
Vehicle Renting System

Design Document

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Contents

Design Requirement.....	3
1.1 Design requirement for customer part	3
1.2 Design requirement for administrator part.....	3
Design of System Structure.....	4
2. 1 E/R model	4
2. 2 SQL Tables	4
Interface design	9
3. 1 Normal User	9
3. 2 Administrator	11
Operation Procedure	16
System rules	16
5.1 Invalid inputs.....	16
5.2 Scrapped Cars.....	18
5.3 Multiple Reservations.....	19
5.4 Privileges	19
Reference.....	20

Design Requirement

In this project, we are going to design an online vehicle renting system, which generally provides ordering and canceling reservation, taking and returning vehicles for customer. The system consists of Customer part and Administrator part. The basic background of the system is that the vehicle renting company has plenty of offices in different cities.

1.1 Design requirement for customer part

- Providing name, address, phone and driving license for first renting
- Reserving vehicle usage during certain time period with information of location for taking and returning vehicle and vehicle type.
- Check order by phone number
- Canceling orders after checking order
- **Having only privileges of select, insert and update.**

1.2 Design requirement for administrator part

- Check orders that are either reserved, cancelled, rent or finished
- Help customer pick up vehicle with their reservation ID, credit card number, expire time.
- Help customer return vehicle with their reservation ID, return date, remained gas, distance measure.
- Decide whether to sell the vehicles that satisfy the condition: vehicle mileage is larger than 100 thousand kilometers or the buy year is three or more years ago
- Add new vehicle to the database
- **Having all the privileges as owner**

Design of System Structure

Specified design of our system is shown below.

2. 1 E/R model

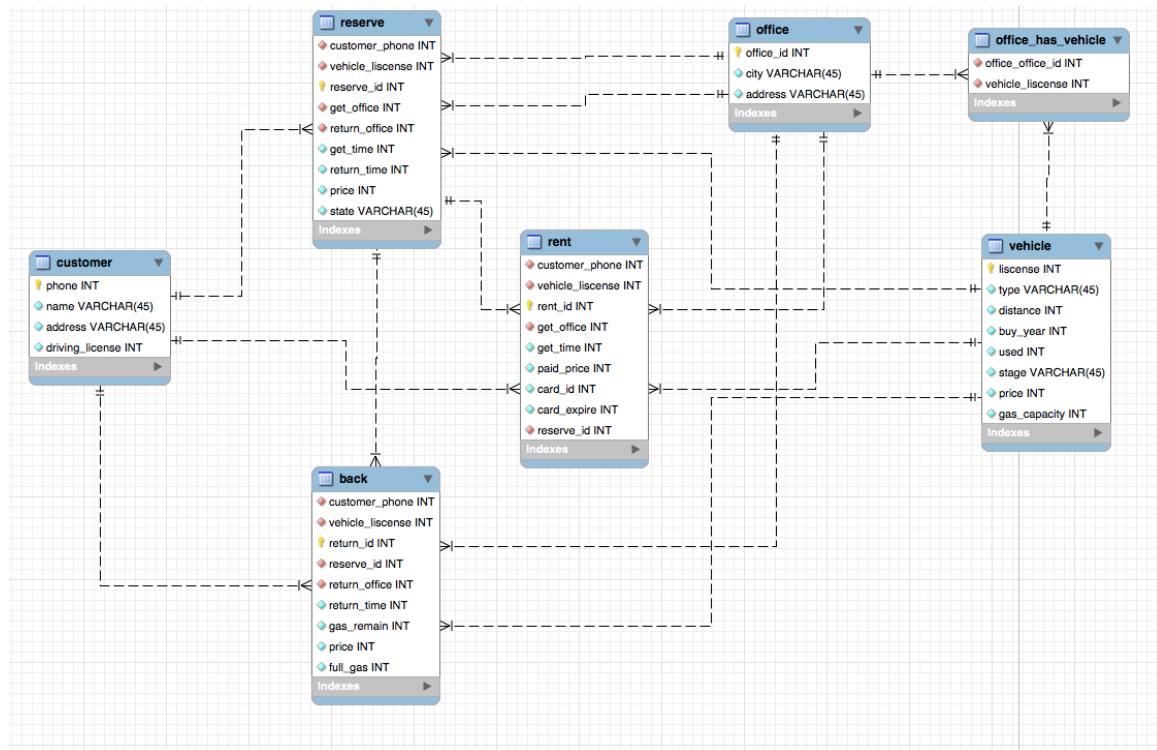


Figure 1. E/R model(Yellow Attrbiutes are keys)

