2017 Fall Semester

Integration of Systems and Business Informatics

Final Project

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1. Executive Summary

To increase the profit of KJ Rental, this project suggests a new business model which integrates long-term rent and short-term car sharing. At first, two ways of increasing profit were considered: reducing cost and increasing revenue by differentiation. In terms of cost reduction, the cost structure of rental industry makes it hard to reduce the cost. As for differentiation, there are already too many differentiated services used by other competitors, thus making it hard to further differentiate service. Therefore, instead of differentiating services, this project suggests differentiating the business model, which targets small businesses.

The business model is based on a prediction model of car usage patterns. For the analysis, data were collected, organized, and then clustered by utilizing Decision Tree. By using this model, a group of same cars can be shared among firms that have different usage patterns from each other. This strategy is beneficial for KJ Rental because it can increase market share and reach more customers. In addition, the model helps customers save costs because the rental fee is low. To actualize this model, mobile application design and web page design are suggested as well.

2. The Objective of the Project

2.1 Goal

KJ Rental, the target company, has two main businesses: long-term rent and accident rent. Long-term rent takes the most important portion of the revenue; thus, this project focuses on this part of business. The purpose of this project is to maximize the operating income of KJ Rental, especially in the domain of long-term rent.

2.2 Strategies

To maximize the operating income, both cost and revenue were considered. First, in terms of cost reduction, it is hard to decrease cost due to the characteristic of rental companies that most of the costs are depreciation costs of operating assets. For example, the largest portion of assets in AJ Rent-a-car is

Account	2016 Operating Expense	%
Used Car sales cost	197,867,004	32.18%
Insurance	40,477,680	6.58%
Fee	30,175,839	4.91%
Vehicle Maintenance	40,201,358	6.54%
Depreciation Cost	229,335,403	37.29%
…	…	…
SUM	614,922,935	100.00%

Figure 1. AJ Rent-a-car Business Report

tangible assets – especially rental cars. Moreover, most of its operating costs is depreciation costs and insurance costs. Therefore, it is hard to further reduce the cost. Considering this industrial context, this project focuses on increasing the revenue.

As for increasing revenue, differentiation strategy can be an option, in that providing services that competitors do not provide would be advantageous. However, competitors, especially large rental companies, already provide as many kinds of differentiated services as possible, fully utilizing their infrastructures. Car maintenance services, dashcam, and fuel discounts are the examples. In contrast, since KJ Rental does not have as many infrastructures as they have, differentiating services can be very costly. Furthermore, it is very difficult to find more innovative services to attract customers. Therefore, it is hard to further differentiate the services.

On the other hand, because the business of KJ Rental is more flexible compared to larger competitors, changing its business structure is also more feasible. In fact, mass consumer nowadays values innovativeness and novelty of the entire business. Moreover, if the new business model successfully delivers new benefits to customers, possibility of developing a whole new segment of the market is drastically increased. In this context, this project suggests differentiation of the business model to increase revenue.

3. Environment Analysis for New Business

3.1 Trend in Car Rental Market

Car sharing is a fast-growing business. The market size in Korea is expected to grow to 500 billion won in 2020. This can be attributed to a shift in mindsets about car ownership. Nowadays, the idea of owning a car to use it is thought to be unnecessary. In the car sharing market, not only new companies solely focusing on car sharing business, such as Socar and Greencar, but many other players also have noticed the potential of car sharing business, in which they are beginning to invest heavily. These players include car manufacturing companies and

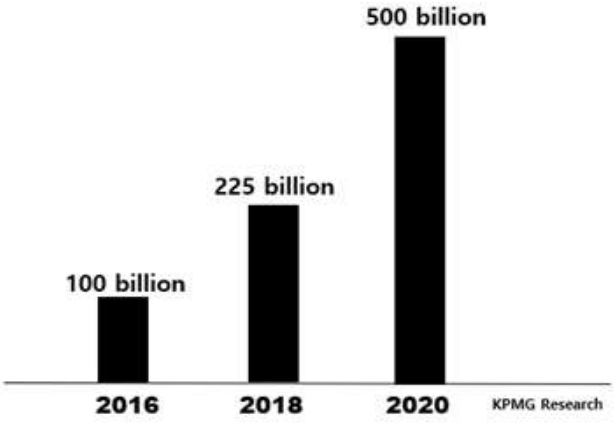

Figure 2. Expected Market Size of the Car Sharing Market in Korea

even those from different business sectors. That is, car sharing has become a major trend for mobility, which is an inevitable part of car industry.

Car Manufacturing Companies	KIA, BMW, GM, Mercedes-Benz, Volkswagen, Hyundai Motors
Other Business Sector	Hyundai Capital, GS Caltex
New Car Sharing Companies	Socar, Greencar

Figure 3. Companies Entering Car-Sharing Market

3.2 Customer Analysis

Small businesses are sensitive to costs[1], which means they would not want to let the rental cars being left in the parking lot idly. However, the demand for vehicles is not always constant. It causes owning cars to make corporate customers spend more than their actual usage. In fact, among the cars used by corporations, which they buy, lease or rent, some 50% of cars are not in operation, and some 20% are lacking on some days[2]. Moreover, the number of the newly registered long-term rental cars for a year is 200,000. And out of these, about 100,000 units are used for executives to commute, and the others are used for business trips, which means the cars are not used at all times[3].

