



# Coursework Submission – Cover Sheet

*\*Please complete ALL information\**

Leeds Student ID Number: 201389106	
SWJTU Student ID Number: 2019110034	
Student Name: Lingfeng Ren	
Module Code & Name: XJCO3011 Web Services and Web Data (36587)	
Title of Coursework Item: Coursework 1 Report	
For the Attention of: Dr.Guilin Zhao	
Deadline Time: 23:59	Deadline Date: 2023/4/17
Student Signature: 任凌风	For office use:

date stamp

## DECLARATION of Academic Integrity

I am aware that the University defines plagiarism as presenting someone else's work, in whole or in part, as your own. Work means any intellectual output, and typically includes text, data, images, sound or performance.

I promise that in the attached submission I have not presented anyone else's work, in whole or in part, as my own and I have not colluded with others in the preparation of this work. Where I have taken advantage of the work of others, I have given full acknowledgement. I have not resubmitted my own work or part thereof without specific written permission to do so from the University staff concerned when any of this work has been or is being submitted for marks or credits even if in a different module or for a different qualification or completed prior to entry to the University. I have read and understood the University's published rules on plagiarism and also any more detailed rules specified at School or module level. I know that if I commit plagiarism I can be expelled from the University and that it is my responsibility to be aware of the University's regulations on plagiarism and their importance.

I re-confirm my consent to the University copying and distributing any or all of my work in any form and using third parties (who may be based outside the EU/EEA) to monitor breaches of regulations, to verify whether my work contains plagiarised material, and for quality assurance purposes.

I confirm that I have declared all mitigating circumstances that may be relevant to the assessment of this piece of work and that I wish to have taken into account. I am aware of the University's policy on mitigation and the School's procedures for the submission of statements and evidence of mitigation. I am aware of the penalties imposed for the late submission of coursework.

# Web Final Report

## Content

Business Situation Analysis .....	2
Requirement Documents .....	2
Requirement Survey .....	2
Airline .....	3
Project Introduction .....	3
Functional Requirements .....	3
Aggregator .....	4
Project Introduction .....	4
Functional Survey .....	4
Payment Provider .....	5
Project Introduction .....	5
Functional Requirements .....	5
Technical Highlights .....	5
Working Principle .....	6
Architecture .....	7
Database .....	7
Airline .....	7
Aggregator .....	9
Paymethod .....	9
System Interface (API) .....	10
Airline .....	10
Payment Provider .....	13
Specifications of the Client Applications .....	16
Meeting Minutes .....	17
Whole Group .....	17
Meeting1 .....	17
Meeting2 .....	17
Payment Provider Group .....	19
Meeting3 .....	19
Meeting4 .....	19
Meeting5 .....	20
Flight Aggregator Group .....	21
Meeting3 .....	21
Meeting4 .....	22
Meeting5 .....	23
Airline Group .....	24
Meeting3 .....	24
Meeting4 .....	25
Meeting5 .....	27

## Business Situation Analysis

The flight search and booking process involves several steps. Each step contributes to the overall booking experience.

First, the user logs in to the aggregator or registers if it is their first time using the system. Next, the user searches for flights and selects one, which generates an order number, passenger information, flight information, and booking time. The aggregator then sends this information to the airline for further processing.

Upon receiving the request, the airline generates an AID and updates the seat information for the selected flight. The airline then responds to the aggregator with a booking confirmation, supported payment platforms, and the AID. This ensures that the user has access to the most up-to-date flight and availability information.

Once the user has selected a payment platform and clicked "pay," the aggregator generates an order number, order total price, and selected payment platform. This information is sent to the airline, which sends the order number, AID, total price, and airline company name to the payment platform for processing.

The payment platform generates an invoice with a PID, AID, order number, total price, and key. The invoice is sent to the airline with the key removed. The invoice serves as an official record of the transaction and provides the user with a clear breakdown of the costs involved.

After the user has confirmed the payment, the payment platform sends the order number and its corresponding key to the aggregator. The aggregator then sends the order number, corresponding key, and payment time to the airline for confirmation. This ensures that the payment has been processed correctly and that the user's reservation is confirmed.

Finally, the airline compares the key and sends the order number and confirmation to the aggregator. This provides the user with a final confirmation of their reservation and ensures that any discrepancies or issues are addressed in a timely manner.

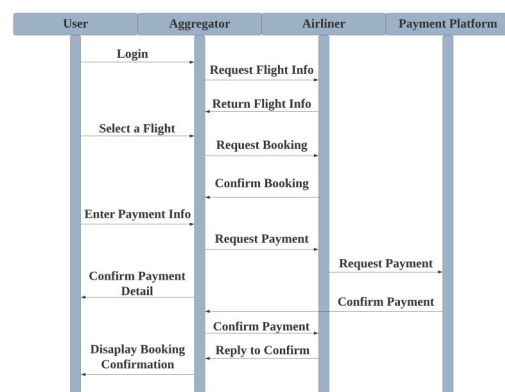


Fig 1 System Sequence Diagram

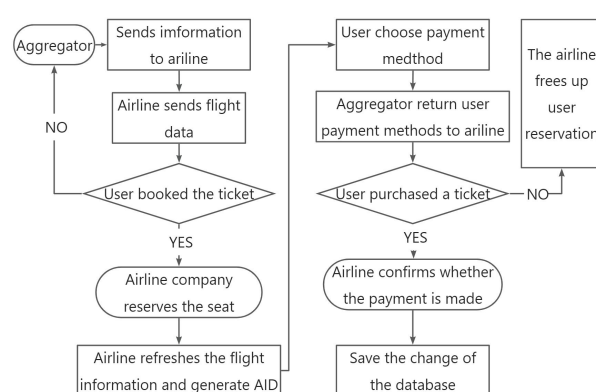


Fig 2 Functional Flow Diagram of Airline

## Requirement Documents

### Requirement Survey

To meet the diverse requirements of users for air ticket reservation, aggregation and payment, we have investigated and analyzed the current mainstream applications and websites to extract their features. Our requirement survey will also involve gathering user feedback through surveys and focus groups to identify additional features and functionalities that users would like to see in the platform. This will enable us to develop a comprehensive and user-friendly platform that meets the diverse needs of travelers. Additionally, the project will need to comply with industry standards and regulations to ensure the safety and security of user data and payment information.