2. 2 SQL Tables

2.2.1 Customer Table

Field	Type	Null	Key	Default	Extra
phone	int(11)	NO	PRI	NULL	
name	varchar(45)	NO		NULL	
address	varchar(45)	NO		NULL	
driving_license	int(11)	NO		NULL	

Table 1. Customer

- customer (phone, name, address, driving_license);
- This table contains information of each customer. Phone records customer's phone number and is key of the table. Name, address and driving_license records customer's name, address and driving_license separately.
- Administrator has all privileges to the table, customer can only insert information to the table.

2.2.2 Vehicle Table

Field	Type	Null	Key	Default	Extra
liscense	int(11)	NO	PRI	NULL	auto_increment
type	varchar(45)	NO		NULL	
distance	int(11)	NO		0	
buy_year	int(11)	NO		NULL	
used	int(11)	NO		0	
stage	varchar(45)	NO		NULL	
price	int(11)	NO		NULL	
gas_capacity	int(11)	NO		NULL	

Table 2. Vehicle

- vehicle (liscense, type, distance, buy_year, used, stage, price, gas_capacity);
- This table contains information of each vehicle. Liscense is the key of vehicle, which increases automatically in the order of insertion of vehicles. Type is the vehicle type, distance contains the mileage of the vehicle and buy year is the year company buys the vehicle. Additionally, used is set to 1 when the vehicle should be sold. Stage includes four type, in office, reserved, using.
- Administrator has privilege of select, insert, delete, update. Customer has privilege of select and update the table.

2.2.3 Office Table

Field	Type	Null	Key	Default	Extra
office_id	int(11)	NO	PRI	NULL	auto_increment
city	varchar(45)	NO		NULL	
address	varchar(45)	NO		NULL	

Table 3. Office

- office (office_id, city, address);
- Office_id is key of the office table. Office table also contains city and address of the office.
- Administrator has all privilege to the table. Customer has no privilege to the table.

2.2.4 Office_has_vehicle Table

Field	Type	Null	Key	Default	Extra
office_office_id	int(11)	NO	MUL	NULL	
vehicle_liscense	int(11)	NO	MUL	NULL	

Table 4. Office_has_vehicle

- office_has_vehicle(office_office_id, vehicle_liscense);
- Office has vehicle table is a weak entity set, office_office_id is determined by office_id in office_table, vehicle_liscense is determined by liscense in vehicle table.
- Each vehicle with id belongs to exact one office.
- Administrator has all privilege to the table. Customer has no privilege to the table.

2.2.5 Reserve Table

Field	Type	Null	Key	Default	Extra
customer_phone	int(11)	NO	MUL	NULL	
vehicle_liscense	int(11)	NO	MUL	NULL	
reserve_id	int(11)	NO	PRI	NULL	
get_office	int(11)	NO	MUL	NULL	
return_office	int(11)	NO	MUL	NULL	
get_time	int(11)	NO		NULL	
return_time	int(11)	NO		NULL	
price	int(11)	NO		NULL	
state	varchar(45)	NO		reserved	

Table 5. Reserve

- reserve (reserve_id, customer_phone, vehicle_liscense, get_office, return_office get_time, return_time, price, state);
- Reserve_id is the key. Reserve table contains all the information needed for vehicle reservation. Specially, price is the estimated price for renting the vehicle for several days. State is set as reserved by default. State will change to canceled, rent or finished during the vehicle renting.
- Administrator has all privilege to the table. Customer has privilege of selecting inserting, updating to the table.