The bottom line is that there are still unmet needs of small businesses for on-demand use of cars at low costs. It is expected that corporations will be able to significantly reduce their expenses by purchasing or renting only a minimum quantity of cars and using car sharing services, as for the rest.

3.3 Competitor Analysis

Besides other players, other rent-a-car companies also already launched or at least prepared car sharing services. Lotte Rent-a-car acquired Greencar in 2013. SK invested 59 billion won in Socar, and SK Rent-a-car launched a car sharing service called ‘Smartlink’, in which employees can use rental cars for private purpose such as shopping and leisure, when the car is not operated. In addition, AJ Rentacar partly began car sharing services, and have tried to broaden the services.

Now, car sharing has become an irreversible trend, and it is expected to massively grow. And almost all players in the car industry and even player from other industry have took part in car sharing business. Furthermore, customers, particularly corporate customers that do not use car sharing services

as much as individual customers, still are not fully satisfied their needs to operate cars most cost-efficiently. Putting these together, if KJ Rental do not enter car sharing business, it will lose growing demand for car sharing, which replace existing demand for current form of long-term rent. It will eventually lead to great decrease in sales.

4. Suggestion

4.1 Business Model Explanation

This proposal suggests a business model which is a blended form of long-term rent and car sharing. KJ Rental can earn incomes from two sources: fixed earnings from long-term rental contracts and variable earnings from short-term car sharing contracts. To be specific, it charges 1 year fixed rental fee and rental costs per time at the same time. At first, customers should select a car model and pay for the fixed rental fee. Then, they can reserve the car when they need it. Variable costs are charged for the short-term car sharing. It is recommended to reserve cars at least a week earlier, because 'Today's Reservation' costs an extra fee. This is because urgent bookings will increase KJ Rental employees' work volume; they have to prepare and deliver cars in a hurry.

This business model targets small businesses that are cost sensitive and have patterns on time they are using. Based on the analysis of each company's car using pattern, a group of same cars are shared by a group of companies that have different usage patterns. In this way, a car can be fully used and the idle time would be minimized. Meanwhile, car shortage or double-booking problem may arise. These problems can be minimized by precise data analysis. Accumulated data of numerous companies' car usage details are used to predict car usage patterns of new customers. Collected patterns are clustered into several categories which can all be used together to prevent problems mentioned above. As data are more and more accumulated and become big data, the prediction model will be more accurate, and the problems will be reduced more. However, if problems occur in spite of utilizing the prediction model, lending a better car model and issuing 'Apology Coupons' would be an attractive solution.

4.2. Strength of the Business Model

Benefits for KJ Rental

KJ Rental can increase market share and reach more customers by utilizing this business model. The model not only follows the current trend of 'sharing economy' but also suggests a new form of rental business. Also, less expensive rental fee is competitive compared to other rental companies or car sharing companies, which will result in increasing number of customers. Therefore, KJ Rental can establish a solid position in the car rental market.

Moreover, KJ Rental can earn regular incomes from the fixed rental fee. The main reason why rental companies prefer long-term rent is that they can secure fixed revenue. In this context, despite the lower amount of money compared to the original long-term rent fee, it is beneficial for KJ rental to increase the number of contracts and secure more fixed earnings.

Benefits for Customers

Customers can enjoy the low rental fee and save costs. Most of the long-term rented cars are not used all the time; they are usually left in the parking lot idly. This is inefficient and a waste of money, because companies are continuously paying for the time when the rent cars are not in use. Therefore, the business model suggested by this project is a great solution for them. It requires lower rental costs and helps companies use cars only for the time when they are needed.

To be specific, the new service offered by the business model is cost-effective for customers who use rent cars not that frequently; in this model, the reference point is 80 hours per month. Companies that use rent cars for less than 80 hours per month can be benefited by this service, as shown in the graph.

The below table is an example of a company that use rent cars 32 hours per month. The service provided by this project is less expensive than Lotte Rentacar, which is a strong competitor of KJ Rental. Thus, customers can save costs by using this service.

〈Long-term rental fee of Lotte Rentacar〉 VS.			〈The suggested service's fee of 32 hours per month〉		
	Total		Variable Fee per hour	Fixed Fee per month	Total
Sorento	600,000	per month	5,000	200,000	360,000
Grandeur	600,000	per month	4,000	200,000	328,000
Avante	400,000	per month	3000	150,000	246,000
Carnibal	560,000	per month	4500	200,000	344,000

Figure 4. Comparison of Lotte Rent-A-Car and Suggested Model (Table)

