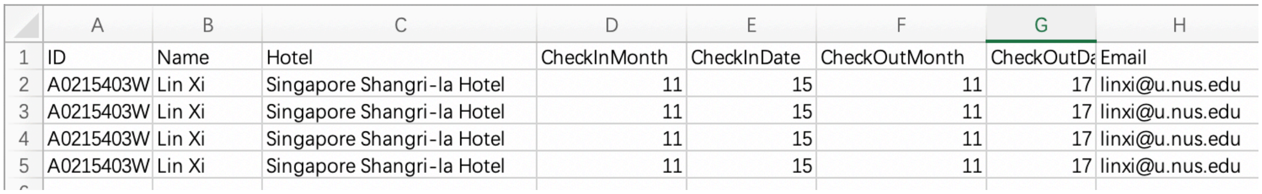
1. **meeting** EVENT
Salience: 0.23

2. **staff** PERSON
Salience: 0.23

3. **data department** ORGANIZATION
Salience: 0.11

Fig 4-6: RPA1- Extract Name Entities in Email Text

5. Structure requestor hotel booking data and output csv file.



	A	B	C	D	E	F	G	H
1	ID	Name	Hotel	CheckInMonth	CheckInDate	CheckOutMonth	CheckOutDa	Email
2	A0215403W	Lin Xi	Singapore Shangri-la Hotel	11	15	11	17	linxi@u.nus.edu
3	A0215403W	Lin Xi	Singapore Shangri-la Hotel	11	15	11	17	linxi@u.nus.edu
4	A0215403W	Lin Xi	Singapore Shangri-la Hotel	11	15	11	17	linxi@u.nus.edu
5	A0215403W	Lin Xi	Singapore Shangri-la Hotel	11	15	11	17	linxi@u.nus.edu

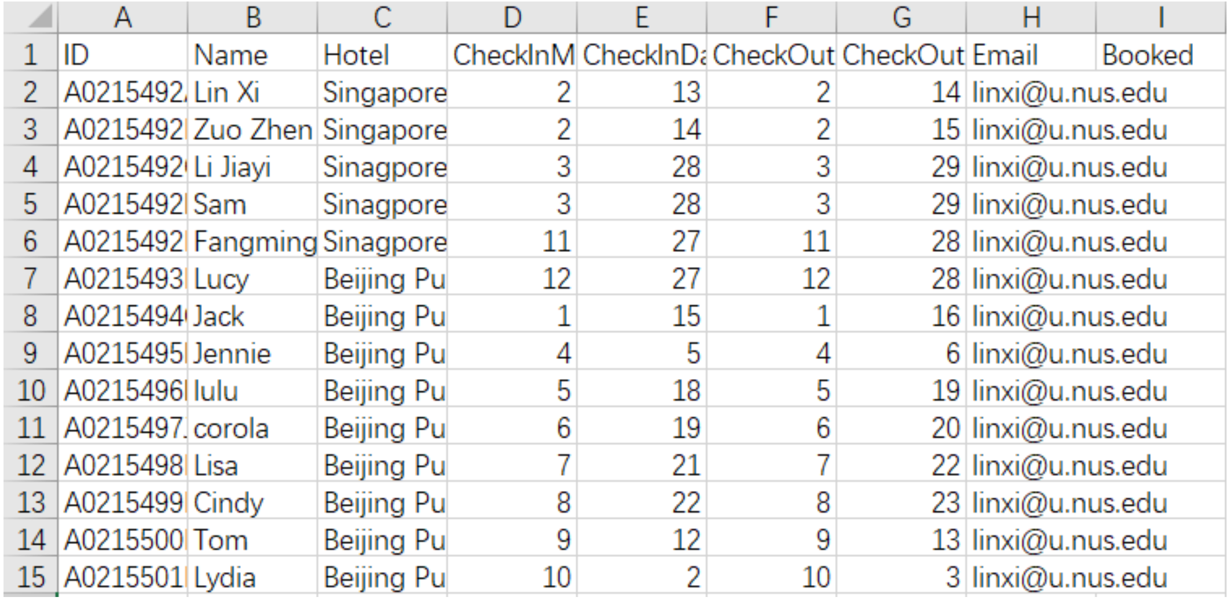
Fig 4-7: RPA1- Structured Booking Request Information

4.2.2 RPA2 Compare Hotel Price in different Travel Agents

Extract key information of business travelers

After RPA2 obtains the traveler application information obtained from the previous automated workflow, it first extracts the key information. The table which information need to be extracted by preprocessing is as follows:

Table 4-1: Business Traveler Information Passed in The Previous Workflow

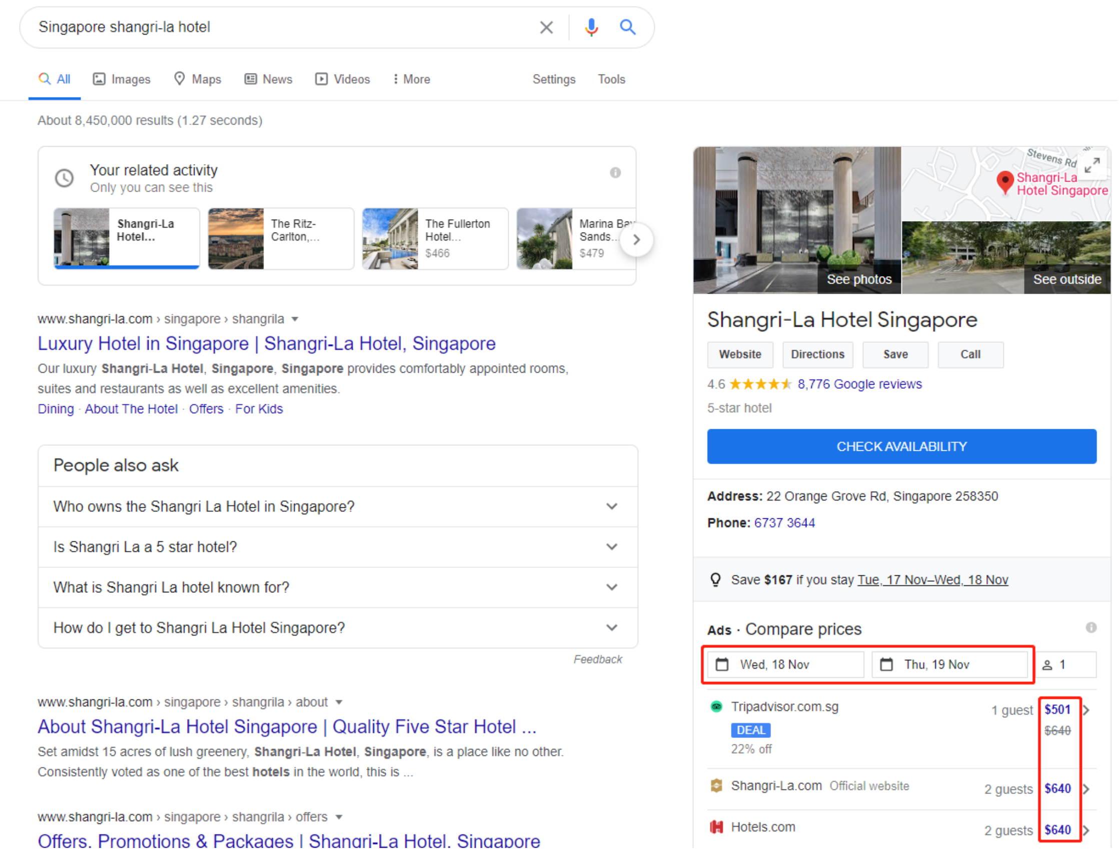


	A	B	C	D	E	F	G	H	I
1	ID	Name	Hotel	CheckInM	CheckInDa	CheckOut	CheckOut	Email	Booked
2	A0215492	Lin Xi	Singapore	2	13	2	14	linxi@u.nus.edu	
3	A0215492	Zuo Zhen	Singapore	2	14	2	15	linxi@u.nus.edu	
4	A0215492	Li Jiayi	Sinagpore	3	28	3	29	linxi@u.nus.edu	
5	A0215492	Sam	Sinagpore	3	28	3	29	linxi@u.nus.edu	
6	A0215492	Fangming	Sinagpore	11	27	11	28	linxi@u.nus.edu	
7	A0215493	Lucy	Beijing Pu	12	27	12	28	linxi@u.nus.edu	
8	A0215494	Jack	Beijing Pu	1	15	1	16	linxi@u.nus.edu	
9	A0215495	Jennie	Beijing Pu	4	5	4	6	linxi@u.nus.edu	
10	A0215496	lulu	Beijing Pu	5	18	5	19	linxi@u.nus.edu	
11	A0215497	corola	Beijing Pu	6	19	6	20	linxi@u.nus.edu	
12	A0215498	Lisa	Beijing Pu	7	21	7	22	linxi@u.nus.edu	
13	A0215499	Cindy	Beijing Pu	8	22	8	23	linxi@u.nus.edu	
14	A0215500	Tom	Beijing Pu	9	12	9	13	linxi@u.nus.edu	
15	A0215501	Lydia	Beijing Pu	10	2	10	3	linxi@u.nus.edu	

In this part, use the pandas DataFrame data structure to extract the accommodation information applied by the traveler, including the travel to location, hotel name, check-in and check-out time so as to take advantage of these information to do hotel searching. Meanwhile, the applicant's identity information is retained for the next automated workflow processing.