2.2.6 Rent Table

Field	Type	Null	Key	Default	Extra
customer_phone	int(11)	NO	MUL	NULL	
vehicle_liscense	int(11)	NO	MUL	NULL	
rent_id	int(11)	NO	PRI	NULL	auto_increment
get_office	int(11)	NO	MUL	NULL	
get_time	int(11)	NO		NULL	
paid_price	int(11)	NO		NULL	
card_id	int(11)	NO	MUL	NULL	
reserve_id	int(11)	NO	MUL	NULL	

Table 6. Rent

- rent(rent_id, customer_phone, vehicle_liscense, get_office, get_time, paid_price, d_id, reserve_id);

- Rent_id is the key. Rent table contains all the information needed for vehicle renting. Specially, paid_price is needed as a guarantee of renting the car, decided by administrator. Rent table also records corresponding reserve_id.
- Administrator has all privilege to the table. Customer has privilege of selecting inserting, updating to the table.

2.2.7 Back Table

Field	Type	Null	Key	Default	Extra
customer_phone	bigint(20)	NO	MUL	NULL	
vehicle_liscense	int(11)	NO	MUL	NULL	
return_id	int(11)	NO	PRI	NULL	
reserve_id	int(11)	NO	MUL	NULL	
return_office	int(11)	NO	MUL	NULL	
return_time	int(11)	NO		NULL	
gas_remain	int(11)	NO		NULL	
price	int(11)	NO		NULL	
full_gas	int(11)	NO		NULL	

Table 7. Back

- back(return_id, customer_phone, vehicle_liscense, return_office, return_time, gas_remain, price, full_gas, reserve_id);
- Return_id is the key. Back table contains all the information needed for vehicle renting. Specially, price is the actual price paid by customer. It depends on vehicle type, renting day and gas capacity. Back table also records corresponding reserve_id.
- Administrator has all privilege to the table. Customer has privilege of selecting inserting, updating to the table.

Interface design

3. 1 Normal User

This is the homepage for users.

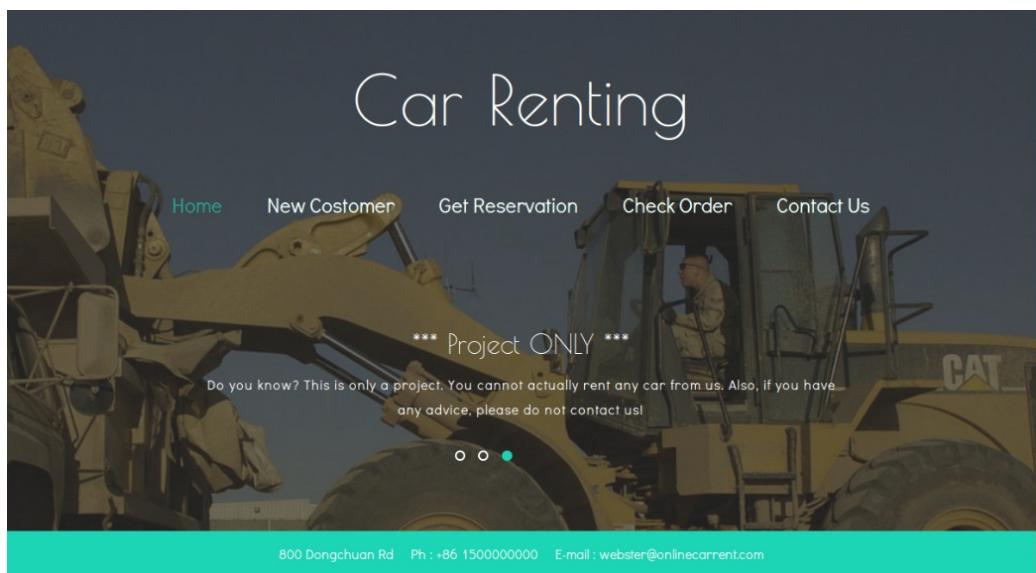


Figure 2. Homepage for user

This is the interface for customers to register. Customer types in their name, phone number, address and driving license as basic information.

You can sign up here. Welcome!

Do you know? Our online carrent use customer's mobile phone number as identification.
So we dont need password. So don't worry about forgetting your password.

Address
SJTU Shanghai Jiaotong University Domitory.