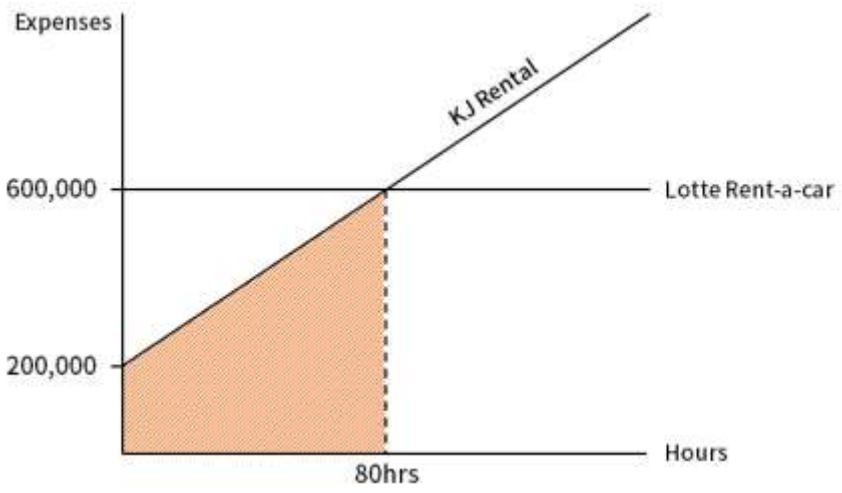

Figure 5. Comparison of Lotte Rent-A-Car and Suggested Model (Graph)

4.3 Preparation at the Beginning

Figure 6. Pivot Table Comparison of the Holding Amount & Rental Frequency of Each Model

Before expanding the business, KJ Rental's base-stock level should be increased. It is important to identify what kinds of cars should the company prepare more. Based on the analysis of the records given by KJ Rental, it was revealed out that several car models are generally more preferred than the others.

For example, the number of Sorento being rented is relatively higher than the holding amounts of Sorento. This indicates that KJ Rental should purchase Sorento more in order to maximize rental profit. On the other hand, the number of Starex being rented is relatively lower than the holding amounts of Starex. This implies that KJ Rental does not need to increase the stock of Starex at present.

4.4 Prediction Model

Goal of the Prediction Model

After KJ Rental launches the business model, the cars must be prepared for the customers that will use the suggested service. The problem will happen if the customer cannot make a reservation to use a car because of lack of cars. However, it is inefficient and impractical to buy tons of cars for unpredicted future demand. The most efficient way to run the service with minimum number of cars is using prediction model of car usage pattern. For instance, a new company A wants to join the service. If KJ Rental can predict its car usage pattern, it can find out when the cars, which company A wants to use, Grandeur in this case, are needed. After collecting all that kind of information, it can forecast the whole demand of Grandeurs at certain day or time. By using this information, it can figure out how many Grandeurs are required as a total and optimize it to calculate the minimum number of Grandeurs to buy.

How to Make Prediction Model

Thus, this project devised the prediction model to expect the pattern of car usage with some inputs. First, the companies in training data would be clustered into several groups according to the car use pattern. Then the classification model is trained to classify the company into groups made by clustering. The independent variables are the features of companies' basic information, and the dependent variable is the group name. Thus, when a new company comes in, the model returns the group that are similar to the new company based on its basic information. With group names, the car use pattern of the new company is predicted as the average car use pattern of the groups. Every time KJ gets the new data, the clustering and classification model are updated in the real-time base.

Summary

1. Collecting the data
2. Clustering
    Input: Car use pattern of companies in the training data
    Return: Group numbers that each company assigned
3. Classification
    <1> Training
    Input:
        X: The basic information of companies in the training data
        Y: Group numbers of each company

<2> Test
Input:
X: The basic information of a new company
Return: Y (Group numbers)
4. Get the car usage pattern
Average of the car usage pattern in predicted group

Step1) Collecting the Data

This project requires a collection of data: car usage patterns of companies. This project tried to gather the data from the Internet, but failed. This was because internal data is generally classified as confidential. Moreover, most of the small companies do not record this data in a clean, relational form. However, when KJ Rental starts this business, it can gather the data of general car usage patterns from the customers. Thus, this project tried to make a model with sample data to show how this model works, rather than make an exact model with accurate data. The researchers of this project asked the information of car usage pattern from acquaintances who work for various companies. In addition, the researchers searched the Internet and found several explanations that are related to companies' car usage patterns. After gathering the data, the analysts of this project did 'Datafication' to organize the data in a matrix form with numbers. Several virtual companies were created based on the above information, and then organized based on the categories such as 1) the customer (B2B, B2C), 2) the types of business (service, retail, manufacturer, livestock, publishing), 3) the purpose of using rent cars (sales, non-sales). 4) the number of employees, 5) the number of branches. To classify car usage patterns, each day of the week was divided into 4 separated times: daybreak, morning, afternoon, and midnight. In the table, 1 represents that rent cars were used, whereas 0 means that the rent cars were not used. (Appendix 1).

Step2) Clustering the Companies with Their Car Use Pattern

'K-means' clustering method was applied to cluster the companies based on their car usage patterns. They were classified into 5 groups, and then they were labeled by their group numbers.