## **Airline**

### **Project Introduction**

#### **Project Background and Purpose**

To promote their business and to increase the chances of customers finding suitable flights, a group of airlines decided to form an alliance (consortium). One of the aims of this alliance is to develop a distributed web-based system that allows flight aggregator applications (booking engines) to find the most suitable flights for a customer, book seats on a flight, and pay for this online. For this purpose, the alliance also partnered with a number of payment service providers to facilitate online payment for the flights.

#### **Project Scope**

1. Search for flight  
Return the corresponding flight information (available seat count, flight number, price, aircraft model) based on the data sent by the aggregator.
2. Undertake booking business.  
Providing detailed flight ticket data to the booking platform, supporting payment methods, and dynamically adjusting the database based on purchase data transmitted from the platform. Verifying payment status with the payment platform.
3. Cancel booking business  
After the user has reserved a seat, if payment has not been made, the reservation can be cancelled, the reserved seat will be released, and the order number and information will be retained. The user's payment will also be automatically canceled after the user has not paid for a period of time.

### **Functional Requirements**

#### **Functional Flow Diagram**

Fig2

#### **Airline Terminal Specifications**

1. Search for flight  
The aggregator sends the user's input restrictions, including time, destination, and departure location, to the airline to query relevant flight information. Upon receiving the request, the airline responds with all flight information that meets the criteria, including details on each flight such as price, remaining seats, and supported payment platforms.

2. Undertake booking business.

After the user places an order, the aggregator sends a message to the airline, and the airline temporarily locks the seat. The user then selects a payment platform and completes the payment. Upon successful payment, the airline then verifies the payment status and confirms the change to the flight seat availability in the database. If payment fails or times out, the order is canceled and the seat status is restored.

## Aggregator

### Project Introduction

#### Project Background and Purpose

The Booking Air Ticket Aggregator project provides a reliable and convenient air ticket booking experience by aggregating information from multiple airline companies into an easy-to-use interface. Users can search for flights and compare prices and schedules across multiple airlines. This all-in-one solution addresses the challenges faced by travelers when booking air tickets, such as comparing prices and schedules to make informed decisions on their travel plans.

#### Project Scope

1. The application interacts to a web service to help users to search for flights by picking dates, times, and places they want to go.
2. The goal is to simplify the air ticket booking process by aggregating information from multiple airlines in a single platform.
3. Under the payment confirmation of the system, users can safely carry out payment operations.
4. Users can get e-tickets and manage their bookings through the application.

### Functional Survey

#### Functional Flow Diagram

Fig 3

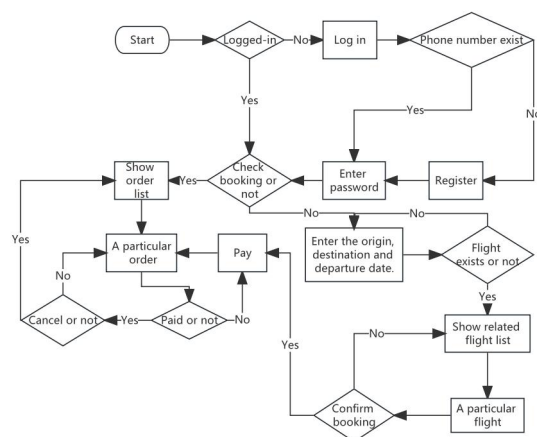


Fig 3 Functional Flow Diagram of Aggregator

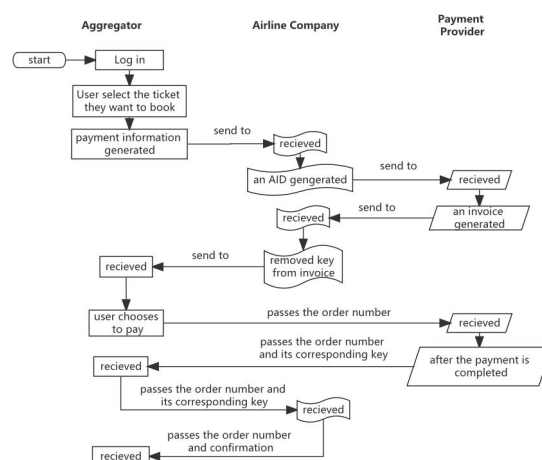


Fig 4 Functional Flow Diagram of Payment Provider

## **Flight Aggregator Terminal Specifications**

1. Users must log in with their mobile phone number to access flight and order information.
2. Flight inquiries require the user to input departure place, destination, and departure date.
3. Paid orders can be cancelled, while unpaid orders can either be paid or cancelled.

## **Payment Provider**

### **Project Introduction**

#### **Project Background and Purpose**

A Payment Service Provider acts as a mediator between Booking Air Ticket Aggregator and the Airline Company, making the payment process efficient and seamless for merchants and customers. It validates transaction information and distributes funds to the merchant once a sale is completed. Security of user data, especially payment information, must be strictly guaranteed.

#### **Project Scope**

1. basic functions: pay, sign up, sign in, log in
2. deposit: deposit money into your account
3. transfer: transferring money to others
4. balance: check your account balance
5. statement: view all bills

## **Functional Requirements**

### **Functional Flow Diagram**

Fig4

#### **Pay Terminal Specifications**

1. Users need to register or login to access the payment function
2. Once logged in the user can pay for previously booked orders or access other functions such as transferring funds, checking balances, viewing statements etc.

## **Technical Highlights**

### **1. Overall Architecture**

The system is part of the Django Rest Framework (DRF) project, which uses Django-Python as the back-end framework, along with the RestFul-API architecture to implement three APIs: a flight aggregator, an airline, and a payment service provider.

### **2. Database Design**

Django provides built-in support for several types of database backends with built-in support. With just a few lines in our setting.py file, it can support PostgreSQL, MySQL, Oracle or SQLite. we intend to use SQLite, the simplest database, because it can be run with a single file and does not require a complex database installation process. Using SQLite, we designed a database structure listed in later sections. Django imports a modular model to help build the new database model, which will 'model' the

characteristics of the data in our database (Zhao, 2023). So we need to provide an explicit name to make it easier for developers, and especially designers, to know what is contained in the template. Technically, the `db.sqlite3` file is created when the migration or run server is first run. Using the run server configures the database using Django's default settings, but the migration will synchronize the database with the current state of any database models included in the project and listed in `INSTALLED_APPS`. In other words, to ensure that the database reflects the current state of the project, the migration needs to be run (and performed) every time the model is updated when writing this system.