Headquarters
800 Dongchuan Rd.
Min hang district
Shanghai, China

Get In Touch
Telephone: +86 1500000000
FAX: +86 1500000001
E-mail: webster@onlinecarrent.com

Your name:	<input type="text" value="try"/>
Your Phone:	<input type="text" value="13100000000"/>
Your Address:	<input type="text" value="Shanghai"/>
Your Driving License:	<input type="text" value="1"/>

Figure 3. Register

After registration, users can start renting.

Let's get started!

Welcome!

Your Phone:	13100000000
Vehicle type:	mid-size
When to get:	20160707
When to return:	20160901
Get office:	Shanghai
Return office:	Beijing
<input type="button" value="Confirm"/>	

Figure 4. Starting Renting

After renting successfully, customers can check their orders by inputting their phone numbers.

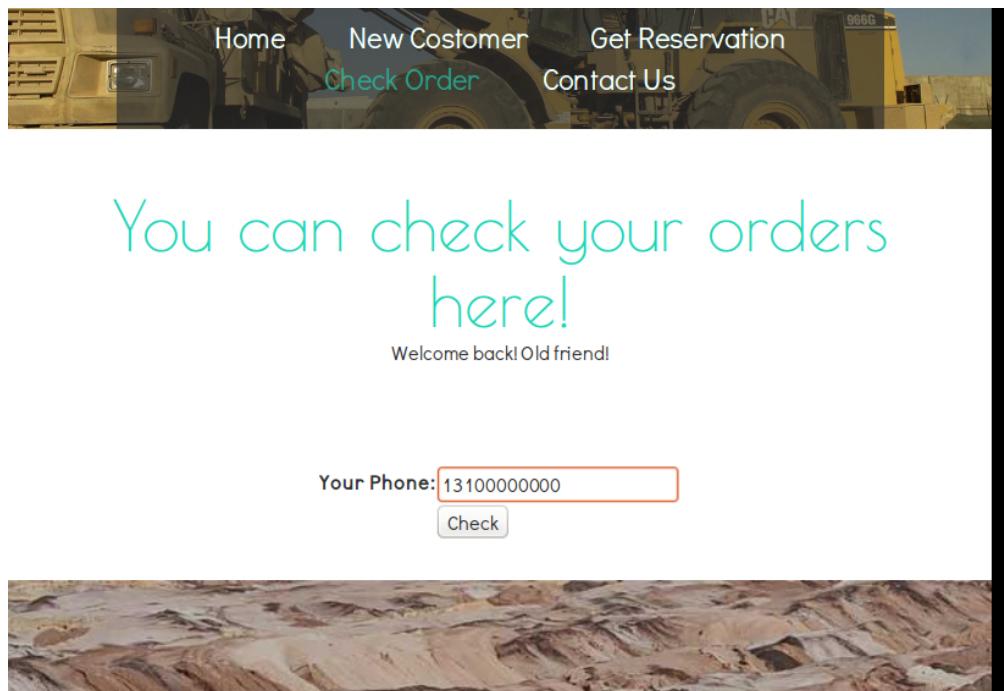
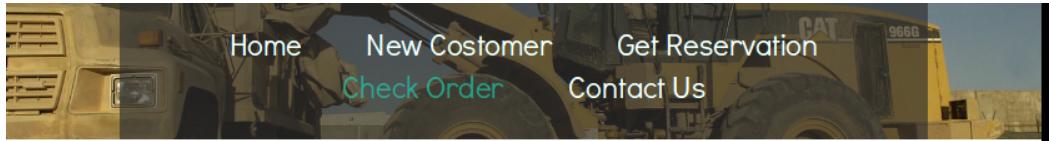


Figure 5. Check Orders

Here is the result. Customers can cancel their order by click the button cancel.



This is the result!

Welcome back! Old friend!

Reserve ID	Vehicle type	Vehicle license	Get time	Retrun time	Price	State	Cancel
1	mid-size	7	20160910@Shanghai	20160911@Beijing	50	reserved	Cancel

Figure 6. My Orders

3. 2 Administrator

3.2.1 Homepage, office list and vehicle list

Here is the home page for administrator. There are four offices in total, including Shanghai, Guangzhou, Beijin and Fujian. Click see vehicles, the administrator can see the vehicles in each office.