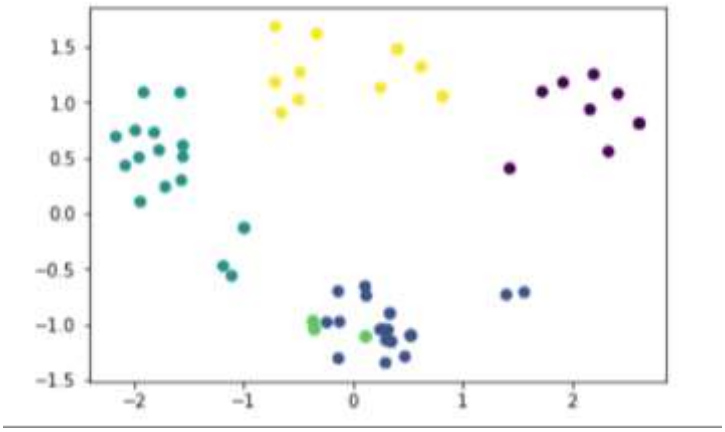

Figure 7. Scattered Plot of Clustering Result

Step3) Classification - Train the Model

Decision Tree was utilized to visualize the model and represent how it works. But this project selected Random forest because it showed better result than other algorithms. The basic information of the companies was used to train the model: 1) the customer (B2B, B2C), 2) the types of business (service, retail, manufacturer, livestock, publishing), 3) the purpose of using rent cars (sales, non-sales). 4) the number of employees, 5) the number of branches. For the Y data, the group number was used as a label.

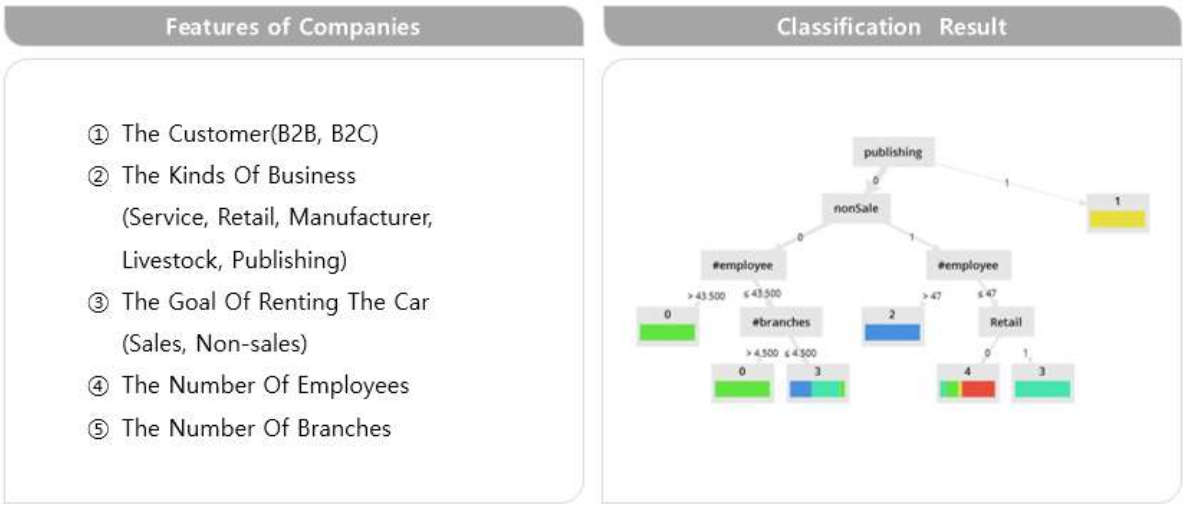

Figure 8. Features of Companies & Decision Tree Result

Step4) Input a New Company and Get the Predicted Car Usage Pattern

The trained model will give the results when a new company's data is inserted. The new company can be classified into one of the existing 5 groups, based on the model. After acquiring the

group number, the car usage pattern of the companies positioned in the group will be similar to the car usage pattern of the new company.

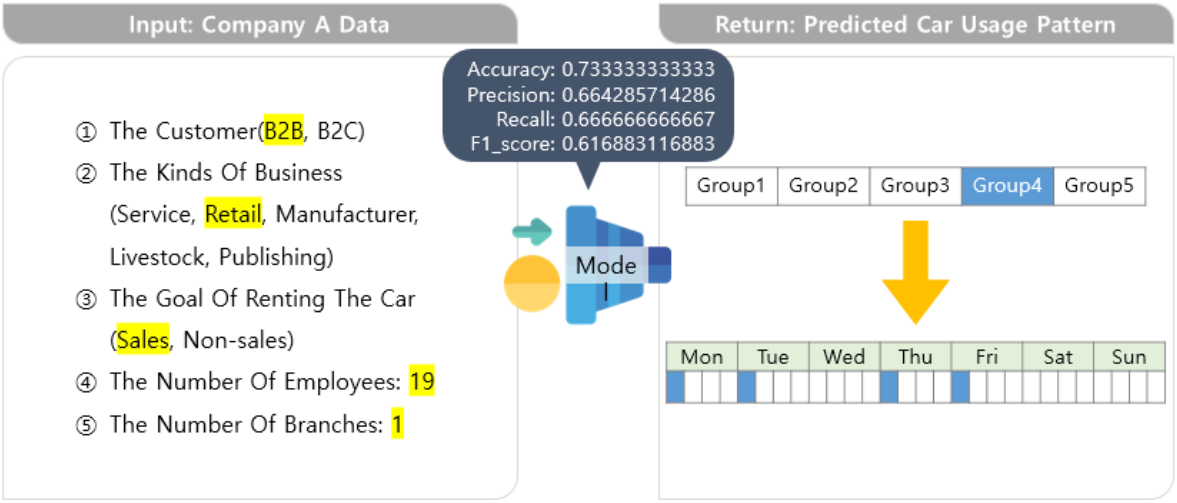

Figure 9. Process of Prediction

4.5 Application

Mobile Application for Customers

In tune with mobile-first era, mobile applications are frequently utilized for numerous businesses. Therefore, this proposal suggests a mobile application which can help customers rent and share cars conveniently. By utilizing it, KJ Rental can reach more customers and manage services more effectively.