### **3. API**

We used DRF Swagger to design and write the Rest API.

### **4. Front-end Design**

Design the front-end interface according to the requirements, including the flight search page, order details page, payment page, etc. The main front-end interface will be run from the command line.

### **5. Testing and Deployment**

Writing tests is important as it is the process that can be performed automatically to confirm that the code is working as expected. While in our application we can manually see if the home and about pages exist and contain the expected content. In addition, whenever we make changes to our code - adding new features, updating existing features, removing unused areas of the site - we want to make sure we haven't inadvertently broken other parts of the site. Automated testing allows us to show how we expect a particular part of the project to behave and then let the computer do the checking for us automatically. Django provides robust built-in testing tools for writing and running tests (Zhao, 2023). Since we also need to deal with the database, we use `Django.Test.TestCase` to perform unit and integration tests during development to ensure system stability and security. After development is complete, the system is deployed to a server to ensure that it is up and running. Deployment can be achieved using container technologies such as Docker.

## **Working Principle**

To develop a Django Rest Framework (DRF) project applied to a system for finding and booking flights, the following steps are followed.

- Integrate three APIs (payment service, airline, flight aggregator) into the system, implement the interface calls and data passing through the routing and view functions provided by Django, and write and implement the Restful-API through the `Rest_framework`.
- The project is built and applied through `django.db` to implement the database. The database schema is defined by creating a model using Django's `db.models` class. Fields can be added, including the data types and default values for the fields.
- Once a model is defined, it can be converted to other data formats such as JSON or XML using DRF's `ModelSerializer`.
- Views are then created by developing a subclass of DRF's `APIView` or its corresponding subclasses such as `GenericAPIView`. These classes are responsible for processing incoming `HttpRequest` objects and returning a `Response` object.

- The DefaultRouter provided by DRF can be used to register objects and create the corresponding routing address.
- The DRF Swagger tool provides a visual API interface that can be generated using the `get_swagger_view()` function.
- In addition, the project includes login functionality. `django.contrib.auth.urls` has a `LoginView` for implementing login functionality.

## Architecture

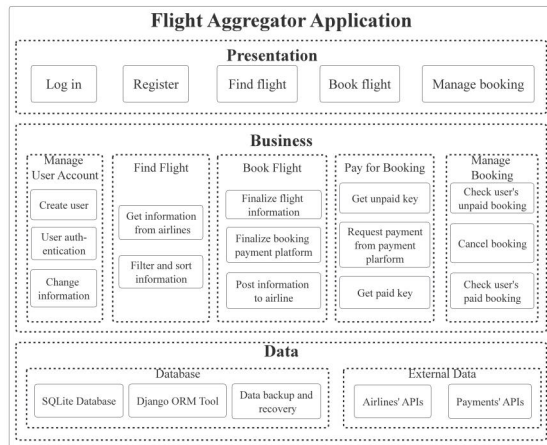


Fig 5 Architecture Diagram of Aggregator

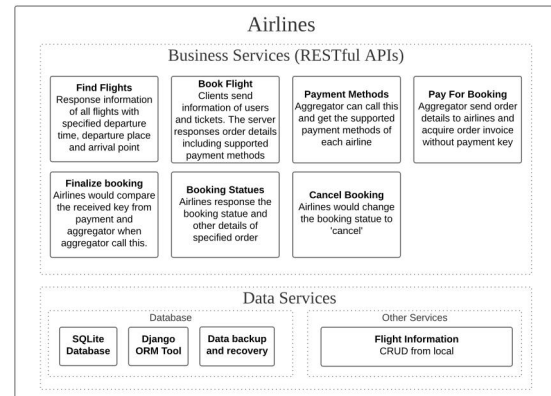


Fig 6 Architecture Diagram of Airlines

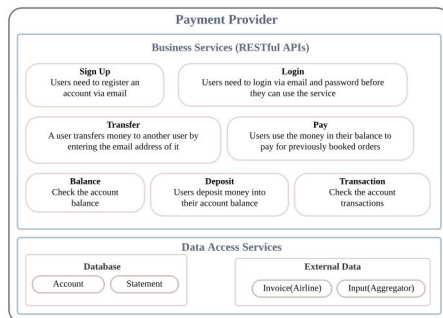


Fig 7 Architecture Diagram of Payment Provider

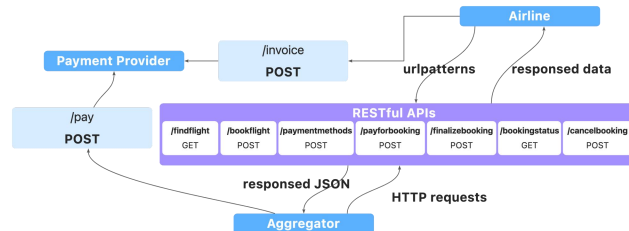


Fig 8 Architecture Diagram of The System

## Database

### Airline

Table Name	flight		
Description	Airline flight detail information		
Primary Key	id		
Field Name	Description	Type	Default
id		INT	Not null
flight_id	Flight number	VARCHAR(10)	Not null
airline	Airline company	VARCHAR(50)	Not null
departure_date	Departure date	DATE	Not null
arrival_date	Arrival date	DATE	Not null



<b>arrival_time</b>	Departure time	TIME	Not null
<b>arrival_time</b>	Arrival time	TIME	Not null
<b>departure</b>	Departure airport	VARCHAR(50)	Not null
<b>arrival</b>	Arrival airport	VARCHAR(50)	Not null
<b>flight_price</b>	Flight price	INT	Not null
<b>seat_number</b>	Available Seats	INT	Not null

Table Name	order		
Description	Airline order detail information		
Primary Key	id		
Field Name	Description	Type	Default
<b>id</b>		INT	Not null
<b>order_id</b>	Order id	INT	Not null
<b>AID</b>	Airline order id	INT	Not null
<b>PID</b>	Payment order id	INT	
<b>flight_id</b>	Flight number	VARCHAR(10)	Not null, FK,refer flight information
<b>order_price</b>	Order price	INT	
<b>ticket_time</b>	Ticketing time	DATETIME	
<b>payment_status</b>	Payment status	TINYINT(1)	0: no pay 1: Paid 2: Cancel paying
<b>key</b>	Electronic payment create key	VARCHAR(50)	
<b>payment_platform</b>	Payment method	VARCHAR(50)	