Hotel information search process

Different from other existing price comparison systems, need to search from many different kinds of Travel agent, which is time-consuming and not cost-effective. In our system, this RPA system takes advantage of the rapidity and completeness of information in RPA search and the inclusiveness of Google which contain hotel information provided by various agent. By directly searching the hotel information on Google, the automated search results are as shown in the figure:



Singapore shangri-la hotel

About 8,450,000 results (1.27 seconds)

Your related activity
Only you can see this

www.shangri-la.com › singapore › shangrila
Luxury Hotel in Singapore | Shangri-La Hotel, Singapore
Our luxury **Shangri-La Hotel**, **Singapore**, **Singapore** provides comfortably appointed rooms, suites and restaurants as well as excellent amenities.
Dining · About The Hotel · Offers · For Kids

People also ask
Who owns the Shangri La Hotel in Singapore?
Is Shangri La a 5 star hotel?
What is Shangri La hotel known for?
How do I get to Shangri La Hotel Singapore?
Feedback

www.shangri-la.com › singapore › shangrila › about
About Shangri-La Hotel Singapore | Quality Five Star Hotel ...
Set amidst 15 acres of lush greenery, **Shangri-La Hotel**, **Singapore**, is a place like no other. Consistently voted as one of the best **hotels** in the world, this is ...

www.shangri-la.com › singapore › shangrila › offers
Offers, Promotions & Packages | Shangri-La Hotel, Singapore

Shangri-La Hotel Singapore

4.6 ★★★★★ 8,776 Google reviews
5-star hotel

Address: 22 Orange Grove Rd, Singapore 258350
Phone: 6737 3644

Save **$167** if you stay Tue, 17 Nov–Wed, 18 Nov

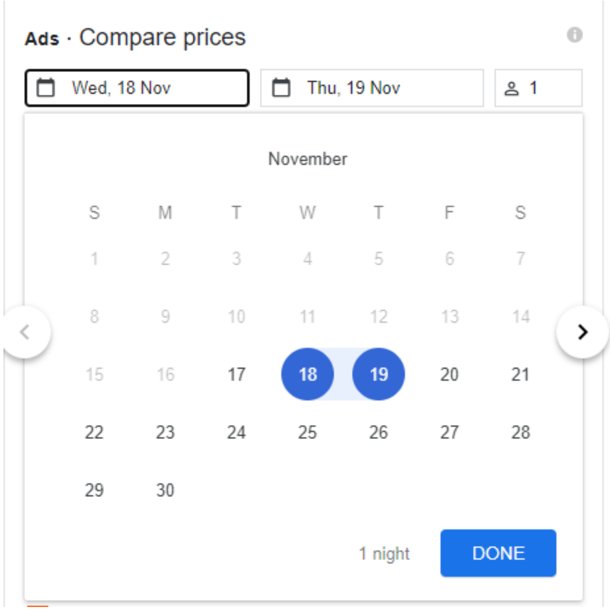
Ads · Compare prices

Wed, 18 Nov | Thu, 19 Nov | 1

Tripadvisor.com.sg DEAL 22% off	1 guest	$501 ~~$640~~
Shangri-La.com Official website	2 guests	$640
Hotels.com	2 guests	$640

Fig 4-8: Automated Searching Webpage

On the right side of the page, there will be a check-in date selector and prices provided by various agent. Here the system needs to set the calendar selector based on the travel information of the traveler in the form.



Ads · Compare prices

Wed, 18 Nov | Thu, 19 Nov | 1

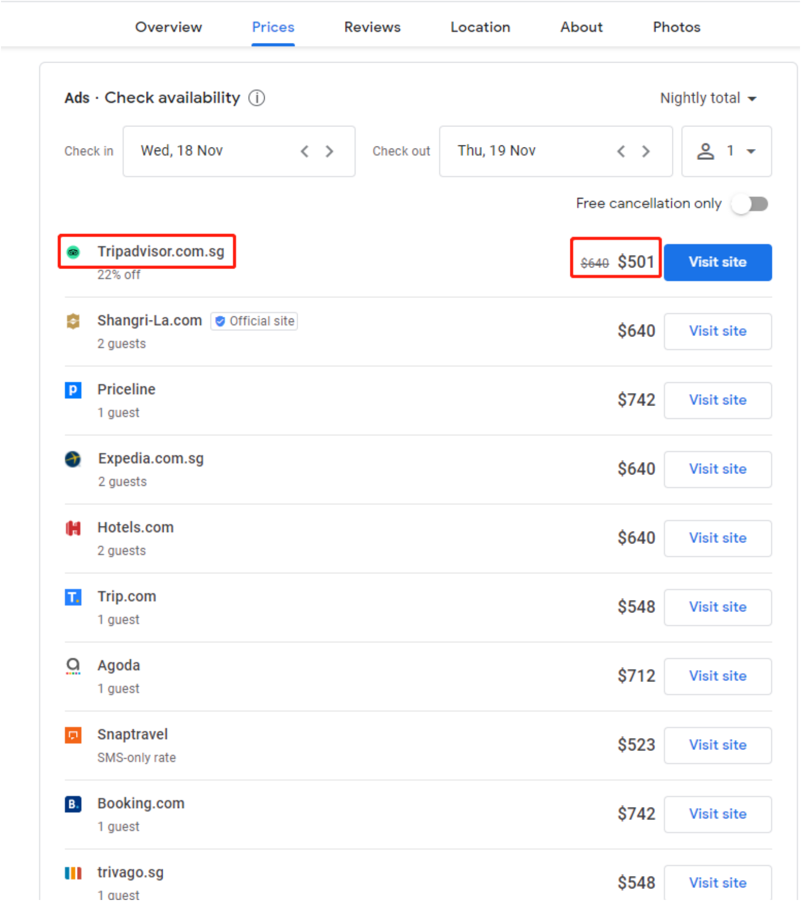
November

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

1 night

Fig 4-9: Calendar Selector Need to be Set

RPA here matched the extracted month and date information of the business traveler with the month and date information on the calendar selector, so as to filter hotels on specific dates according to the form requirements. Fuzzy matching, the method of building multiple graph matching libraries and the visual automation function which included in Python TagUI are all used here, and after many tests and training, the error rate can be ignored, which means hotels can be screened using calendar selector accurately based on the check-in date applied by business travelers.



Ads · Check availability

Check in Wed, 18 Nov

Check out Thu, 19 Nov

1

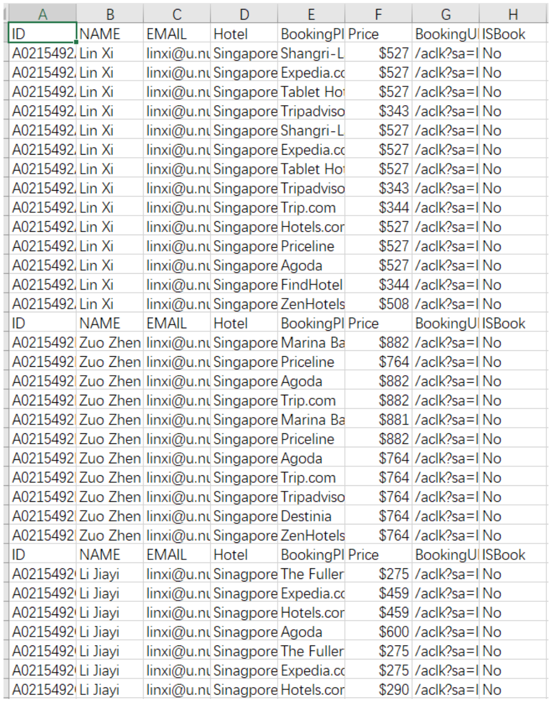
Free cancellation only

Tripadvisor.com.sg 22% off	~~$640~~ $501	Visit site
Shangri-La.com Official site 2 guests	$640	Visit site
Priceline 1 guest	$742	Visit site
Expedia.com.sg 2 guests	$640	Visit site
Hotels.com 2 guests	$640	Visit site
Trip.com 1 guest	$548	Visit site
Agoda 1 guest	$712	Visit site
Snaptravel SMS-only rate	$523	Visit site
Booking.com 1 guest	$742	Visit site
trivago.sg 1 guest	$548	Visit site

Fig 4-10: Information Extraction Interface

With the help of TagUI's Xpath search function, the system extracts the filtered hotel information based on the form information provided by the company on business travelers, including the Travel booking agent, real-time price and the URL of the ordering agent for subsequent automated workflow use. Then, save the extracted information in the list and stored in one Excel file.

Table 4-2: The Result of Webpage Information Extraction



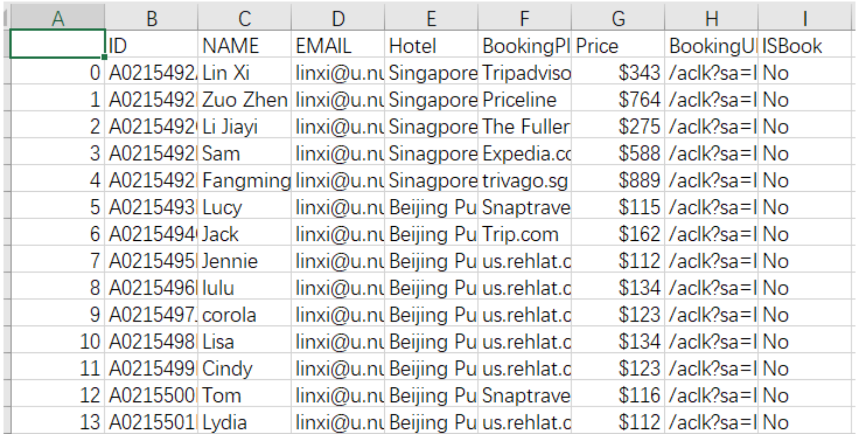
A	B	C	D	E	F	G	H
ID	NAME	EMAIL	Hotel	BookingPl	Price	BookingUI	ISBook
A0215492	Lin Xi	linxi@u.nu	Singapore	Shangri-L	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Expedia.cc	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Tablet Hot	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Tripadviso	$343	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Shangri-L	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Expedia.cc	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Tablet Hot	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Tripadviso	$343	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Trip.com	$344	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Hotels.cor	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Priceline	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	Agoda	$527	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	FindHotel	$344	/aclk?sa=l	No
A0215492	Lin Xi	linxi@u.nu	Singapore	ZenHotels	$508	/aclk?sa=l	No
ID	NAME	EMAIL	Hotel	BookingPl	Price	BookingUI	ISBook
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Marina Ba	$882	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Priceline	$764	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Agoda	$882	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Trip.com	$882	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Marina Ba	$881	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Priceline	$882	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Agoda	$764	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Trip.com	$764	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Tripadviso	$764	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	Destinia	$764	/aclk?sa=l	No
A0215492	Zuo Zhen	linxi@u.nu	Singapore	ZenHotels	$764	/aclk?sa=l	No
ID	NAME	EMAIL	Hotel	BookingPl	Price	BookingUI	ISBook
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	The Fuller	$275	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	Expedia.cc	$459	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	Hotels.cor	$459	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	Agoda	$600	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	The Fuller	$275	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	Expedia.cc	$275	/aclk?sa=l	No
A0215492	Li Jiayi	linxi@u.nu	Sinagpore	Hotels.cor	$290	/aclk?sa=l	No

Hotel Price Compare process

First, perform data preprocessing on the data obtained in the previous part, de-duplicate the same price, and then separate the files according to the different business traveler's ID. The hotel application information of travelers will be stored in different forms for convenience Hotel Price screening.

Respectively read the hotel information that has been extracted from multiple different business travelers in a folder, call the function to compare the prices, and then save the information of the hotel applied by each traveler with **the lowest price**, including the reservation platform information, into the final Name the form file with today's date.