Office List

- Office name: Shanghai Address: 800 Dongchuan RD [See vehilces in the office](#)
- Office name: Guangzhou Address: 78 Baiyun RD [See vehilces in the office](#)
- Office name: Beijin Address: 19 King"s RD [See vehilces in the office](#)
- Office name: Fujian Address: 989 Queen"s RD [See vehilces in the office](#)

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 7. Homepage for Administrator

Results of vehicles are shown in Figure 8. For those vehicles with age 3 or more,

a link of selling message will be shown on the page. Administrator can click the link to sell the vehicles.

Vehicle List

- Office name: Shanghai Vehicle Type: economy License: 1 Distance: 0 Gas capacity: 100 Buy year: 2013 State: in office [Sell it with \\$7500.](#)
- Office name: Shanghai Vehicle Type: economy License: 2 Distance: 0 Gas capacity: 100 Buy year: 2013 State: in office [Sell it with \\$7500.](#)
- Office name: Shanghai Vehicle Type: economy License: 3 Distance: 0 Gas capacity: 100 Buy year: 2013 State: in office [Sell it with \\$7500.](#)
- Office name: Shanghai Vehicle Type: compact License: 21 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: compact License: 22 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: compact License: 23 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: compact License: 24 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: mid-size License: 41 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: mid-size License: 42 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: mid-size License: 43 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: mid-size License: 44 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: mid-size License: 45 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 8. Vehicle List

3.2.2 Check Orders of different states

Administrators can check reserved, cancelled, rent, finished orders at Check reservation.

Here is the reservation.

Check Orders

State of the reservation order:

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 9. Check reserved Orders

View Reservation

- Reserve ID: 2 Customer Phone: 15895681222 Vehicle type: luxury Vehicle license: 118 Get Time: 20160620 @Beijing
Return Time: 20161015 @Shanghai State: reserved

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure10. View reserved Orders

Here is the canceled order.

Check Orders

State of the reservation order:

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 11. Check canceled Orders

View Reservation

- Reserve ID: 1 Customer Phone: 15895681222 Vehicle type: standard Vehicle license: 61 Get Time: 20160910 @Shanghai Return Time: 20160930 @Beijing State: canceled

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 12. View canceled Orders

Here is rent order.

Check Orders

State of the reservation order:

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 13. Check rent Orders

View Reservation

Reserve ID: 4 Customer Phone: 15895681222 Vehicle type: van Vehicle license: 129 Get Time: 20160101 @Fujian Return Time: 20160214 @Shanghai State: rent Paid Price: 1000 Credit Card: 123123

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure14. View rent Orders

Here is finished order.

Check Orders

State of the reservation order:

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 15. Check finished Orders

View Reservation

- Reserve ID: 3 Customer Phone: 15895681222 Vehicle type: premium Vehicle license: 105 Get Time: 20160503 @Guangzhou Return Time: 20161120 @Shanghai State: finished Final Price: 492500 Remain Gas: 100
- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure16. View Reserved Orders

3.2.3 Rent Vehicle

When customers come to the office, administrators can start orders customers have reserved before.

Input Information

Reservation id:
Credit Card Number:
Card Expire Time:
Paid price:

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 17. Start Order

After starting orders successfully, we can see the status of orders become from

reserved to rent.

View Reservation

- Reserve ID: 1 Customer Phone: 13100000001 Vehicle type: mid-size Vehicle license: 7 Get Time: 20160910 @Shanghai Return Time: 20160911 @Beijing State: rent Paid Price: 10000

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 18. Result of Starting Order

3.2.4 Return Vehicle

When customers are returning vehicles, administrators can finish orders.

Input Information

Reserve ID:	<input type="text" value="1"/>
Vehicle license:	<input type="text" value="7"/>
Return Date:	<input type="text" value="20161001"/>
Remained Gas:	<input type="text" value="100"/>
Distance Measure:	<input type="text" value="100"/>
<input type="button" value="Confirm"/>	

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure19. Finish Order

Here is the result of return orders. The result shows the final price needed for the renting.