Table Name	join		
Description	User passenger detail information		
Primary Key	id		
Field Name	Description	Type	Default
<b>id</b>	order and passenger join id	INT	Not null, refer to airline order
<b>order_id</b>	order id	INT	Not null,FK,refer to order
<b>passenger_id</b>	Passenger id	VARCHAR(50)	Not null,FK, refer to passenger

Table Name	passenger		
Description	User passenger detail information		
Primary Key	id		
Field Name	Description	Type	Default
<b>id</b>	Passenger id	INT	Not null
<b>passenger_name</b>	Passenger name	VARCHAR(50)	Not null

Table Name	payment_method		
------------	----------------	--	--

Description	Airline order detail information		
Primary Key	id		
Field Name	Description	Type	Default
id	Table id	INT	Not null
payment_platform	payment platform	VARCHAR(50)	Not null

## Aggregator

Table Name	user			
Description	store the information of user			
Primary Key	id			
Field Name	Description	Type	Default	
id	Table id	INT	Not null	
phone_number	user phone number	VARCHAR(50)	Not null	
status	0: normal 1: unsubscribe	TINYINT(1)	Not null	
password	the password of account	VARCHAR(255)	Not null	

Table Name	order			
Description	the user order table			
Primary Key	id			
Field Name	Description	Type	Default	
id	Table id	INT	Not null	
order_number	order_number	VARCHAR(50)	Not null	
airline	airline	VARCHAR(50)	Not null	
user_id	user_id	int	Not null	
status	0: pay 1: not pay	tinyint(1)	Not null	
key	key	VARCHAR(50)		

## Paymethod

Table Name	Payment_Account		
Description	Payment information		
Primary Key	id		
Field Name	Description	Type	Default
user_id	User id	INT	Not null
username	Username of User	VARCHAR(50)	Not null
password	Password of User	VARCHAR(50)	Not null
balance	Balance of User	INT	Not null
order_id	Order id	INT	Not null, FK, refer to airline order
name	Real name of user	VARCHAR(50)	Not null
user_id_number	Identification number	INT	Not null
user_phone	Phone number	INT	Not null

<b>user_email</b>	Email address	VARCHAR(50)	Not null
-------------------	---------------	-------------	----------

Table Name	Payment_invoice		
Description	Payment detail information		
Primary Key	PID		
Field Name	Description	Type	Default
<b>PID</b>	Payment id	INT	Not null
<b>AID</b>	Airline id	INT	Not null
<b>Price</b>	Total order price	INT	Not null
<b>Key</b>	Key of ticket	VARCHAR(50)	Not null
<b>order_id</b>	Order id	INT	Not null, FK, refer to airline order
<b>invoice_id</b>	Invoice id	INT	Not null
<b>airline</b>	Name of the Airline	VARCHAR(50)	Not null

Table Name	Payment_order		
Description	Payment detail information		
Primary Key	payment_order_id		
Field Name	Description	Type	Default
<b>user_id</b>	User id	INT	Not null
<b>invoice_time</b>	Time of invoice	DateTime	Not null
<b>invoice_description</b>	Description of invoice	VARCHAR(50)	Not null
<b>Price</b>	Total order price	INT	Not null
<b>status</b>	Income(0) or expenses(1)	INT	Not null

## System Interface (API)

### Airline

<b>URL</b>	<b>/findflight</b>	
<b>Description</b>	Response information of all flights with specified departure time, departure place and arrival point	
<b>Request</b>	GET	
<b>Field</b>	<b>Description</b>	<b>Type</b>
departure_date	date	Date
departure	departure	String
arrival	arrival	String
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": [     {       "flight_num": "CA1000",       "airline": "Air China",       "departure_date": "2023/03/08",     }   ] }</pre>		

```

"departure_time":"14:30",
"arrive_date":"2023/03/08"
"arrive_time":"23:45",
"flight_price":2000,
"seat_number":999,
"departure":"Chengdu",
"arrival":"London",}}}}

```

URL	/bookflight	
<b>Description</b>	Clients send information of users and tickets. The server responses order details including supported payment methods	
<b>Request</b>	POST	
<b>Field</b>	<b>Description</b>	<b>Type</b>
flight_num	flight number	String
passenger_name	passenger name	List
order_id	order number	String
order_price	order price	Int
ticket_time	ticket time	Time
payment_status	payment status	Int
<b>Response</b>		
<pre> {"code": "200", // "503" for fail  "msg": "successful", // "fail" for fail  "data": {"booking_status": "booking successful"}} </pre>		

URL	/paymentmethods
Description	Aggregator can call this and get the supported payment methods of each airline
Request	GET
Response	
<pre>{ "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": { "payment_platform": [ "Wechat", "Alipay"], } }</pre>	

URL	/payforbooking	
<b>Description</b>	Aggregator send order details to airlines and acquire order invoice without payment key	
<b>Request</b>	POST	
<b>Field</b>	<b>Description</b>	<b>Type</b>
payment_platform	payment platform	String
order_id	order number	String
<b>Response</b>		
<pre> {"code": "200", // "503" for fail  "msg": "successful", // "fail" for fail </pre>		

```
"data": {"AID": "999999999",
  "PID": "999999999",
  "order_price": "4500",
  "order_id": "999999999"}, {} }
```

URL	/finalizebooking	
Description	Airlines would compare the received key from payment and aggregator when aggregator call this.	
Request	POST	
Field	Description	Type
order_id	Order number	String
key	Payment verification	String
Response		
<pre>{ "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": { "payment_status": "1" } }</pre>		

URL	/bookingstatus	
Description	Airlines response the booking statue and other details of specified order	
Request	GET	
Field	Description	Type
order_id	order number	List
Response		
<pre>{ "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": [ { "order_id": "4",     "payment_status": 0,     "flight_id": "CA8633",     "departure_date": "2023/03/08",     "arrive_date": "2023/03/08",     "departure_time": "14:30",     "arrive_time": "23:45",     "departure": "Chengdu",     "arrival": "London",     "ticket_time": "11:00" }, ] }</pre>		