The first screen displays a friendly logo of KJ Rental so that it can attract more customers. Also, there are shortcut keys which can help users quickly access to several services.

The next page shows the list of cars that customers can rent. In order to help users find cars efficiently, there are click boxes of car sizes and brands. From the car list, customers can check each car's release date, gas mileage, and the type of fuel. In addition, they can check 1 year fixed rental fee and daily sharing fee of each car. After selecting a car, users should pay the fixed fee first. Then, they are ready to use KJ Rental's car sharing service.

Users can reserve cars through this page. Gray-colored dates are past dates or dates that are already occupied. Thus, users can reserve cars for black-colored dates. The chance of double booking is very low because this data model analyzed several companies' car usage patterns and allocated cars

to a group of companies whose patterns are completely different from each other. After selecting the dates, users can set the time that they want to use the cars.

After car delivery, users can utilize Smart Key, which helps them lock and unlock cars conveniently. In My Page, users should input their information. This information will be used to strengthen the prediction model.

Web Page for KJ Rental

This project suggests a web page that help KJ Rental make decisions, which aims to operate most efficiently, and at the lowest possible cost. The main role of the web page and the procedure are as follows.

1. When a company subscribes to this business model, the company should enter basic information about the company, such as type of business, main tasks, number of employees and branches, and location of the branches. In the web page, it is possible to access the information and use it.

2. Next, the web page shows clusters by average usage pattern through existing customers data and show which group the new company belongs to, reflecting the received information. This will tell the average usage pattern of the companies in the group, and help KJ Rental approximately predict the usage pattern of the company newly subscribing, such as preferred time zone and frequency, and hours of usage.

3. Then, the web page gives an advice on the operation of the vehicle considering the type of vehicle the new customer intends to borrow, the number of KJ Rental's current vehicle types, and the current status of the vehicle.

To be specific, Jinyang Pharm, for instance, begins to subscribe to this business model and wants to borrow Grandeur IG. And KJ Rental has five Grandeur IGs and already lent all 5. In this situation, if the usage pattern of the borrowing companies is very different from the expected usage pattern of Jinyang Pharm, it is possible to operate it with the vehicles that KJ Rental currently has. And if the usage patterns of the borrowing companies are similar, the web page will advise to buy additional vehicles of the model.

5. Conclusion

The business model suggested by this proposal mainly targets companies that are located in Seoul and Gyeonggi-do. As this business develops, KJ Rental can cover larger area. Also, prediction models can be customized by each city, and become more accurate. Location-based clustering can be realized, resulting in reduced car-delivery time. This business model has a high potential to manage rental business effectively, which will definitely contribute to the growth of KJ Rental.