Table 4-3: The Result of RPA2 Workflow

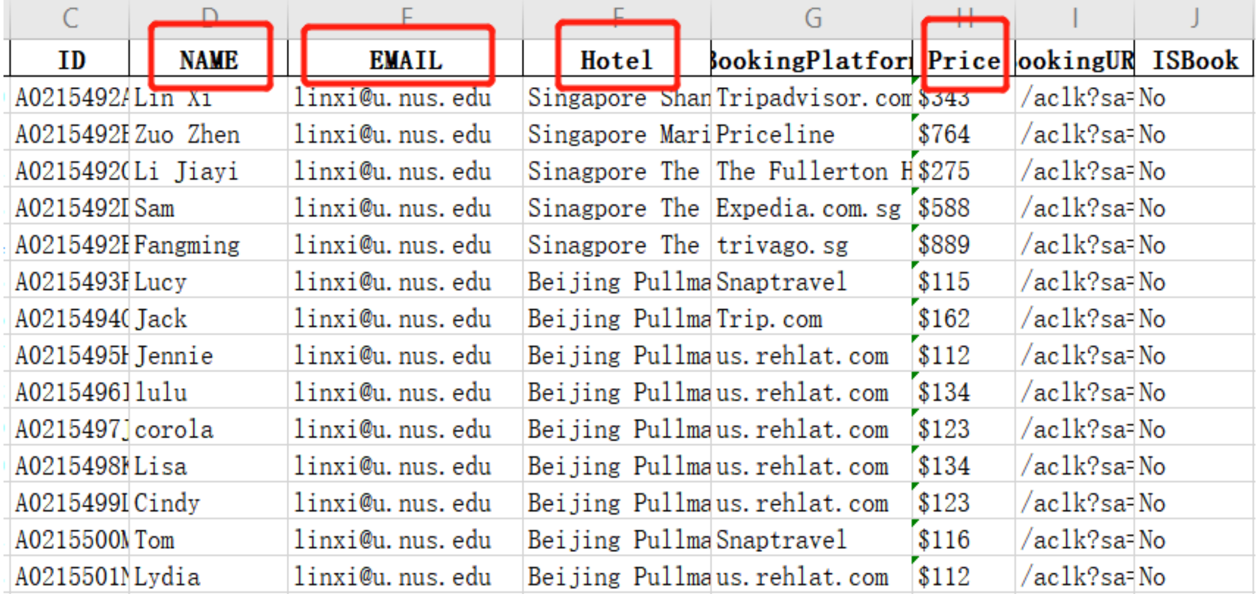


A	B	C	D	E	F	G	H	I
	ID	NAME	EMAIL	Hotel	BookingPl	Price	BookingU	ISBook
0	A0215492	Lin Xi	linxi@u.nu	Singapore	Tripadviso	$343	/aclk?sa=l	No
1	A0215492	Zuo Zhen	linxi@u.nu	Singapore	Priceline	$764	/aclk?sa=l	No
2	A0215492	Li Jiayi	linxi@u.nu	Sinagpore	The Fuller	$275	/aclk?sa=l	No
3	A0215492	Sam	linxi@u.nu	Sinagpore	Expedia.cc	$588	/aclk?sa=l	No
4	A0215492	Fangming	linxi@u.nu	Sinagpore	trivago.sg	$889	/aclk?sa=l	No
5	A0215493	Lucy	linxi@u.nu	Beijing Pu	Snaptrave	$115	/aclk?sa=l	No
6	A0215494	Jack	linxi@u.nu	Beijing Pu	Trip.com	$162	/aclk?sa=l	No
7	A0215495	Jennie	linxi@u.nu	Beijing Pu	us.rehlat.c	$112	/aclk?sa=l	No
8	A0215496	lulu	linxi@u.nu	Beijing Pu	us.rehlat.c	$134	/aclk?sa=l	No
9	A0215497	corola	linxi@u.nu	Beijing Pu	us.rehlat.c	$123	/aclk?sa=l	No
10	A0215498	Lisa	linxi@u.nu	Beijing Pu	us.rehlat.c	$134	/aclk?sa=l	No
11	A0215499	Cindy	linxi@u.nu	Beijing Pu	us.rehlat.c	$123	/aclk?sa=l	No
12	A0215500	Tom	linxi@u.nu	Beijing Pu	Snaptrave	$116	/aclk?sa=l	No
13	A0215501	Lydia	linxi@u.nu	Beijing Pu	us.rehlat.c	$112	/aclk?sa=l	No

4.2.3 RPA3 Send Confirmation Email to Requestor

The task for this Robot is quite simple. Firstly, the robot will get a table from robot2. The table is illustrated as following image:

Table 4-4: Output of RPA2

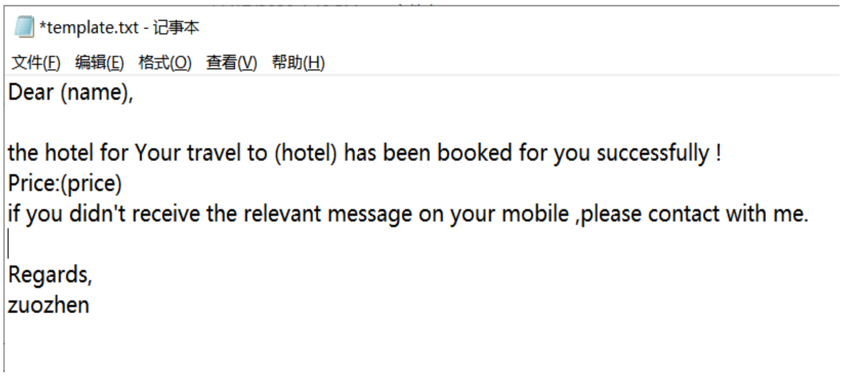


C	D	E	F	G	H	I	J
ID	NAME	EMAIL	Hotel	BookingPlatfor	Price	ookingUR	ISBook
A0215492	Lin Xi	linxi@u.nus.edu	Singapore Shan	Tripadvisor.com	$343	/aclk?sa=	No
A0215492	Zuo Zhen	linxi@u.nus.edu	Singapore Mari	Priceline	$764	/aclk?sa=	No
A0215492	Li Jiayi	linxi@u.nus.edu	Sinagpore The	The Fullerton H	$275	/aclk?sa=	No
A0215492	Sam	linxi@u.nus.edu	Sinagpore The	Expedia.com.sg	$588	/aclk?sa=	No
A0215492	Fangming	linxi@u.nus.edu	Sinagpore The	trivago.sg	$889	/aclk?sa=	No
A0215493	Lucy	linxi@u.nus.edu	Beijing Pullma	Snaptravel	$115	/aclk?sa=	No
A0215494	Jack	linxi@u.nus.edu	Beijing Pullma	Trip.com	$162	/aclk?sa=	No
A0215495	Jennie	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$112	/aclk?sa=	No
A0215496	lulu	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$134	/aclk?sa=	No
A0215497	corola	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$123	/aclk?sa=	No
A0215498	Lisa	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$134	/aclk?sa=	No
A0215499	Cindy	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$123	/aclk?sa=	No
A0215500	Tom	linxi@u.nus.edu	Beijing Pullma	Snaptravel	$116	/aclk?sa=	No
A0215501	Lydia	linxi@u.nus.edu	Beijing Pullma	us.rehlat.com	$112	/aclk?sa=	No

For example, in the default reply template, only the name, hotel price is required by users. Then these data will be contained in the output of RPA2. RPA3 will use these data to construct a reply text for each staff.

The way how RPA3 reply:

1. Get data (email, hotel, name, price) from RPA2.
2. replace the corresponding part in template.txt using data.



Dear (name),

the hotel for Your travel to (hotel) has been booked for you successfully !
Price:(price)
if you didn't receive the relevant message on your mobile ,please contact with me.

Regards,
zuozhen

Fig 4-14: template.txt

3.Login in outlook account

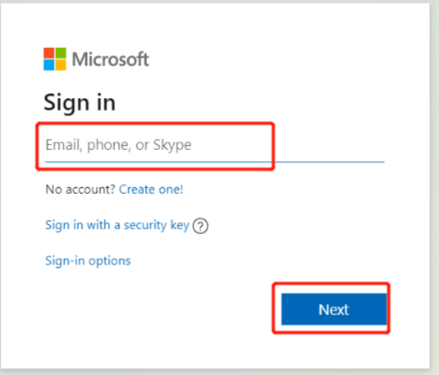
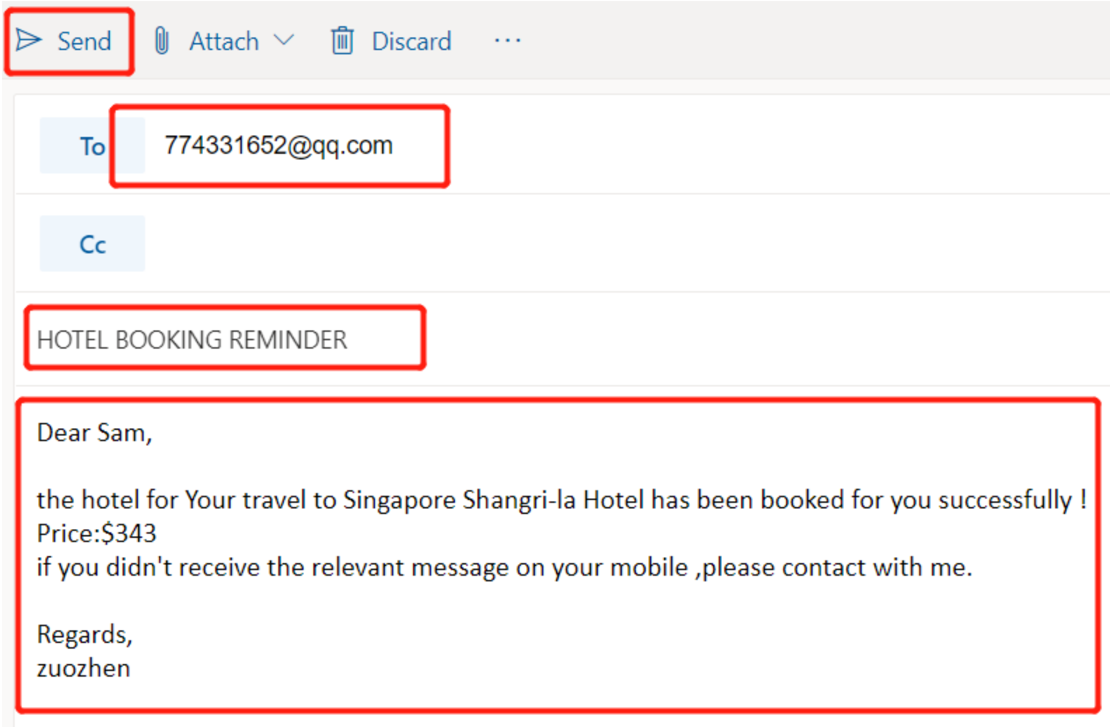


Fig 4-15: Login Outlook

4. Type in target email address, Email subject and reply content



774331652@qq.com

HOTEL BOOKING REMINDER

Dear Sam,

the hotel for Your travel to Singapore Shangri-la Hotel has been booked for you successfully !
Price:$343
if you didn't receive the relevant message on your mobile ,please contact with me.