View Return Orders

- Return ID: 1 Reserve ID: 1 Vehicle license: 7 Return Time: 20161001 @Beijing Remain Gas: 100 Price: 10500

- [Home](#)
- [Check Reservation](#)
- [Start Order](#)
- [Finish Order](#)
- [New Vehicle](#)
- [See Return](#)
- [See Rent](#)
- [Contact Us](#)

Figure 20. See Return

Operation Procedure

1. Normal User Part

- a. Register with name, phone number, address and driving license.
- b. After registering successfully, reserve orders Phone number, vehicle type, the time and the office that customers get and return vehicles
- c. Check order after reserving successfully.

2. Administrator Part

- a. Add new vehicles, which can be rent by customers.
- b. Check reserved, cancelled, rent or finished orders.
- c. Start orders customers have reserved before when customers come.
- d. See all the rent vehicles in “See Rent”.
- e. Finish orders when customers are returning vehicles.
- f. See all the returned orders in “See Return”.

System rules

5.1 Invalid inputs

When customer inputs invalid inputs, system will tell them the problem.

Here are three examples.

1. Phone, driving license, get time and return time must be integer.

The screenshot shows a sign-up form with the following fields and errors:

- Address:** Input field contains "111".
- Headquarters:** Input field contains "a123456789". Error message: "Must be an Integer".
- Your Address:** Input field contains "Nanjing Road".
- Your Driving License:** Input field contains "abc". Error message: "Must be an Integer".

Below the form, there is a note: "Do you know? Our online carrent use customer's mobile phone number as identification. So we dont need password. So don't worry about forgetting your password."

Figure 20. Wrong phone and driving license

The screenshot shows a web page titled "Let's get started!" with a sub-header "Welcome!". Below the title is a form with the following fields:

Your Phone:	<input type="text" value="ABC"/>	Must be an integer
Vehicle type:	<input type="text" value="SUV"/>	
When to get:	<input type="text" value="AAAA"/>	Must be an integer
When to return:	<input type="text" value="BBBB"/>	Must be an integer
Get office:	<input type="text" value="Shanghai"/>	
Return office:	<input type="text" value="Beijin"/>	

Below the form, there is a "Confirm" button and some explanatory text: "Car type: economy, compact, mid-size, standard, fullsize, premium, luxury, SUV, and van." and "Office: Shanghai, Beijin, Guangzhou, Fujian".

Figure 21. Wrong input

2. Output: Input invalid when office is not same as the office listed below.

The screenshot shows a web page titled "Let's get started!" with a sub-header "Welcome!". Below the title is a form with the following fields:

Your Phone:	<input type="text" value="15001970942"/>	
Vehicle type:	<input type="text" value="SUV"/>	
When to get:	<input type="text" value="20160503"/>	
When to return:	<input type="text" value="20160930"/>	
Get office:	<input type="text" value="1"/>	
Return office:	<input type="text" value="2"/>	

Below the form, there is a "Confirm" button and some explanatory text: "Car type: economy, compact, mid-size, standard, fullsize, premium, luxury, SUV, and van." and "Office: Shanghai, Beijin, Guangzhou, Fujian".