URL	/cancelbooking	
Description	Airlines would change the booking statue to 'cancel'	
Request	POST	
Field	Description	Type
order_id	order_id	String
Response		

```
{
  "code": "200", // "503" for fail
  "msg": "successful", // "fail" for fail
  "data": {
    "booking_status": "booking successfully"
  }
}
```

**Payment Provider**

URL	/signup	
Description	User fill in their personal information and create a new account in the payment provider system	
Request	POST	
Field	Description	Type
userName	real name	String
userIDNumber	identification number	String
userPhone	phone number	Int
userEmail	email	String
userPassword	password for login	String
Response	<pre>{"code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {"userId": "1",     "userBalance": "0",     "username": "Jack",     "userIDNumber": "233813200007212421",     "userPhone": "13943938738",     "userEmail": "3137983@qq.com",     "userPassword": "f3fsdd4gdgbfrf5vf5h7\$/dadhk03swomdw"}}</pre>	

<b>URL</b>	<b>/signin</b>	
<b>Description</b>	User can log onto the system by filling in the correct phone number and password.	
<b>Request</b>	POST	
<b>Field</b>	<b>Description</b>	<b>Type</b>
userPhone	phone number	Int
userPassword	password for login	String
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "userId": "1",     "userPhone": "13943938738",     "userPassword": "f3fsdd4gdgbfrf5vf5h7\$/dadhk03swomdw",     "token": "eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.ee"   } }</pre>		

<b>URL</b>	<b>/deposit</b>
<b>Description</b>	User deposits money in the account
<b>Request</b>	POST

Field	Description	Type
depositMoney	deposited money amount	Float
userId	user who deposits	Int
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "userBalance": "200"   } }</pre>		

URL	/invoice	
<b>Description</b>	Create invoice based on the order information from airline	
<b>Request</b>	POST	
Field	Description	Type
orderId	ID number of the order	Int
AID	ID number of the airline	Int
totalAmount	money needs to be paid	Float
airline	airline name	String
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "PID": "999999999",     "AID": "999999999",     "airline": "China Air",     "orderId": "999999999",     "totalAmount": "800",     "payment_status": "1",     "key": "gv7f0sljejs8vm15qpycxb4"   } }</pre>		

URL	/pay	
<b>Description</b>	User pay for the invoice	
<b>Request</b>	POST	
Field	Description	Type
userId	the user who pays	Int
orderId	ID number of the order	Int
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "payment_status": "0",     "payTime": "2023-3-21 18:41:06",     "payDescription": "airline",     "userBalance": "100"   } }</pre>		

URL	/transfer
<b>Description</b>	Transfer money to a specified user's account.

<b>Request</b>	POST	
<b>Field</b>	<b>Description</b>	<b>Type</b>
phoneNumber	phone number of the payee	Int
userName	name of the payee	String
userId	the user who transfers	Int
transferMoney	money needs to be transferred	Float
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "transferStatus": "True",     "balance": "100"   } }</pre>		

<b>URL</b>	<b>/balance</b>	
<b>Description</b>	Check account balance	
<b>Request</b>	GET	
<b>Field</b>	<b>Description</b>	<b>Type</b>
userId	the user who checks balance	Int
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "balance": "100"   } }</pre>		

<b>URL</b>	<b>/statement</b>	
<b>Description</b>	Look at the bill and the details of each bill.	
<b>Request</b>	GET	
<b>Field</b>	<b>Description</b>	<b>Type</b>
userId	user who checks statement	Int
<b>Response</b>		
<pre>{   "code": "200", // "503" for fail   "msg": "successful", // "fail" for fail   "data": {     "payTime": "2023-3-21 18:41:06",     "payDescription": "airline",     "moneyFlow": "income", // income/expenditure     "payAmount": "800" // the amount of this order   } }</pre>		



# Specifications of the Client Applications

The interface between the user and the flight aggregator is described here, defining the ways in which the user is allowed to interact with the system, the inputs and the corresponding outputs.

## **Register**

Description: Allow users to create their aggregator account.

Input: Phone number, password, password again.

Output: Registered successfully (phone number is new to aggregator database and password is confirmed); Phone number already taken; Inconsistent passwords.

## **Login**

Description: Allow registered users to log in the system.

Input: Phone number, password.

Output: Log in successfully (correct phone number and password); Unregistered phone number; Incorrect password.

## **Find flight**

Description: Allow users to find flight with necessary information.

Input: Date, departure location, arrival location.

Output: List of eligible flights

## **Flight information**

Description: Allow users to check the detailed information of the chosen flight.

Input: Chosen flight.

Output: Detailed information.

## **Book flight**

Description: Allow users to book flight from the airline.

Input: Chosen flight, passengers.

Output: Booked successfully; Failed.

## **Pay for booking**

Description: Allow users to pay for booking and confirm booking.

Input: Chosen payment platform.

Output: Successful payment; Fail.

## **Manage bookings**

Description: List the bookings of the user and allow user to manage them.

Input: Nothing but enter the order list.

Output: List of the bookings.

## **Cancel booking**

Description: Allow users to cancel the booking.

Input: Chosen booking.

Output: Cancelled successfully; Failed.

# Meeting Minutes

## Whole Group

### Meeting1

Meeting Date: March 11, 2023

Attending Members:

Group1: Zhao Yimin, Ge Jianhao, lv Haodong, Ren Lingfeng, Zhao Yanbo

Group2: Liu Yunzhu, Chen Xinyi, Ding Yiran, Yao Yifei

Group3: Lou Junhong, Xiao Yang, Zhao Chenhao, Qiu Keyu

Absent Members: None

#### Main Topics

- Topic 1: Understand the process and grouping

#### Discussion and Decision

Each member observes domestic and international ticket reservation systems and flight aggregator (including PDF recommendations for British Airways or Turkish Airlines, PayPal or Klarna, Skycanner) to understand the process of searching, booking and paying for tickets, and map them to the subsystem or support service who are responsible for.

There are mainly four parts:

1. An airline web service
2. A payment provider web service
3. A flight aggregator (booking engine) application
4. Supporting services

Members also discussed general user needs:

1. Find the most suitable flights for a journey
2. Book seats on certain flights
3. Use payment services to pay for bookings
4. Receive electronic tickets
5. Manage their bookings

Afterwards, the members were grouped into three teams based on their corresponding systems, which has been written above.