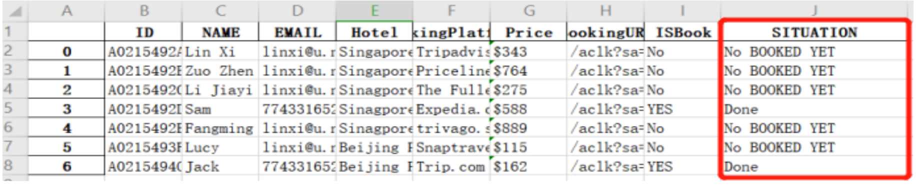
Regards,
zuozhen

Fig 4-16: Email

5. Click ‘send’

6. Build a report file.

Table 4-5: A demo of report file



	ID	NAME	EMAIL	Hotel	kingPlat	Price	ookingUR	ISBook	SITUATION
0	A0215492A	Lin Xi	linxi@u.r	Singapore	Tripadvis	$343	/aclk?sa=	No	No BOOKED YET
1	A0215492E	Zuo Zhen	linxi@u.r	Singapore	Priceline	$764	/aclk?sa=	No	No BOOKED YET
2	A0215492C	Li Jiayi	linxi@u.r	Sinagpore	The Fulle	$275	/aclk?sa=	No	No BOOKED YET
3	A0215492I	Sam	77433165	Sinagpore	Expedia.c	$588	/aclk?sa=	YES	Done
4	A0215492E	Fangming	linxi@u.r	Sinagpore	trivago.s	$889	/aclk?sa=	No	No BOOKED YET
5	A0215493F	Lucy	linxi@u.r	Beijing F	Snaptrave	$115	/aclk?sa=	No	No BOOKED YET
6	A0215494C	Jack	77433165	Beijing F	Trip.com	$162	/aclk?sa=	YES	Done

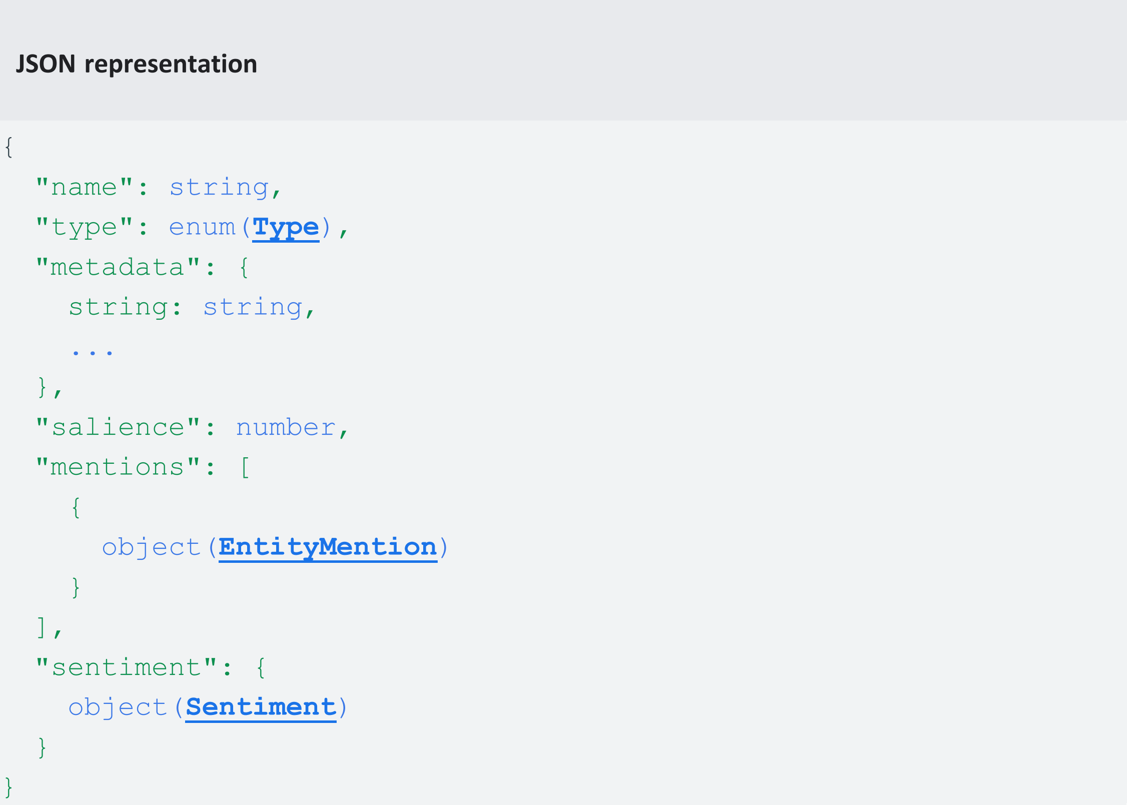
The column ‘SITUATION’ inform the replay state. ‘Done’ represent the email have been sent. ‘NO BOOKED YET’ means the booking specialist have not booked the hotel. Other part of the form is the same with the output of RPA2.

4.3 Google Natural Language Process API

Natural Language uses machine learning to reveal the structure and meaning of text. It can extract information about people, places, and events. Natural Language enables our solution to analyze the email text and recognize the entities in email text.

4.3.1 Name Entity Json Representation

When we call the Natural Language API to analyze the email text, the API will return the entities recognized and its salience score, the sentiment associated with this entities expressed in the text in a json format.



JSON representation

```
{
  "name": string,
  "type": enum(Type),
  "metadata": {
    string: string,
    ...
  },
  "salience": number,
  "mentions": [
    {
      object(EntityMention)
    }
  ],
  "sentiment": {
    object(Sentiment)
  }
}
```

Fig 4-18: Name Entity Representation

Table 4-6: Field Explanation

Fields Explanation Table	
`name`	`string` The representative name for the entity.
`type`	`enum` The entity type.
`metadata`	`map (key: string, value: string)` Metadata associated with the entity. For most entity types, the metadata is a Wikipedia URL and Knowledge Graph MID, if they are available. For the metadata associated with other entity types, see the Type table below. An object containing a list of `"key": value` pairs. Example: `{ "name": "wrench", "mass": "1.3kg", "count": "3" }`.
`salience`	`number` The salience score associated with the entity in the [0, 1.0] range. The salience score for an entity provides information about the importance or centrality of that entity to the entire document text. Scores closer to 0 are less salient, while scores closer to 1.0 are highly salient.
`mentions[]`	`Object` The mentions of this entity in the input document. The API currently supports proper noun mentions.
`sentiment`	`Object` This field will contain the aggregate sentiment expressed for this entity in the provided document.

4.3.1 Name Entity Type

In RPA1 we mainly use the API to recognize the following entities.

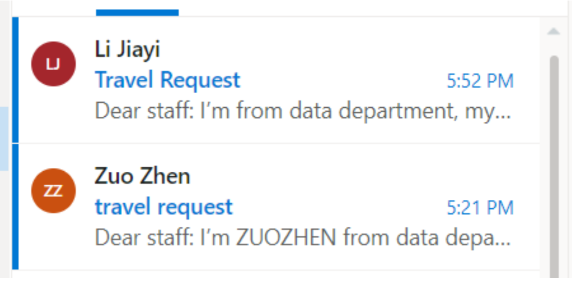
Table 4-7: Name Entity Type

Name Entity Type	
UNKNOWN	Unknown
PERSON	Person
LOCATION	Location
ORGANIZATION	Organization
PHONE_NUMBER	Phone number The metadata lists the phone number, formatted according to local convention, plus whichever additional elements appear in the text: number - the actual number, broken down into sections as per local convention national_prefix - country code, if detected area_code - region or area code, if detected extension - phone extension (to be dialed after connection), if detected
ADDRESS	Address The metadata identifies the street number and locality plus whichever additional elements appear in the text: street_number - street number locality - city or town street_name - street/route name, if detected postal_code - postal code, if detected country - country, if detected< broad_region - administrative area, such as the state, if detected narrow_region - smaller administrative area, such as county, if detected

Name Entity Type	
	`sublocality` - used in Asian addresses to demark a district within a city, if detected
`DATE`	Date The metadata identifies the components of the date: `year` - four digit year, if detected `month` - two digit month number, if detected `day` - two digit day number, if detected
`PRICE`	Price The metadata identifies the `value` and `currency`.

5 Performance & validation

We simulate a use case to verify the system. Assume now we have some request unread in the email box. (Assume we have 2 unread email)