6. Appendix

Appendix 1

B2B	B2C	Service	Retail	Manufactor	livestock	publishing	nonSale	sale	#employee	#branches	label
1	0	1	0	0	0	0	0	1	14	1	2
1	0	1	0	0	0	0	0	1	8	1	2
1	0	1	0	0	0	0	0	1	11	1	2
1	0	1	0	0	0	0	0	1	12	1	2
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1	0	1	0	0	0	0	0	1	13	1	2
1	0	1	0	0	0	0	0	1	13	2	2
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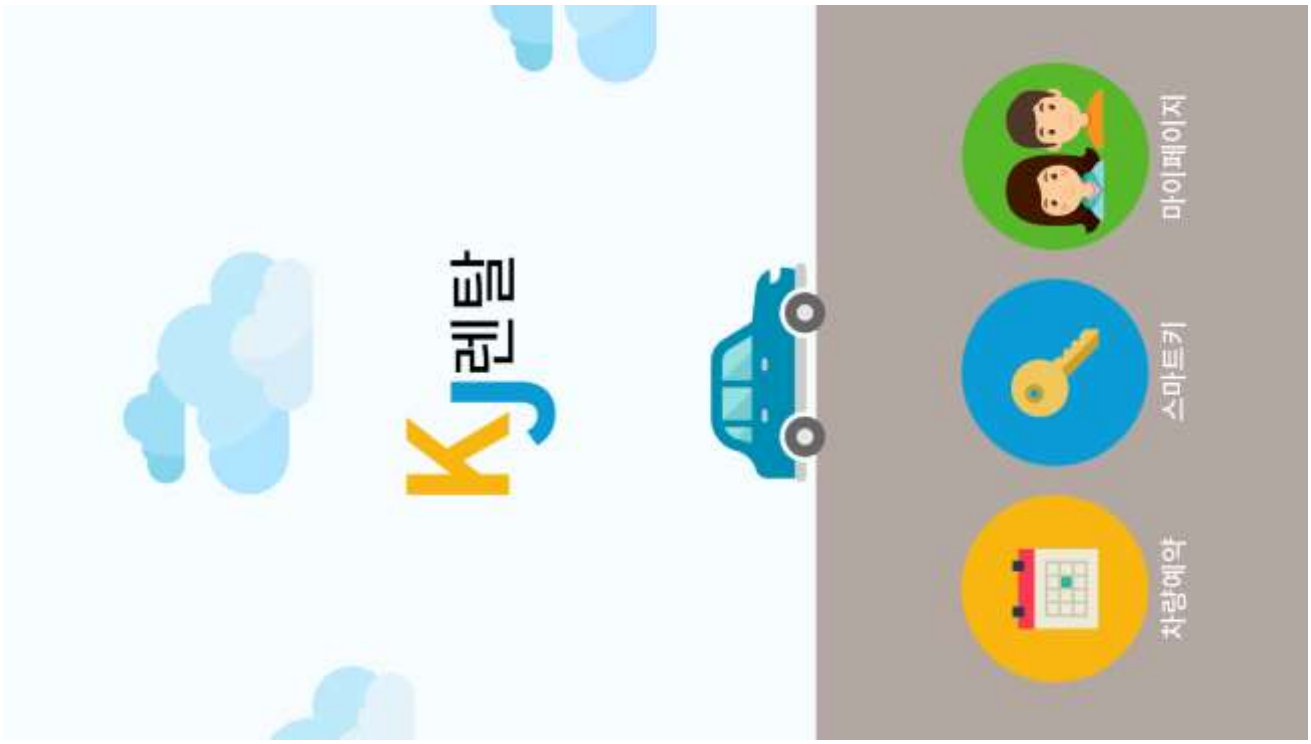
Appendix 2. Smartphone Application Prototype