#### Next Steps

1. Determine the parts that each subsystem contain
2. Determine their corresponding user requirements.
3. Find a suitable document template.

#### Next Meeting

Meeting Date: March 18, 2023

#### Topic

- Topic 1: Detailed task assignment for each group

### Meeting2

Meeting Date: March 18, 2023

Attending Members:

Group1: Zhao Yimin, Ge Jianhao, lv Haodong, Ren Lingfeng, Zhao Yanbo

Group2: Liu Yunzhu, Chen Xinyi, Ding Yiran, Yao Yifei

Group3: Lou Junhong, Xiao Yang, Zhao Chenhao, Qiu Keyu

Absent Members: None

### **Main Topics**

- Topic 1: Detailed task assignment for each group

### **Discussion and Decision**

We have confirmed the three main responsibilities, and each of them can still be further divided into sub-tasks.

1. Document the process:

After a brief discussion, we decided to have each person document their tasks to facilitate communication between the different groups. After completion, we will have a discussion between the groups to determine whether tasks can be merged and optimized, potentially increasing efficiency.

2. Learn web system architecture:

Each group will select several individuals to learn and build the web system architecture. One member from each group will be assigned to search for tutorials and materials to learn about web system architecture. They will first draw a high-level architecture diagram and map their group's assigned subsystems (including their respective small functions) to the architecture diagram. After completion, we will invite members from the other two groups to discuss and finalize the overall architecture diagram.

(Zhao Yimin, Liu Yunzhu, Ding Yiran, Ren Lingfeng, Qiu Keyu )

Each group will design the architecture for their required API and database (Zhao Yanbo, lv Haodong, Xiao Yang), and the responsible members from each group will need to communicate with each other to determine the necessary components.

3. Document writing

Each group should assign one member to learn how to write requirement documents (Ge Jianhao, Yao Yifei, Zhao Chenhao) and another member to learn how to write design documents (Chen Xinyi ). During this process, three members responsible for the same task can discuss and generate templates and examples for the requirement and design documents. The requirement document should be completed first so that the group members responsible for building the Web API and database can use it as a reference for their designs.

4. Meeting minutes

Based on the simple document recorded during the meeting, write the full meeting minutes. (Lou Junhong)

### **Next Steps**

1. Subsystem procedures
2. Determine the overall architecture
3. Determine the document format

### **Next Meeting**

Meeting Date: March 25-28, 2023

### **Topic**

- Topic 1: Determine the main functions of the three subsystem

## **Payment Provider Group**

### **Meeting3**

Meeting Date: March 28, 2023

Attending Members: Liu Yunzhu, Chen Xinyi, Yao Yifei, Ding Yiran

Absent Members: None

#### **Main Topics**

- Topic 1: The main functions of the payment provider system
- Topic 2: Assign tasks

#### **Discussion and Decision**

1. Discuss the main functions of the payment provider system
  - Payment provider system should contain functions of register, login, pay, deposit, transfer, check balance and statement.
  - The invoice information can store locally and then call it up when paying.
2. Assign tasks
  - Chen Xinyi is responsible for the templates of design document, and communicate with members in other team who takes charge of the same task to determine the final template.
  - Yao Yifei is responsible for the templates of requirements document, and communicate with members in other team who takes charge of the same task to determine the final template.
  - Liu Yunzhu and Ding Yiran are responsible for the design of architecture of payment system, and contact with other team members to determine the interaction among three systems.

#### **Next Meeting**

Meeting Date: April 4, 2023

### **Topic**

- Topic 1: The completion of last task
- Topic 2: Data exchange in payment system
- Topic 3: Assign tasks

### **Meeting4**

Meeting Date: April 4, 2023

Attending Members: Liu Yunzhu, Chen Xinyi, Yao Yifei, Ding Yiran

Absent Members: None

#### **Main Topics**

- Topic 1: The completion of last task
- Topic 2: Data exchange in payment system
- Topic3: Assign tasks

#### **Discussion and Decision**

1. The completion of last task

- Finish the search for templates of design and requirements documents, draw a draft of the system architecture.
2. Data exchange in payment system
    - The payment provider system should receive the information of flights from the airline.
    - The system creates invoice and a key consisting of information of the flights, then send it to the airline again.
  3. Assign tasks
    - Chen Xinyi completes the writing of design documents and the design of databases.
    - Yao Yifei completes the writing of requirements documents and the design of api.
    - Ding Yiran is responsible for the writing of interface documents and the meeting minutes.
    - Liu Yunzhu is responsible for the system architecture and the workflow of the system.

### **Next Meeting**

Meeting Date: April 11, 2023

### **Topic**

- Topic 1: The completion of last task
- Topic 2: The details in the system
- Topic 3: Assign tasks

## **Meeting5**

Meeting Date: April 11, 2023

Attending Members: Liu Yunzhu, Chen Xinyi, Yao Yifei, Ding Yiran

Absent Members: None

### **Main Topics**

- Topic 1: The completion of last task
- Topic 2: The details in the system
- Topic 3: Assign tasks

### **Discussion and Decision**

1. The completion of last task
  - Finish the design of databases and api, writing of design and requirements documents, drawing of the system architecture.
  - Continue to perfect the content of documents, contact members in other teams to ensure the data change between systems work successfully.
2. The details in the system
  - The payment provider system should store the information of transaction details of each order.
  - The system should contain a function of creating invoice.
3. Assign tasks
  - Yao Yifei completes the requirements document of the payment system and integrate the whole system requirements documents.
  - Ding Yiran integrates the interface documents of the whole system and records

the meeting minute.

- Chen Xinyi extracts technical points and working principles from labs 1-4.
- Liu Yunzhu completes the architecture diagram involving interaction.