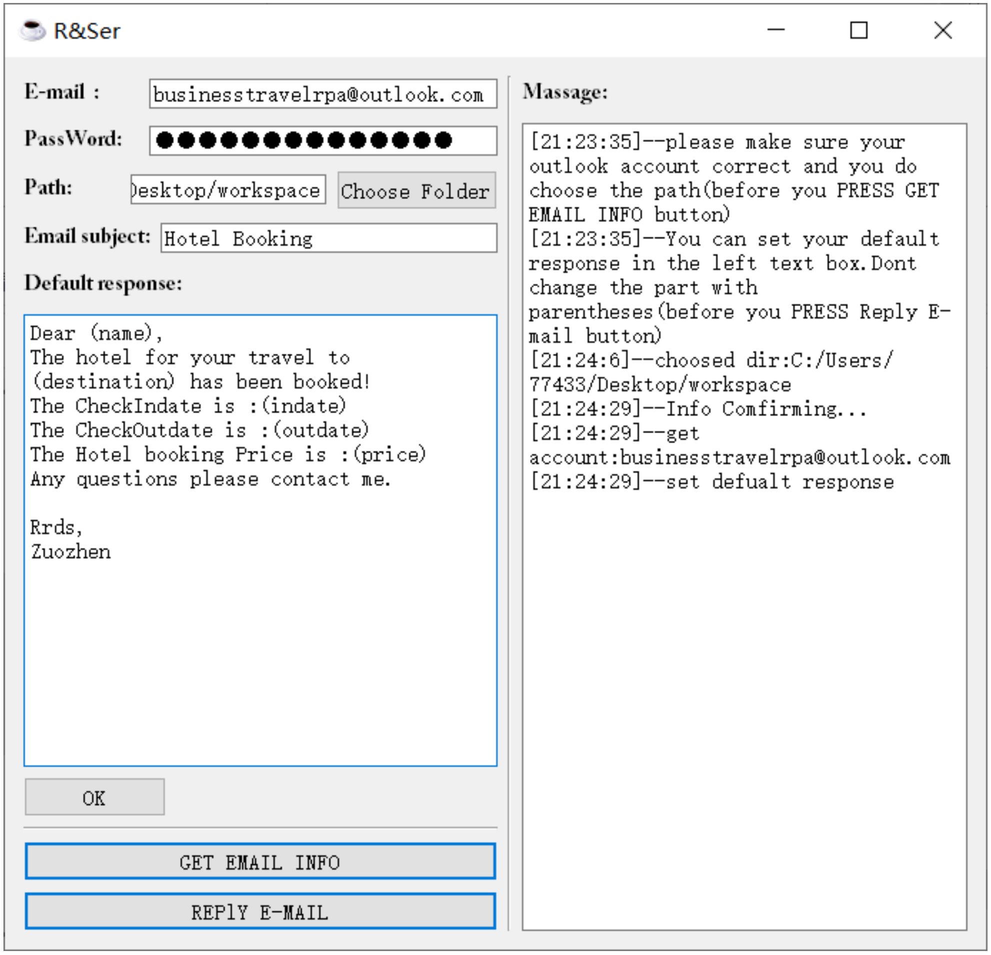
Li Jiayi
Travel Request 5:52 PM
Dear staff: I'm from data department, my...

Zuo Zhen
travel request 5:21 PM
Dear staff: I'm ZUOZHEN from data depa...

Fig 5-1: Request Unread Inbox

Now, run the system to process. (You can view the total process via our video attachment)

First, we need to set up the system as follow, point a path to store the output file, click 'ok' and 'GET EMAIL INFO' by sequence. The robot starts to read the email and grab hotel information through internet.



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●

Path: esktop/workspace

Email subject: Hotel Booking

Default response:

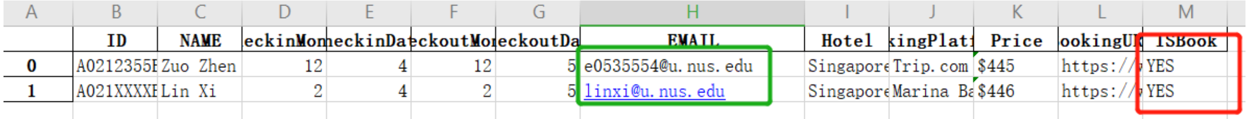
```
Dear (name),
The hotel for your travel to
(destination) has been booked!
The CheckIndate is :(indate)
The CheckOutdate is :(outdate)
The Hotel booking Price is :(price)
Any questions please contact me.

Rrds,
Zuozhen
```

Massage:

```
[21:23:35]--please make sure your
outlook accont correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[21:23:35]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[21:24:6]--choosed dir:C:/Users/
77433/Desktop/workspace
[21:24:29]--Info Comfirming...
[21:24:29]--get
account:businesstravelrpa@outlook.com
[21:24:29]--set defualt response
```

Fig 5-2: The Robot running page

After the robot complete their tasks, open the path you have pointed. Open the 'hotelinfo-today' table, and manually book hotel for them. After we have booked hotel for them, we need to change the book state on this table.

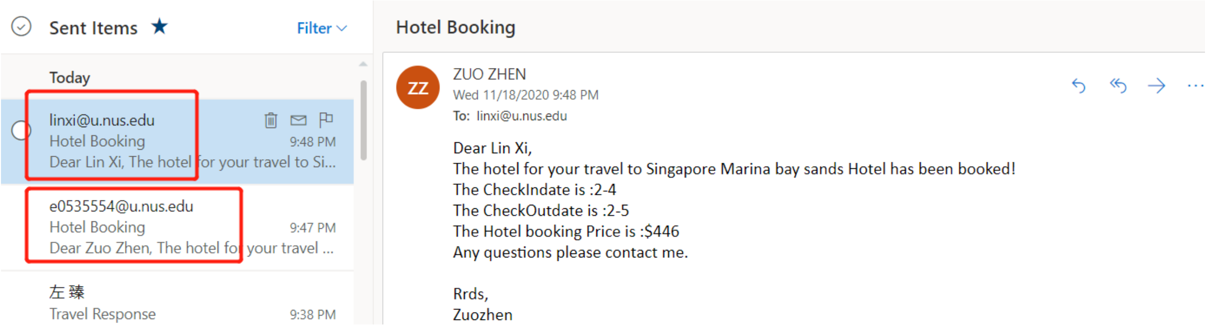


A	B	C	D	E	F	G	H	I	J	K	L	M
	ID	NAME	eckinMon	eckinDa	eckoutMo	eckoutDa	EMAIL	Hotel	kingPlat	Price	ookingU	ISBook
0	A0212355E	Zuo Zhen	12	4	12	5	e0535554@u.nus.edu	Singapore	Trip.com	$445	https://	YES
1	A021XXXXE	Lin Xi	2	4	2	5	linxi@u.nus.edu	Singapore	Marina Ba	$446	https://	YES

Fig 5-3: The form need to be updated after booking

The finally step is reopening the system, click OK button, and click 'REPLY E-MAIL' . Another robot will automatically send e-mail according your template reply.

The following image show the sent item of the account, confirm the e-mail has been sent out. Our system work well !



Today

linxi@u.nus.edu
Hotel Booking 9:48 PM
Dear Lin Xi, The hotel for your travel to Si...

e0535554@u.nus.edu
Hotel Booking 9:47 PM
Dear Zuo Zhen, The hotel for your travel ...

左臻
Travel Response 9:38 PM

ZZ ZUO ZHEN
Wed 11/18/2020 9:48 PM
To: linxi@u.nus.edu

Dear Lin Xi,
The hotel for your travel to Singapore Marina bay sands Hotel has been booked!
The CheckIndate is :2-4
The CheckOutdate is :2-5
The Hotel booking Price is :$446
Any questions please contact me.

Rrds,
Zuozhen

Fig 5-4: Confirmed Response Email

6 Challenge & Recommendation

Our team has successfully deployed the Intelligent Commercialized RPA-Business traveler for corporate business travelers on the local machine area, which can provide services for various types of companies. It is an enterprise automated work intelligent system that integrates application mail processing, natural language processing extraction requirements, request information processing, automatic information collection, price comparison, hotel ordering and automatic mail notification etc. Although the system has been successfully deployed and can be used smoothly, we have encountered many problems and challenges in the process, and there are still some areas for improvement.

6.1 Challenges

6.1.1 Data Acquisition via Web Automation

As mentioned in **4.2.2 RPA2 Compare Hotel Price in different Travel Agents**, the system makes hotel reservations based on the date requested by the traveler. Because in the automated search for hotel information, the calendar selector must be selected according to the date of the business trip, and the Xpath of the calendar selector will change according to the selection of different months, so this is a huge challenge for information screening. The first problem is how to select the corresponding month attribute according to the travel month. The second is how to accurately identify the specific date based on the determination of the month. The third problem is that the calendar selector will record the history of each search. After selection, the icon will change and cannot be visualized. These problems need to be solved in the process of information screening and extraction.

As described before, Fuzzy matching, the method of building multiple graph matching libraries and the visual automation function which included in Python TagUI are being used to solve these problems, and after many tests and training, the error rate can be ignored, which means hotels can be screened using calendar selector accurately based on the check-in date applied by business travelers.

6.1.2 Reaching out to the Business Companies

A recent report stated that robotic process automation (RPA) software revenue increased by 63.1% in 2018 to reach $846 million, making it the fastest growing segment of the global enterprise software market. Well-known analysts also predict that in 2019 alone, RPA software revenue has reached 1.3 billion US dollars. RPA technology is designed to automate repetitive low-value activities, such as processing insurance claims, payroll, filling out forms and performing calculations. Removing these mundane practices from the employee's workflow can provide employees with more time to perform high-value tasks such as strategic planning and corporate governance, including how to get closer to users, communicate with users, understand user needs, and specify solutions.

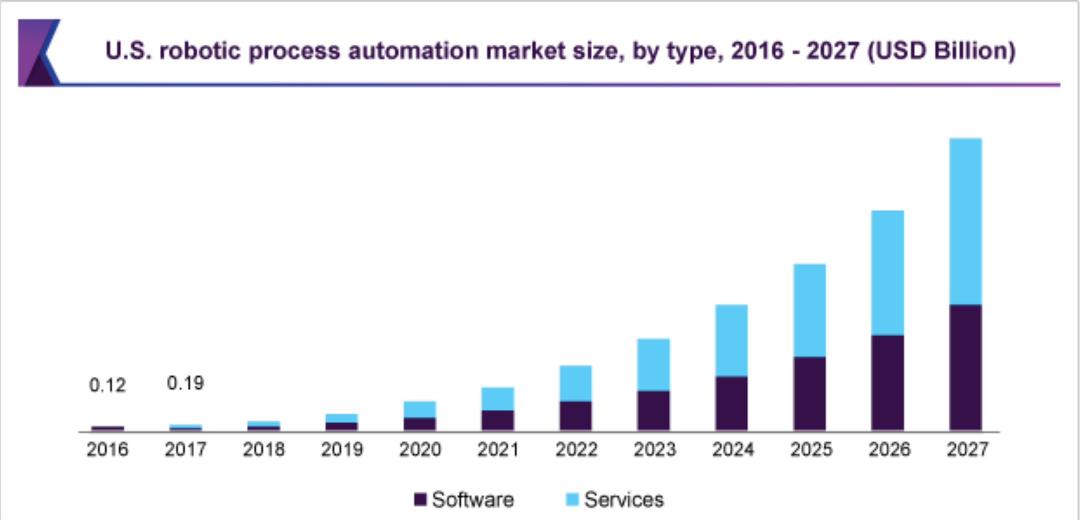


Fig 6-1: RPA market Size

Our Hotel Booking Agent, which is an enterprise automated work intelligent system that integrates application mail processing, requirements extraction, request information processing (powered by Google Cloud AI natural language processing), automatic information collection, price comparison, hotel ordering and automatic mail notification etc. In the whole process, some low-value workflows including reading emails, comparing prices, booking and other processes are all replaced by RPA. There is no need to take up corporate staff time to repeat these tasks. The related staffs only need to run RPA regularly and check the final key information. Our system has the huge potential to be integrated into the workflow of various companies, as well as the ability to perform post-service upgrades.