차량예약

상세보기

차량선택 > 차량예약

2018 쏘렌토

연비 8.7 ~ 13.4km/l
연료 디젤, 가솔린

1시간 5,000원
고정 연간 240만원
상기 가격은 유류비를 포함하지 않습니다

날짜선택

예약가능

◀ 2017년 12월 ▶

월	화	수	목	금	토	일
				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	31

✓ 매주 반복 ▶ 종료날짜 선택

시간설정

차량예약

시간선택

2017년 12월 12일 화요일 날짜 변경 대여 장소 반납 장소

▶ 시작 시간 오전 10시 20분

▶ 종료 시간 오후 3시 40분

✓ 매주 반복 ▶ 종료날짜 선택

2017년 12월 15일 금요일 날짜 변경 대여 장소 반납 장소

▶ 시작 시간 오전 9시 30분

▶ 종료 시간 오후 1시 20분

✓ 매주 반복 ▶ 종료날짜 선택

2017년 12월 16일 토요일 날짜 변경 대여 장소 반납 장소

▶ 시작 시간 오후 5시 10분

▶ 종료 시간 오후 8시 50분

✓ 매주 반복 ▶ 종료날짜 선택

예약하기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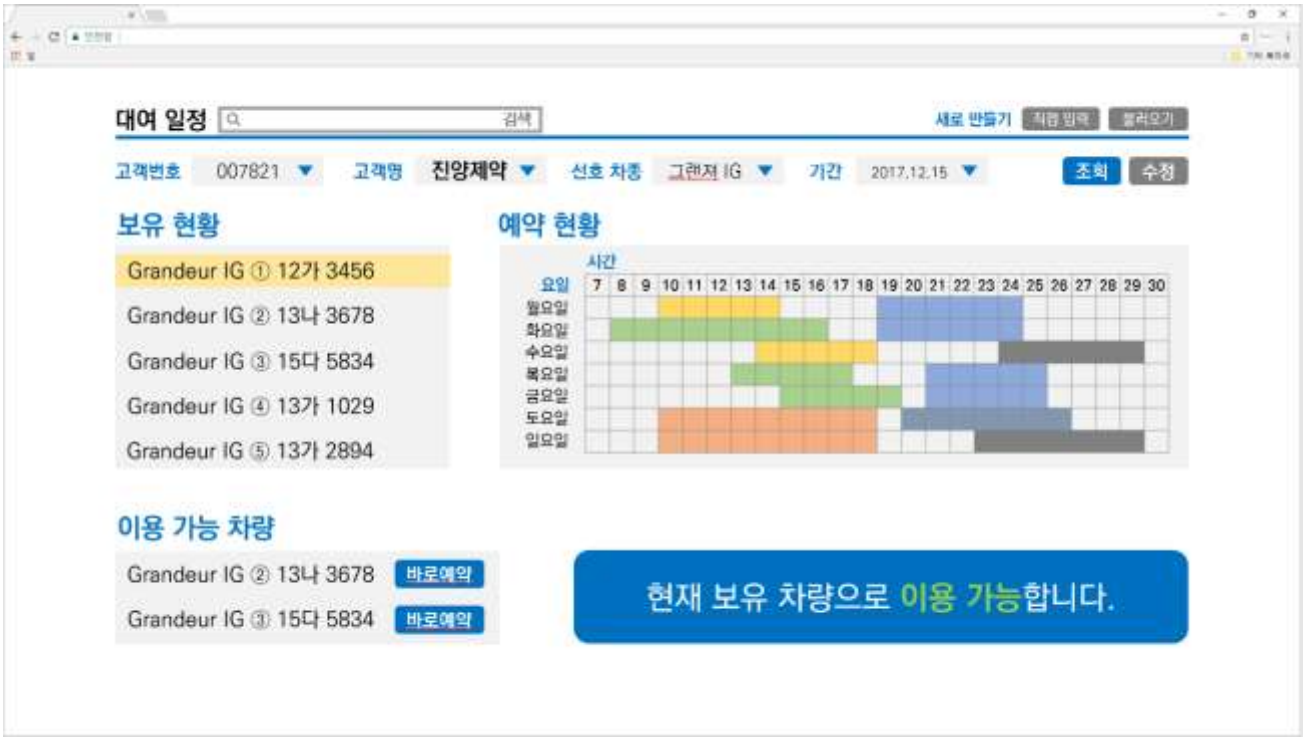
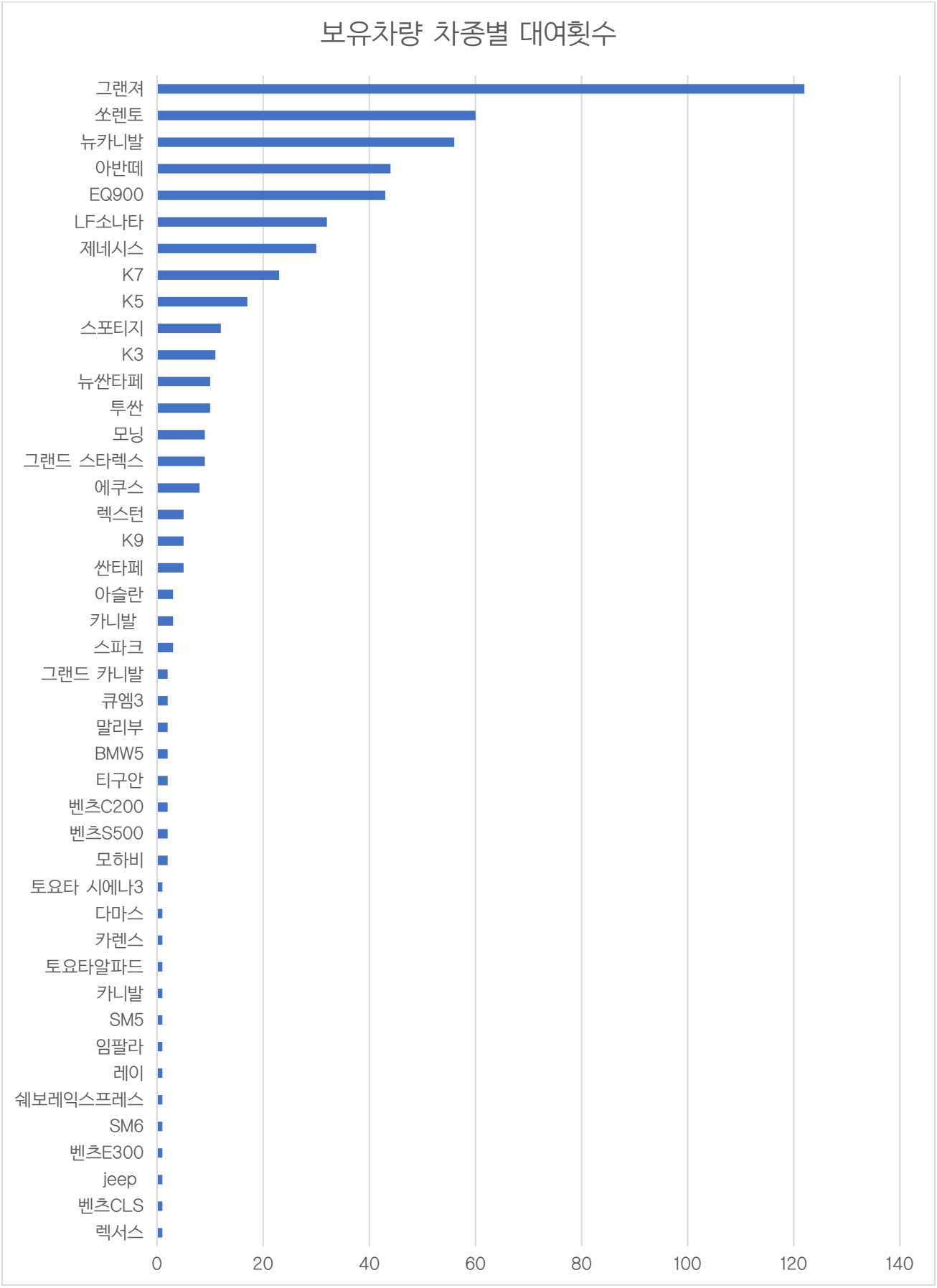
차량정보
2018 쏘렌토 11하1234
연료상태
내부온도 3℃
온도설정
차량 위치 확인
잠금해제
잠금
비상등
사고접수
고객센터