Figure 22. Wrong office

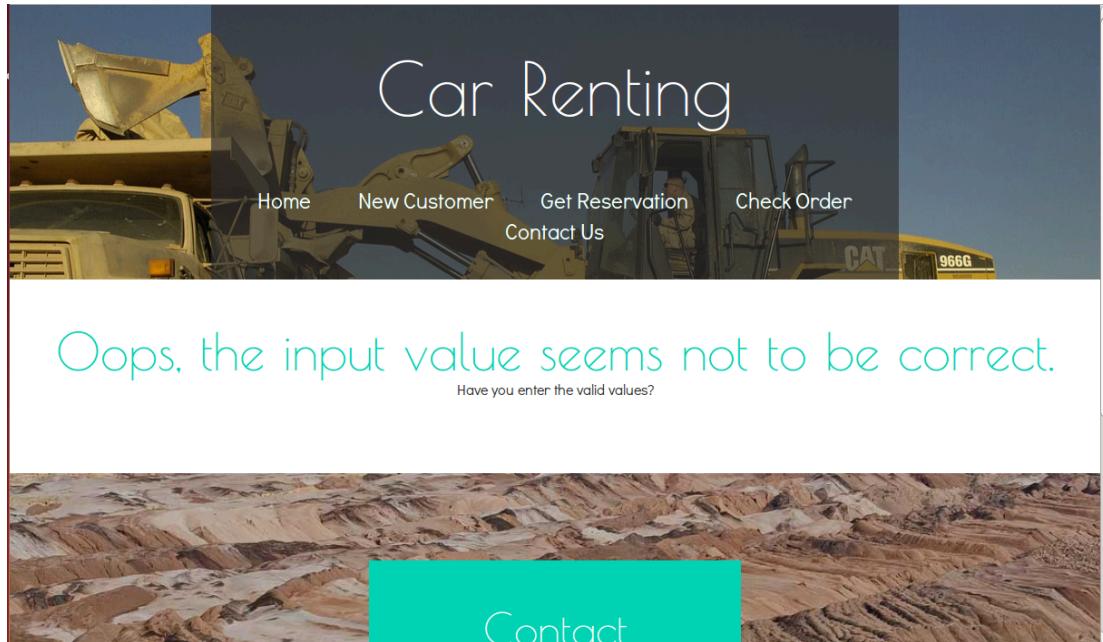


Figure 23. Input not correct

5.2 Scrapped Cars

When one car is bought three years or more, or the mileage is more than 3000 km, there is a click "Sell it at \$xx". If administrator clicks it, the scrapped car will be sold.

In example below, the SUV has distance of 100000000, which needs to be sold. The two economy car are bought in 2013, which also need to be sold.

- Office name: Shanghai Vehicle Type: SUV Liscense: 121 Distance: 100000000 Gas capacity: 100 Buy year: 2015 State: reserved [Sell it with \\$150000](#).
- Office name: Shanghai Vehicle Type: van Liscense: 126 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office
- Office name: Shanghai Vehicle Type: luxury Liscense: 118 Distance: 10000 Gas capacity: 100 Buy year: 2015 State: reserved
- Office name: Shanghai Vehicle Type: economy Liscense: 1 Distance: 0 Gas capacity: 100 Buy year: 2013 State: in office [Sell it with \\$7500](#).
- Office name: Shanghai Vehicle Type: economy Liscense: 4 Distance: 0 Gas capacity: 100 Buy year: 2013 State: in office [Sell it with \\$7500](#).
- Office name: Shanghai Vehicle Type: economy Liscense: 7 Distance: 0 Gas capacity: 100 Buy year: 2014 State: in office

Figure 24. Scrapped Car

5.3 Multiple Reservations

If one vehicle is already reserved, customer can rent and return at the time earlier than the reservation's rent time. But customer cannot rent it after the reservation's return time since we are not sure the car will return on time.

In the following example, there are only 2 luxury cars in Beijin. One can reserve luxury car at 2016 first and also reserve car at 20150909~20151010. Constraint is that the luxury car must return to Beijin so that the next reservation can get the car at Beijin.

The screenshot shows a user interface for a car rental system. At the top, a teal banner reads "This is the result!". Below it, a smaller message says "Welcome back! Old friend!". The main area displays a table of reservations:

Reserve ID	Vehicle type	Vehicle license	Get time	Retrun time	Price	State	Cancel
5	luxury	118	20160909@Beijing	20161201@Shanghai	49200	finished	
6	luxury	119	20160909@Beijing	20161201@Shanghai	41000	reserved	Cancel
7	luxury	118	20150909@Beijing	20151010@Beijing	18600	reserved	Cancel

Office Address

Shanghai: 800 Dongchuan RD

Guangzhou: 78 Baiyun RD

Beijin: 19 King's RD

Fujian: 989 Queen's RD

Figure 25. Multiple Reservations

5.4 Privileges

We give all privilege of new_schema.customer to user and only select, insert, update privilege to other tables in new_schema.

```
grant ALL privileges on new_schema.customer to customer@localhost identified by '123123';
grant select,insert,update on new_schema.* to customer@localhost identified by '123123';
```

Reference

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