But as learned in class, some companies currently have some misapprehension about RPA. Moreover, considering some problems that the introduction of RPA may lead to some layoffs, and will be resisted by some employees of the company, etc. Our Business Traveler system may be promoted with the help of some related platforms, and in some small applications and doing some company conducts pilot projects to obtain more promotion and application opportunities.

6.2 Future Improvements

Optimize the screening process

At present, it is based on the travel time of the business traveler, the travel place and the name of the hotel, and the hotel provided by the Travel Booking agent with the lowest price is obtained. There is no consideration of the screening conditions customized by business travelers, and there are no more special screening conditions for us to choose from the current web automation extraction information webpage, so this system can continue to find better methods and webpage platforms in the future for Information screening and acquisition, so that we can provide more customized hotel screening for the business traveler.

APPENDIX OF REPORT A

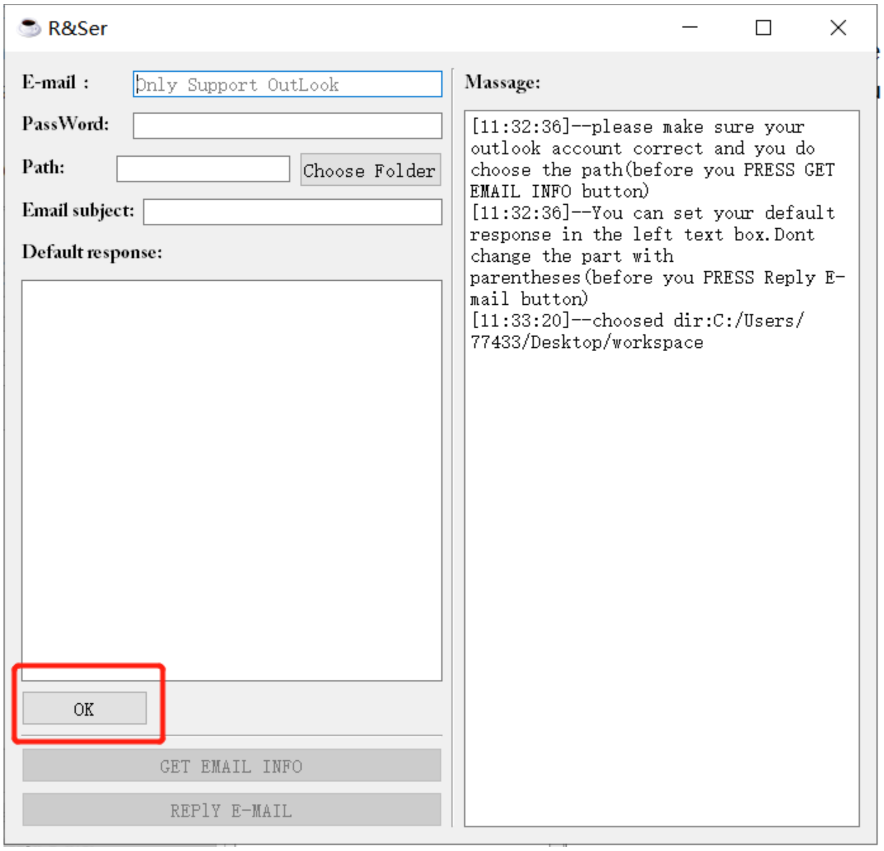
Installation & User Guides

User Guide

1. Configuration

The first time when open Business Traveler, Outlook account need to be fill in the E-mail blank correctly (notice the remind massage at right). Point a certain Path in your computer, the relevant file will be output to that path.

Before you confirm your configuration by clicking “OK”, the two buttons below are unable to be clicked.



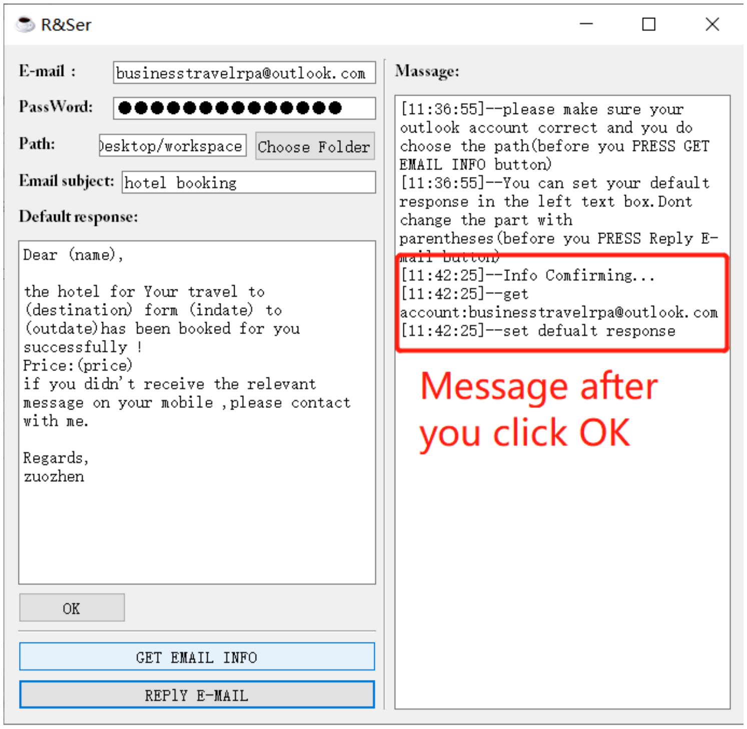
```
[11:32:36]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[11:32:36]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[11:33:20]--choosed dir:C:/Users/
77433/Desktop/workspace
```

Fig 1: Business Traveler Overvies

2. Start RPA1 and RPA2

Two Software robots will be executed in a sequence.

Then, there will be a chrome page launched. Notice: DON’T do anything on that page, all the thing will be done automatically.



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●●

Path:)esktop/workspace

Email subject: hotel booking

Default response:

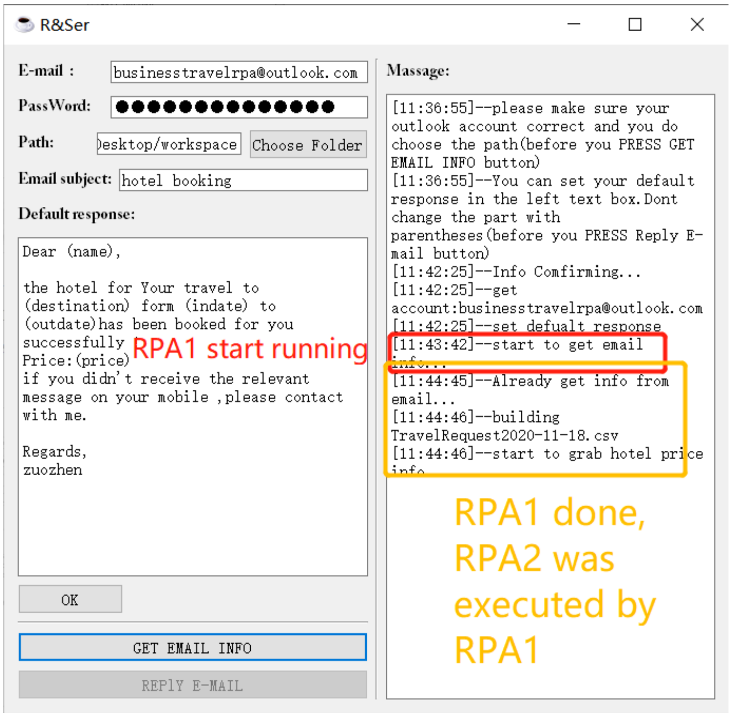
```
Dear (name),

the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully !
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

Massage:

```
[11:36:55]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[11:36:55]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[11:42:25]--Info Comfirming...
[11:42:25]--get
account:businesstravelrpa@outlook.com
[11:42:25]--set defualt response
```

Message after you click OK

Fig 2: After run RPA1&RPA2 Ⅰ



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●●

Path:)esktop/workspace

Email subject: hotel booking

Default response:

```
Dear (name),

the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

RPA1 start running

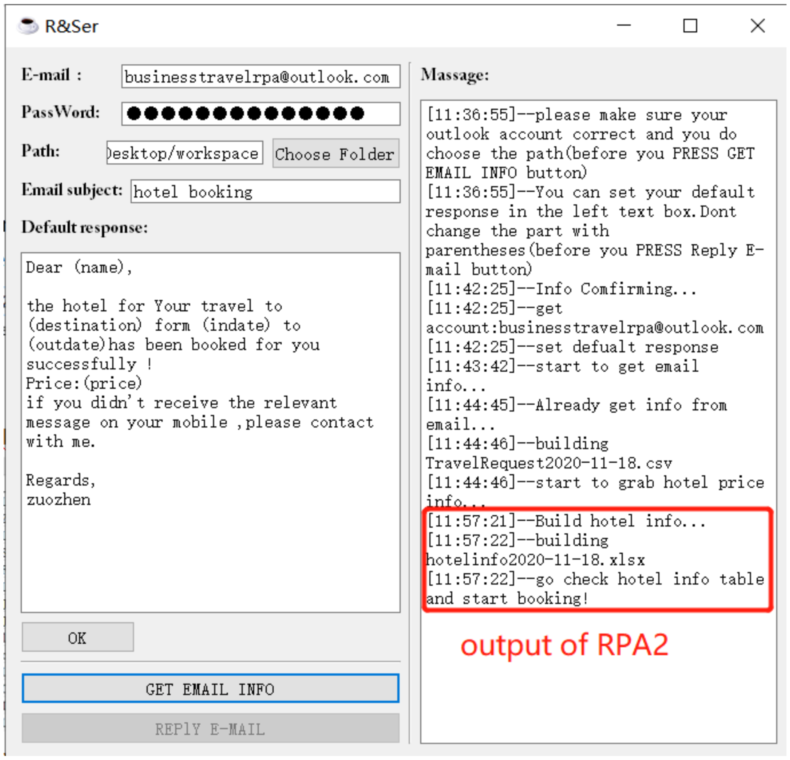
Massage:

```
[11:36:55]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[11:36:55]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[11:42:25]--Info Comfirming...
[11:42:25]--get
account:businesstravelrpa@outlook.com
[11:42:25]--set defualt response
[11:43:42]--start to get email
info...
[11:44:45]--Already get info from
email...
[11:44:46]--building
TravelRequest2020-11-18.csv
[11:44:46]--start to grab hotel price
info.
```

RPA1 done, RPA2 was executed by RPA1

Fig 3: After run RPA1&RPA2 Ⅱ

The name of output file of RPA1 is in format like “Travel Request-YEAR-MONTH-DAY”. The name of output file of RPA2 is in format like “hotel info-YEAR-MONTH-DAY”.