## **Flight Aggregator Group**

### **Meeting3**

Meeting Date: March 25, 2023

Attending Members: YangXiao, Chenghao Zhao, Junhong Lou, Keyu Qiu

Absent Members: None

#### **Main Topics**

- Topic 1: Determine the format of the requirement document and complete the content of the requirement document
- Topic 2: Determine the format of the design document and complete the content of the design document
- Topic 3: Confirm the format of the architecture diagram and complete the team system architecture diagram

#### **Discussion and Decision**

##### **Meeting Discussion**

1. Determine the format of requirements and design documents (15 minutes)
  - The host invites Xiao Yang and Zhao Chenhao, the leaders of the requirements document and design document, to introduce the main content and format requirements of the document.
  - Participants discuss and determine the unified format and style of the document, and raise any questions or suggestions.
  - The host summarizes the discussion results and confirms whether there is a need to modify or supplement the document format.
2. Complete the content of the requirements and design documents (30 minutes)
  - The host invites Xiao Yang and Zhao Chenhao, the leaders of the requirements and design documents, to introduce the main chapters and details of the document.
  - Participants jointly modify the content of the document and raise any questions or feedback.
  - The host summarizes the writing situation and confirms whether there is a need to modify or supplement the document content.
3. Confirm the format of the architecture diagram (10 minutes)
  - The person in charge of the architecture diagram asks Ke Yu to introduce the main elements and format requirements of the architecture diagram.
  - Participants discuss and determine the unified format and style of the architecture diagram, and raise any questions or suggestions.
  - The host summarizes the discussion results and confirms whether there is a need to modify or supplement the frame composition format.
4. Complete the team system architecture diagram (30 minutes)
  - The person in charge of the architecture diagram asks Ke Yu to introduce the

main components and relationships of the system architecture diagram.

- Participants use the language sparrow to jointly draw a system architecture diagram and raise any questions or feedback.
- The host summarizes the drawing situation and confirms whether there is a need to modify or optimize the system architecture diagram.

### **Meeting Decision**

1. The team successfully determined the format of the requirement document and completed its content.
2. The team successfully determined the format of the design document and completed its content.
3. The team successfully confirmed the format of the architecture diagram and completed the team system architecture diagram.

### **Next Steps**

1. The team starts assigning tasks to each team member
2. Ke Yuqiu will be responsible for overseeing the project and ensuring that it stays on track.
3. The team will meet again in one weeks to review progress and discuss any issues that may have arisen.

### **Next Meeting**

Meeting Date: April 1, 2023

#### **Topic**

- Topic 1: Discuss document content and templates with relevant designers from other groups and resolve remaining issues
- Topic 2: Modify the contents of design documents, focusing on API design and database design.
- Topic 3: Review the content of all documents to identify and correct any issues.

## **Meeting4**

Meeting Date: April 1, 2023

Attending Members: YangXiao, Chenghao Zhao, Junhong Lou, Keyu Qiu

Absent Members: None

#### **Main Topics**

- Topic 1: Discuss document content and templates with relevant designers from other groups and resolve remaining issues
- Topic 2: Modify the contents of design documents, focusing on API design and database design.
- Topic 3: Review the content of all documents to identify and correct any issues.

### **Discussion and Decision**

#### **Meeting Discussion**

1. Discuss document content and templates with relevant designers from other groups and resolve remaining issues (30 minutes)
  - The host invites the responsible person for the content and template of the design document and requirement document to introduce their communication with other groups and the results.

- Participants discuss and determine unified standards and styles for document content and templates, and raise any questions or suggestions.
  - The host summarizes the discussion results and confirms whether there is a need to modify or supplement the document content and template.
2. Modify the content of the design document (45 minutes)
    - The host invited Xiao Yang, the person in charge of API design and database design, to introduce the main contents of the revised design document, focusing on API design and database design.
    - Participants review the revised design document chapter by chapter and raise any questions or suggestions.
    - The host summarizes the review results and confirms whether further modifications or supplements are needed to the design documents.
  3. Review the content of all documents again, identify and correct any issues (30 minutes)
    - The host invites the person in charge of all documents to introduce the issues and corrective measures discovered after their re review.
    - Participants conduct a final review of all documents and raise any questions or feedback.
    - The host summarizes the inspection results and confirms whether final modifications or supplements are needed to all documents.

#### **Meeting Decision**

1. The team successfully discussed and modified document content and templates with relevant designers from other groups.
2. The team further revised the content of the design document, focusing on API design and database design.
3. The team reviewed the content of all documents again and identified and corrected any issues.

#### **Next steps**

1. The team will continue to work on refining and finalizing all documents.
2. Ke Yuqiu will continue to oversee the project and ensure that it stays on track.
3. The team will meet again in one weeks to review progress and discuss any issues that may have arisen.

#### **Next Meeting**

Meeting Date: April 8, 2023

#### **Topic**

- Topic 1: Review and Finalize Design Documents: Teams can review design documents to ensure their completeness and accuracy.
- Topic 2: Discuss and solve any remaining issues: The team can discuss and solve any remaining issues or challenges related to the design documents.
- Topic 3: Plan Next Steps: The team can discuss and plan to continue developing the flight aggregator application.

### **Meeting5**

Meeting Date: April 8, 2023



Attending Members: YangXiao, Chenghao Zhao, Junhong Lou, Keyu Qiu

Absent Members: None

### **Main Topics**

- Topic 1: Review and finalize design document.
- Topic 2: Discuss and resolve any remaining issues
- Topic 3: Plan next steps.

### **Discussion and Decision**

#### **Meeting Discussion**

1. Review and finalize design documents (45 minutes)
  - The host invites the person in charge of designing the document to introduce the main content of the document.
  - Participants review the document chapter by chapter and raise any questions or suggestions.
  - The host summarizes the review results and confirms whether there is a need to modify or supplement the document.
2. Discuss and resolve any remaining issues (30 minutes)
  - The host invites the person in charge of problem-solving to introduce the problems and challenges they have encountered.
  - Participants share their experience and lessons learned in problem-solving and propose any solutions or suggestions.
  - The host summarizes the issues and confirms whether communication or coordination with other groups is necessary.

#### **Meeting Decision**

1. The team successfully reviewed and finalized the design document.
2. The team discussed and resolved any remaining issues or challenges related to the design document.
3. The team planned the next steps for continuing to develop the flight aggregator application.

#### **Next steps**

1. The team will continue to develop flight aggregator applications based on the design documents.
2. Ke Yuqiu will continue to supervise the project and ensure that it remains on track.
3. The team will meet again in two weeks to review progress and discuss any issues that may arise.