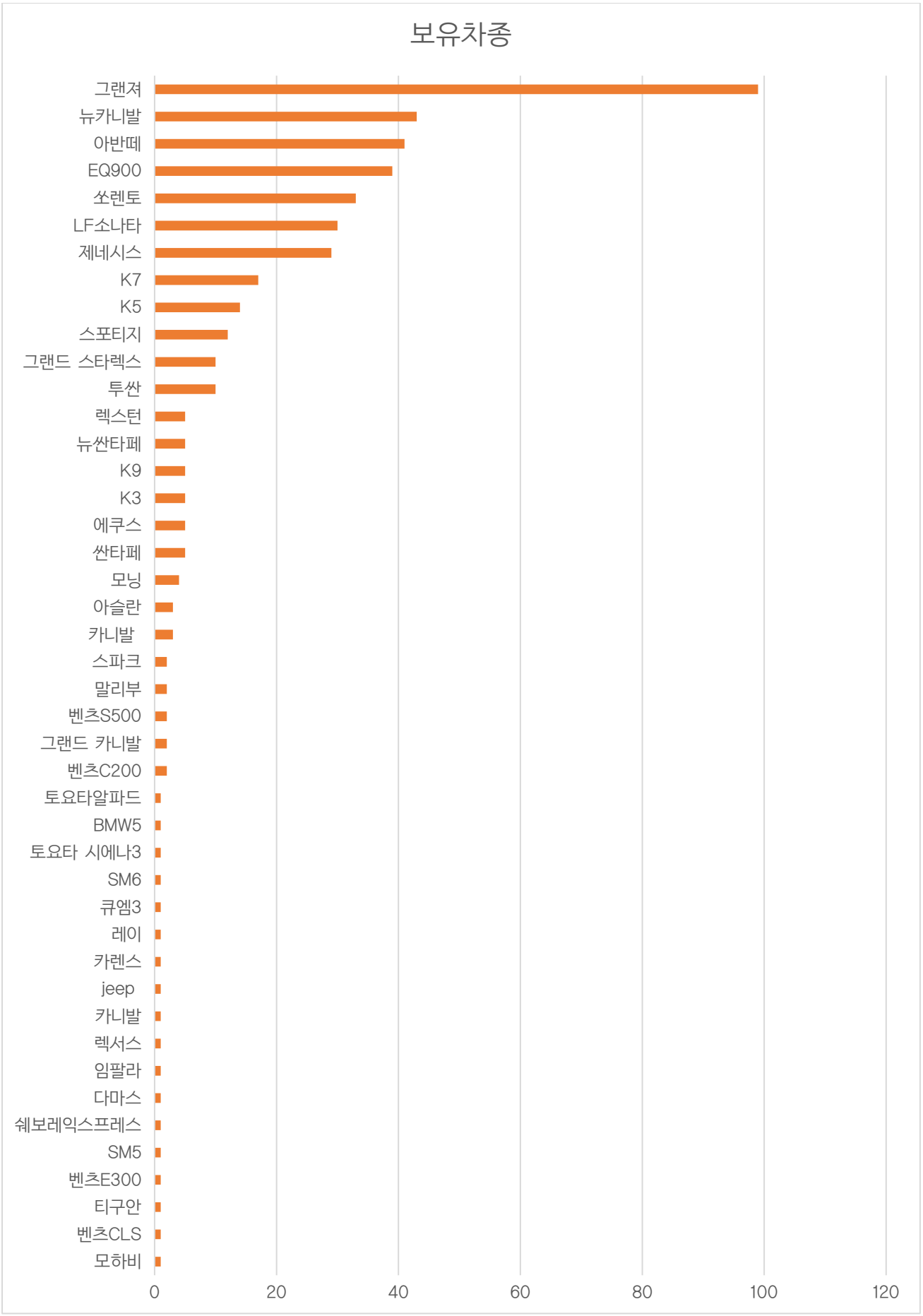

마이페이지
회원정보
법인회원
개인회원
▶ 회사명
▶ 지역
▶ 업종선택
제조업
▶ 용도
영업용
▶ 사원수
대여차량 이용 사원 수
만 30세 이상
명
만 30세 미만
명
전체 사원 수
명
▶ 지점 개수
개
저장

Appendix 3. Web Prototype



Appendix 4. Pivot Tables




보유차종
그랜져
뉴카니발
아반떼
EQ900
쏘렌토
LF소나타
제네시스
K7
K5
스포티지
그랜드 스타렉스
투싼
렉스턴
뉴싼타페
K9
K3
에쿠스
싼타페
모닝
아슬란
카니발
스파크
말리부
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그랜드 카니발
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토요타알파드
BMW5
토요타 시에나3
SM6
큐엠3
레이
카렌스
jeep
카니발
렉서스
임팔라
다마스
쉐보레익스프레스
SM5
벤츠E300
티구안
벤츠CLS
모하비
0
20
40
60
80
100
120

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