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●●

Path:)esktop/workspace

Email subject: hotel booking

Default response:

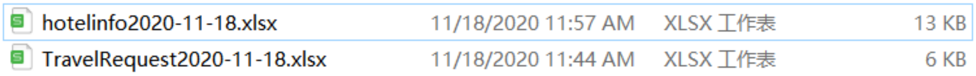
```
Dear (name),

the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully !
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

```
[11:36:55]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[11:36:55]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[11:42:25]--Info Comfirming...
[11:42:25]--get
account:businesstravelrpa@outlook.com
[11:42:25]--set defualt response
[11:43:42]--start to get email
info...
[11:44:45]--Already get info from
email...
[11:44:46]--building
TravelRequest2020-11-18.csv
[11:44:46]--start to grab hotel price
info...
[11:57:21]--Build hotel info...
[11:57:22]--building
hotelinfo2020-11-18.xlsx
[11:57:22]--go check hotel info table
and start booking!
```

output of RPA2

Fig 4: The interface after running RPA2

Notice: before clicking REPLY E-MAIL, you should book hotel manually. Then the file will be found in workspace folder.

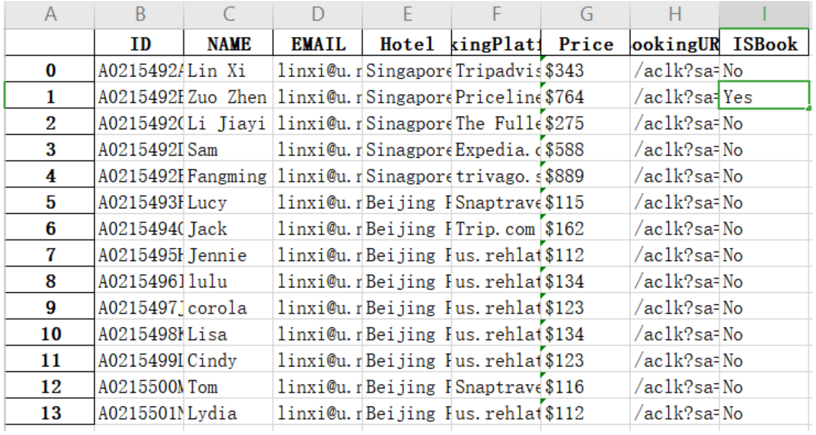


hotelinfo2020-11-18.xlsx	11/18/2020 11:57 AM	XLSX 工作表	13 KB
TravelRequest2020-11-18.xlsx	11/18/2020 11:44 AM	XLSX 工作表	6 KB

Fig 5: Stored files after running robots

3.Initial and change the files

When you get above files, you can close R&Ser and do the booking job and manually and change the’ hotelinfo’ table.



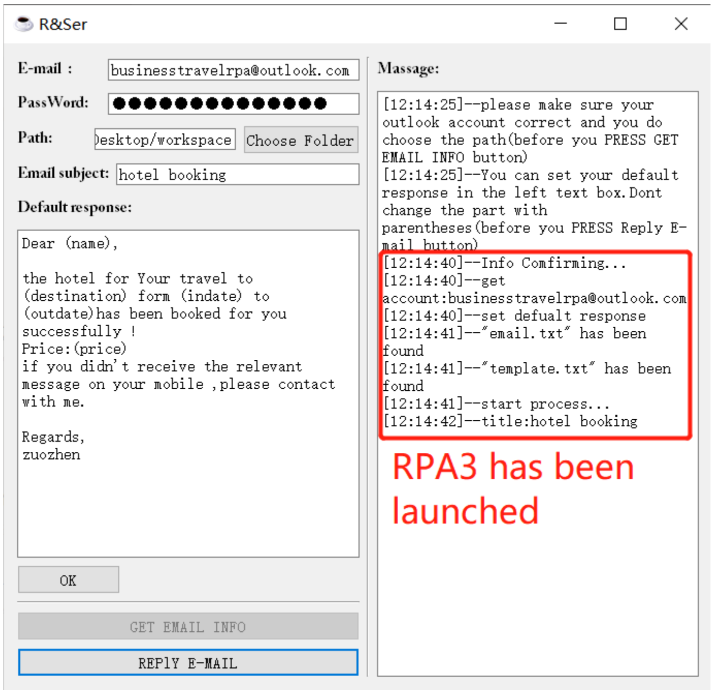
	ID	NAME	EMAIL	Hotel	kingPlatf	Price	ookingUR	ISBook
0	A0215492A	Lin Xi	linxi@u.r	Singapore	Tripadvis	$343	/aclk?sa=	No
1	A0215492B	Zuo Zhen	linxi@u.r	Singapore	Priceline	$764	/aclk?sa=	Yes
2	A0215492C	Li Jiayi	linxi@u.r	Sinagpore	The Fulle	$275	/aclk?sa=	No
3	A0215492D	Sam	linxi@u.r	Sinagpore	Expedia.c	$588	/aclk?sa=	No
4	A0215492E	Fangming	linxi@u.r	Sinagpore	trivago.s	$889	/aclk?sa=	No
5	A0215493F	Lucy	linxi@u.r	Beijing F	Snaptrave	$115	/aclk?sa=	No
6	A0215494G	Jack	linxi@u.r	Beijing F	Trip.com	$162	/aclk?sa=	No
7	A0215495H	Jennie	linxi@u.r	Beijing F	us.rehlat	$112	/aclk?sa=	No
8	A0215496I	lulu	linxi@u.r	Beijing F	us.rehlat	$134	/aclk?sa=	No
9	A0215497J	corola	linxi@u.r	Beijing F	us.rehlat	$123	/aclk?sa=	No
10	A0215498K	Lisa	linxi@u.r	Beijing F	us.rehlat	$134	/aclk?sa=	No
11	A0215499L	Cindy	linxi@u.r	Beijing F	us.rehlat	$123	/aclk?sa=	No
12	A0215500M	Tom	linxi@u.r	Beijing F	Snaptrave	$116	/aclk?sa=	No
13	A0215501N	Lydia	linxi@u.r	Beijing F	us.rehlat	$112	/aclk?sa=	No

Fig 6: Result after running robots

If you already booked for somebody, just change the ISBook column in the right place as 'YES'.

4.Launch RPA3

Re-open R&Ser, the configuration of last time you click 'ok' has been saved and loaded automatically.



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●

Path:)esktop/workspace

Email subject: hotel booking

Default response:

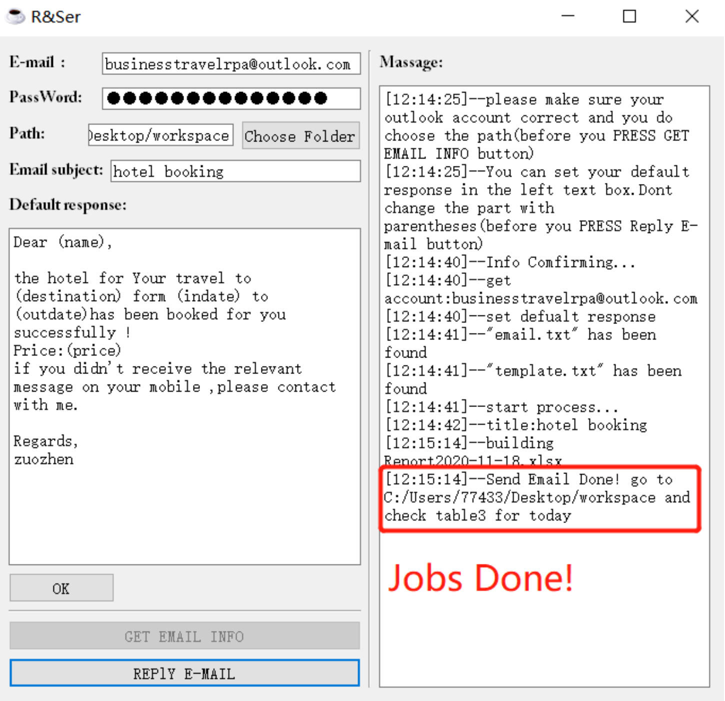
```
Dear (name),

the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully !
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

Massage:

```
[12:14:25]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[12:14:25]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[12:14:40]--Info Comfirming...
[12:14:40]--get
account:businesstravelrpa@outlook.com
[12:14:40]--set defualt response
[12:14:41]--"email.txt" has been
found
[12:14:41]--"template.txt" has been
found
[12:14:41]--start process...
[12:14:42]--title:hotel booking
```

RPA3 has been launched

Fig 7: Result after running RPA3



E-mail : businesstravelrpa@outlook.com

PassWord: ●●●●●●●●●●●●●●

Path:)esktop/workspace

Email subject: hotel booking

Default response:

```
Dear (name),

the hotel for Your travel to
(destination) form (indate) to
(outdate)has been booked for you
successfully !
Price:(price)
if you didn't receive the relevant
message on your mobile ,please contact
with me.

Regards,
zuozhen
```

Massage:

```
[12:14:25]--please make sure your
outlook account correct and you do
choose the path(before you PRESS GET
EMAIL INFO button)
[12:14:25]--You can set your default
response in the left text box.Dont
change the part with
parentheses(before you PRESS Reply E-
mail button)
[12:14:40]--Info Comfirming...
[12:14:40]--get
account:businesstravelrpa@outlook.com
[12:14:40]--set defualt response
[12:14:41]--"email.txt" has been
found
[12:14:41]--"template.txt" has been
found
[12:14:41]--start process...
[12:14:42]--title:hotel booking
[12:15:14]--building
Report2020-11-18.xlsx
[12:15:14]--Send Email Done! go to
C:/Users/77433/Desktop/workspace and
check table3 for today
```

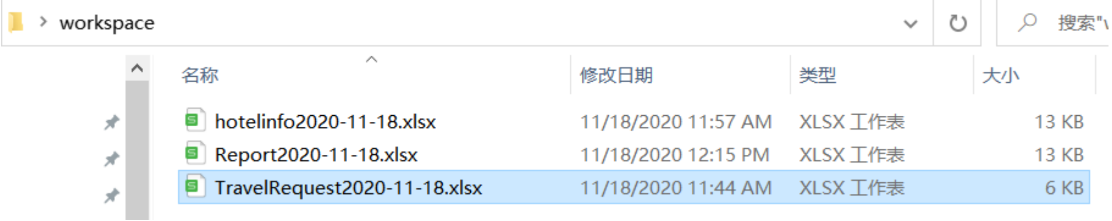
Jobs Done!