## **Airline Group**

### **Meeting3**

Meeting Date: March 24, 2023

Attending Members: Zhao Yimin, Ge Jianhao, lv Haodong, Ren Lingfeng, Zhao Yanbo

Absent Members: None

### **Main Topics**

- Topic1: Requirement specification
- Topic2: Architecture Design

- Topic3: API specification
- Topic4: Database specification

### **Discussion and Decision**

1. Requirement Improvement (Ge Jianhao)  
After confirming that no refunds are required, the refund option was removed. Following communication with the aggregator, flight queries were changed to a one-time retrieval of all information. The payment process was discussed in detail with the payment platform.
2. Architecture Improvement (Zhao Yimin, Ren Lingfeng)  
The architecture was significantly improved, and the tools required for the database were detailed. Improvements to the API were established, and the use of POST and GET was determined. The payment confirmation process with the payment platform and aggregator was re-confirmed.
3. API Improvement (lv Haodong, Zhao Yanbo)  
The API was combined /findallFlight and /findFlight into one and now sends all information for the queried flight. Each field and type was thoroughly improved, and every possible return value was documented. The get/post relationships of some APIs were changed, and suggestions from other systems were incorporated, like /bookingStatus for confirming and /cancelBooking.
4. Database Improvement (lv Haodong)  
We have changed some of the tables, make some of the detail change, like change the order\_id's type. Also, changed the one-to-many to many-to-many relationship, by adding a Join table to connect the order table with the passenger table.

### **Next Steps**

1. Discussions held with other groups; continued improvement was made to achieve the best web architecture design.

### **Next Meeting**

Meeting Date: March 31, 2023

### **Topic**

- Topic 1: Improvement

## **Meeting4**

Meeting Date: March 31, 2023

Attending Members: Zhao Yimin, Ge Jianhao, lv Haodong, Ren Lingfeng, Zhao Yanbo

Absent Members: None

### **Main Topics**

- Topic1: Requirement Improvement
- Topic2: Architecture Improvement
- Topic3: API Improvement
- Topic4: Database Improvement

### **Discussion and Decision**

1. Requirement specification (Ge Jianhao)  
After discussing with other teams, we have identified three main demands from the airlines. 1. Search for flight 2. Undertake booking business. 3. Refund. And we have

confirmed the rough process for these two demands.

The aggregator sends the user's input restrictions to the airline to query corresponding flight information. After receiving the request, the airline will return the corresponding flight information, including detailed information for each flight (price, remaining seats, etc.). After the user places an order, the airline will temporarily lock the seat and send a payment request to the corresponding payment platform. After a successful payment, the payment platform will return a value to notify the airline and the booking platform, and the airline will confirm the changes to the database. If the payment fails, the order will be cancelled and the seat status will be restored.

2. Architecture Design (Zhao Yimin, Ren Lingfeng)

We have drafted an initial organizational chart to assist with the development of APIs and the database.

3. API specification (lv Haodong, Zhao Yanbo)

Based on the requirements, the following APIs have been developed:

- a. Flight search API (/findAllFlight): This API allows the aggregator to send a request to the airline to search for available flights based on user input restrictions.
- b. Flight information API (/findFlight): This API enables the airline to return detailed information about each flight, including price and remaining seats, to the aggregator.
- c. Reservation API (/bookFlight): This API allows the airline to temporarily lock the seat and send a payment request to the corresponding payment platform after the user places an order.
- d. Payment verification API (/paymentMethod /payForBooking): These API enables the airline to verify the payment status with the payment platform and confirm the changes to the database. Also, To make the aggregator aware of the payment methods supported by each flight.
- e. Refund API: This API allows the payment platform to request a refund from the airline, and enables the airline to check if the refund criteria are met and send a refund request to the payment platform.

4. Database specification (lv Haodong)

We have created a total of 5 tables, which are:

- a. Flight: Used for recording flight message
- b. Order: Used for recording order message
- c. Passenger: Used for recording Passenger message
- d. Payment method: Used for recording Passenger message

The primary and foreign keys for each table have been roughly determined to facilitate communication with other systems. Order data and passenger data are connected using a one-to-many relationship.

**Next Steps**

1. Reconnect with members from other groups to discuss and improve specific web designs.

**Next Meeting**

Meeting Date: April 7, 2023

## Topic

- Topic 1: Improvement

## Meeting5

Meeting Date: April 7, 2023

Attending Members: Zhao Yimin, Ge Jianhao, lv Haodong, Ren Lingfeng, Zhao Yanbo

Absent Members: None

### Main Topics

- Topic1: Analyze and change system differences

### Discussion and Decision

1. Look for any differences in column names and field names between the database and the API. (Lv Haodong and Zhao Yanbo)
2. First, find out if there is any dissatisfaction in the business process between the aggregator and the airline, and unify the data incoming and outgoing formats of the API. Secondly, the name of the API is unified and determined, and unnecessary data names are removed. Then, the API names that have been identified are unified and sorted out. (Xiao Yang, Zhao Yanbo, Lv Haodong, Qiu Keyu, Zhao Chenhao)
3. On the premise of future code implementation, the relevant format is decided and improved, which is the basis for CW2 development.(Ge Jianhao, Ren Lingfeng)

## Reference

AirPython 2020. Building a RESTful API service in 10 minutes (Django). cloud.tencent.com. [Online]. [Accessed 17 April 2023]. Available from: <https://cloud.tencent.com/developer/article/1652711>.

Data Services vs. Business Services - Tengiz Tutisani - Software & Solution Architecture Consulting. [Online]. [Accessed 17 April 2023]. Available from: <https://www.tutisani.com/software-architecture/data-services-vs-business-services.html>.

siqiangming 2020. RESTful architecture style overview (graphic introduction)\_restful architecture diagram\_siqiangming's blog - CSDN Blog. [Online].[Accessed 17 April 2023]. Available from: <https://blog.csdn.net/siqiangming/article/details/105573840>. Tutisani, T. 2021.

Zhao, G. 2023. *LAB-handout-Django\_3\_Templates\_View\_Url\_Testing*. [PowerPoint presentation]. XJCO3011 Web Services and Web Data. University of Leeds.

Zhao, G. 2023. *LAB-handout-Django\_4\_Databases*. [PowerPoint presentation]. XJCO3011 Web Services and Web Data. University of Leeds.

Zhao, G. 2023. *RESTful API Design-S23.pdf*. [PowerPoint presentation]. XJCO3011 Web Services and Web Data. University of Leeds.