Fig 8: End of workflow page

5. Check the Output files

There should be three files as follows for today.

Then, Enjoy the convenience and efficiency of office brought by RPA!



名称	修改日期	类型	大小
hotelinfo2020-11-18.xlsx	11/18/2020 11:57 AM	XLSX 工作表	13 KB
Report2020-11-18.xlsx	11/18/2020 12:15 PM	XLSX 工作表	13 KB
TravelRequest2020-11-18.xlsx	11/18/2020 11:44 AM	XLSX 工作表	6 KB

Fig 9: Three stored files for today

Installation

1. Enter folder
   ```
   $ cd SystemCode/
   ```

2. Install dependencies
   ```
   $ pip install -r requirements.txt
   $ pip install --upgrade google-cloud-language
   ```

3. run the application
   ```
   $ python main.py
   ```

APPENDIX OF REPORT E

Individual Reports

Individual Report: Li Jiayi (A0215492E)

Personal Contribution

The first contribution is the design and operation of RP2- Compare Hotel Price in different Travel Agents, including the preprocessing and key information extraction of the traveler's application information obtained from the previous workflow, and the selection of hotels with the help of Web automation according to the traveler's needs and time, and then comparison With the prices provided by all Travel Booking Agent, the best hotel prices are extracted, and then the preferential hotel prices of each traveler and the URL of the booking platform are integrated on a single form for the next workflow.

The next contribution is to comprehensively evaluate the function and performance of the system, and put forward the challenge part and the recommendation part of the system. The first part of the challenge is to automatically extract hotel information with the help of web automation based on travel information, including the accuracy of the calendar selector matching form information, and the intrusiveness of the selector's historical information records. It also puts forward the system's challenges in the commercial market and its advantages promotion plan. Regarding the suggestion part, it is possible to find a wider and more customized method of extracting hotel information according to the specific information preferences of the traveler. This part can continue to be optimized.

Learning outcome

Through the conception, design and operation of the RPA project. I really experienced how to apply what I learned to practice. I also really realized the practicality of RPA in the automation of enterprise business workflow. This project combines the contents of the three modules of Intelligent Software Agents Cert, including Software Robot-Best Practice, Intelligent Process Automation and RPA and IPA strategy and management. We will comprehensively apply what we have learned in class, including the application of RPA software (TagUI), commercial thinking in the process of RPA deployment, RPA operation strategies and the specific realization of IPA, and finally build our project–Hotel Booking Agent. In this process, we internalize and absorb all the knowledge learned in the classroom and can use it flexibly. And in this process, we also encountered a lot of difficulties and problems. In the deployment of the RPA design part that we are responsible for, we have overcome these difficulties through analysis of problems and continuous exploration. The solutions to these problems and the exploration process have made us more proficient in RPA. Design process and operating model.

Knowledge and Skill Application

Through the real design and deployment of RPA projects, I truly understand the power of RPA and IPA in assisting enterprise process automation. They can help employees free themselves from low-value repetitive tasks to focus on higher-value dealings with users work. In terms of technology, through the design of this project, we have made rapid improvements in problem solving and rapid deployment, and we can use this knowledge in future work automation processes. In terms of RPA project management and strategy, we also have our own new cognitions and perspectives. This knowledge will be vital to the enterprise and work in the future.

Individual Report: Lin Xi (A0215403W)

Personal Contribution

In this project, my main contribution is as following:

The first one is the project management, which includes project planning, deciding scope of our application, scheduling of tasks and events for each team member.

The Second one is the product business solution design, mainly including the business scenario definition and business solution design. At the beginning of our project, I propose the business scenario of business trip hotel booking and provide detailed "as is" business process description and the improved "to be" business process with RPA and cloud NLP API.

The third one is contributing to the system architecture design, not only I have participated in defining the function of each RPA modules and data flow but also I have design the database structure of employee booking request data and target hotel reservation data.

The Fourth contribution is the RPA1-Extract Structured Booking Info from Email development, I have managed to realize the email login, email search, and email text and key information extraction automatically. Combined with rule-based engine and google cloud NLP API extracting the structured booking request data from raw text.

My fifth contribution is to implement google cloud natural language process API to analyze the semi-structured employee booking request text, extract key name entities to generate structured request data.

Learning outcome

Through the group project I have learned in RPA implementation project, TagUI, google cloud natural language process API.

First of all, in this project, I have learned the methodology of implementing an RPA project. At initial stage of the project we don't have a clear concept of the real business scenario where our RPA solution should apply to, as a result the design for our product solution became difficult to proceed. Then I changed my attention to focus on defining the business scenario first. When the business scenario detail is confirmed in our group, I begin to analyse the pros and cons for the as is process, each team member has provided their proposal on the business process improvement solution. After our group have reached an agreement on the improved to be process of this business scenario, the project become easier to pushing forward since all our thoughts and solution is supported by real business scenario.

Second, I have learned using TagUI to do web operation process automation, and become more familiar with using Xpath to locate web elements. In the development of RPA process I have encountered many exceptions caused by web structure change and process change, by solving this exceptions I have learned how to make a RPA process more robust.

Third, in this program I have experienced the overall process of implementing a google Cloud Natural Language API, from cloud project create, set up local authentication, Install and initialize the Cloud SDK and Install the client library to entity analysis for the email text, through which I have learned the process of calling a cloud AI API to realize specified business needs.

Knowledge and Skill Application

In this project the methodology of implementation a RPA/IPA program I have learned can be used in my future work to use RPA/IPA tools improve the business process. In my future work I can first look into the business process and to standardize the process, find out where high frequency and repetitive work existing. Therefore, we can use RPA/IPA tools to handle these tasks automatically to improve the quality and efficiency of these process. I can also use RPA/IPA tools to do web automation to collect information.

Second, google cloud AI has provided various of applications, we can use its abilities to solve many business problems when we don’t have specified local AI functions.

Individual Report: Zuo Zhen (A0215464H)

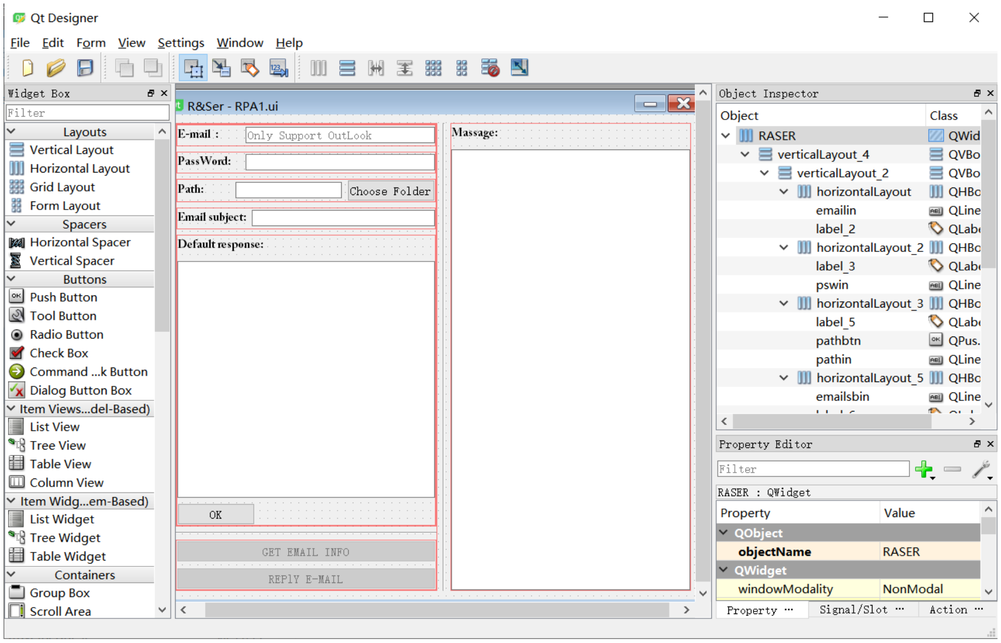
Personal contribution

RPA development

At very beginning, after our discussion and deciding the topic, I contributed to develop a software robot for automatically send email. In this part I mainly used a TagUI to open the email web page and send email. Nothing fancy for my first task.

UI design and UI Implement

My second task is to design a user-friendly for customers. Because we can't ask our user to type in command to execute the RPA robot. (Because we use python here , there are no executable file will be generated). So, I start to learn about GUI program in python. Here I chose PyQt5 library, learned about the basic element of a GUI program, did some practice. Then I learned to use Qtdesigner, which tool can help me to easily design the user interface.



E-mail : Only Support OutLook

Object	Class
RASER	QWid
verticalLayout_4	QVBo
verticalLayout_2	QVBo
horizontalLayout	QHBo
emailin	QLine
label_2	QLab
horizontalLayout_2	QHBo
label_3	QLab
pswin	QLine
horizontalLayout_3	QHBo
label_5	QLab
pathbtn	QPus.
pathin	QLine
horizontalLayout_5	QHBo
emailsbin	QLine

RASER : QWidget

Property	Value
QObject	
objectName	RASER
QWidget	
windowModality	NonModal

Fig 1: Designing in Qt designer

Integration and Logic control

The UI designing process go well, then, I had to connect all the RPA our team made with the elements on the UI, like button, message box and etc. So here I did the system integration job. Because the UI procedure is running as a single thread, and the RPA operation is a little bit time consuming. So, I learned to do the multi-threading program. In this way, we can operate the UI when the RPA working (Although we don't have to). In this part, I design and implement some function of the UI, such as history remember, message reminding. I think it's a little bit complicate to control the system logic. Because for someone use it for first time. He may click it randomly because he don’t know how to use it correctly. That’s may cause some unknown errors. So, I tried to control many signals inside the system and keep the system stable.

System Test

After the integration, I compile the user guides illustrating how to operate the UI. And do the test trying different data. Evaluate and improve the system step by step. Finally, I help to recording the operation video.

Learning outcome

The first part, I become more familiar with TagUI tool. Using python to do exception control makes me more thoughtful when build code.

The second part, I learned about GUI program for the first time. But I learned it quickly, firstly try to understand the fundamental concept in PyQt5, and learned to use Qt Designer to customize a user interface for our system. Creation is a pleasant process. Also, first time contacting with pyinstaller, I learned how to convert a python program into executable file on Windows platform.

When it comes to logic control, I learned about multi-threading program. Trying to understand how the multi thread work, which let me know more about how the operation system running. Which I think will be useful in my future development task.

Knowledge and Skill Application

Python: use to build our system

TagUI: used to do web automation

PyQt5: (UI implement)

Qt designer: used to customize User interface

Multi-threads: used to do logic control, connect RPA with user interface.