



أهجزني | Ahjizni

### Team members

Feda ALnafisah 411201897	Mothla Alnoshan 411201854	Rawf Alharbi 411201943
Lamees Aloqlan 411201927	Deem Alorainy 411201994	Saja Alsaab 411201865
Wajd ALjaber 411201938		

### Prepared for

Dr. Asma Al-Shargabi  
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# SMART PARKING SYSTEM



# Contents

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## 01 Chapter One: Introduction

- Introduction to the system.
- Problem Statement.
- Objectives.
- Design styles
- How this system will be implemented in the real world

## 02 Chapter Two: Analysis

- Questionnaire
- Interview
- target user
- user tasks

## 03 Chapter Three: Design

- Prototypes of Interfaces.
- design principles and styles

## 04 References



At Qassim University, specifically the College of Computer, we decided to design a smart parking system . The system is complex and works on more than one side, not only a program, but the need for external devices such as sensors, surveillance cameras, QR code readers, and electronic gates to work as an integrated system from all sides, but of course communication with this system is done through the program designated for it. The system is linked to the university's database, as each of the university's female members can log in using the university email, password, and mobile number, and thus she can reserve a parking spot through our application. This is to ensure that the owner of the reservation is a member of Qassim University, especially the College of Computer. The system works on displaying the available parking spots, as in the view of a plane or train seats. The member chooses the desired parking spot and reserves it. The system then creates a QR code so that she can log in to the parking lot and also log out after that so that the parking spot is made available to the rest of the university's members. The system supports both languages (Arabic and English).

# Introduction

to the system



We decide to develop this kind of system because there are many problems arising from the lack of dedicated parking spaces for university female members. Among these problems: being late for official working hours, and parking in places not designated for parking. This may expose the car and its owner to accidents, or the car may be exposed to scratches or damages. The solution may lie in coming early until the member finds a parking spot, but the current parking spots are taken by non-university members, including workers or people from outside the college.

# Introduction

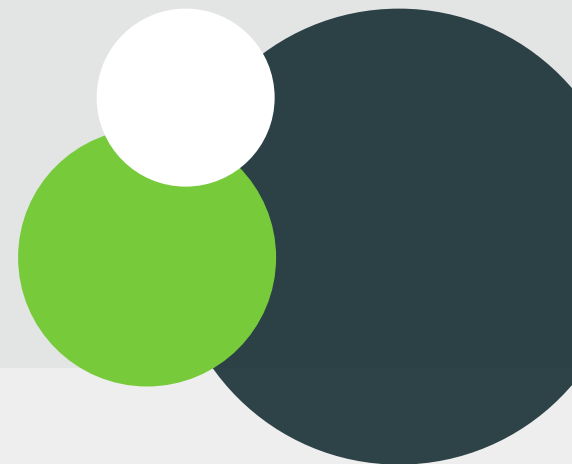
## Problem Statement



**Our goal of this system is to specify university parking lots for university staff and employees by linking this system to the university database, and it also aims to reduce the speed in driving to get a car parking spot and will facilitate and organize this matter, as it will reduce the wrong parking that results in taking more than one parking spot by the member. So we designed this system that solves these problems in all respects.**

# Introduction

## Objectives



- **direct manipulation style**
- **fill-in style**
- **standardized task sequences**
- **descriptive embedded link**
- **format of displayed information is linked  
clearly to the format of data entry.**
- **permit easy reversal of actions**
- **Menu selection**
- **prevent errors**

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# Introduction

Design styles



**Our application allows parking reservation service for 4 consecutive periods :**

**5:00AM-7:30AM**

**7:30AM-10:00AM**

**10:00AM-12:00PM**

**12:00PM-2:00PM**

**Why is that? because if one period of time is allocated for reservation, this will cause the presence of a reserved parking spot without using it for full time, for example, a member who has booked a parking spot at 9 AM, this parking will be available starting from 7 AM, while the member will not come until 9 AM and thus the parking will remain empty until the member comes, on the other hand, there will be members who are required to attend from 7 AM, so she will not find a parking spot for her, so 4 periods have been approved so that each member finds an appropriate spot according to the time of her attendance to the university.**

**How this system will be  
implemented in the real  
world?**



When booking, the parking will be available starting from the parking time until half an hour, for example, if the member booked the parking spot at 9 AM, the parking will be available for her from 9 AM until 9:30 AM, after that the parking spot will be canceled. To avoid any damage or accidents that may result from trying to arrive quickly so as not to cancel the parking spot, the member can log in to her account, update the time counter and add 10 minutes, and this update is available only once per reservation. If she did not attend, a message will be sent to the phone number and email registered in the system, that the reservation has been canceled due to the delay in attendance. In the college car parks, electronic gates and a QR code reader are required, as well as a sensor at the entrance and exit entrances. It also requires the presence of sensors in each parking area.

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How this system will be  
implemented in the real  
world?





**First, we have the ideal state that we want the system to implement:**

**When a member reserve a specific parking spot, a QR code will be generated that contains information about the parking area, its number, and the member-assigned ID, as stored in the database.**

**How is it used? When the member arrives at the university, she will first face the electronic entry portal with a QR code reader and a sensor, the sensor will read the vehicle plate, as she will display the QRCODE on the QR code reader, the reader will store this code after decode it, the system will store the information coming from the sensor and from the reader with each other as one object and store it in the database, we will learn later the importance of this point. After that, the member can enter the parking lot and reach her parking spot using the number and the name of the area as indicated in the reservation details.**

**How this system will be implemented in the real world?**



As we mentioned before, there will be a sensor in each area, this sensor is programmed to specific dimensions of it, which is able to know the dimensions of each parking spot and the name of each one as stored in the database related to it, for example, area A contains two sensors, each one is storing 4 parking spots and the dimensions of each parking, sensor 1 carries data and parking dimensions from A-1 to A-4 and sensor 2 carries from A-5 to A-8 and so on, this sensor will read the vehicle plate and compare it with the database that holds the entry data (when the member enters from the gate) and checks through the code (which the system stored and decode at the gate) and compares the data with the dimensions of the requested parking, if the reserved parking is A-1, the sensor's system will compare the dimensions of the parking A-1 with the spot that the member stands on it, if it matches, there will not be any problems, and this is the ideal case, but if it does not match, then here lies the problem and we will talk about it in the next case. Upon completion and exit, there will be a QR code reader that will read the same entry code to log out and make the parking spot available again.

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How this system will be  
implemented in the real  
world?



In the second case, when the member has reserved a parking spot, but she is parking in another spot that is not hers. The sensor for the area where she stopped will read the vehicle plate and check whether it is in the correct spot or not, if she is in the wrong spot; The system will send a message via her mobile number and e-mail informing her that the place she stopped is wrong and that she must adjust the position. If she does not respond within 10 minutes, an initial warning will be raised to her, and when she reaches 3 warnings; A wrong parking violation will be imposed on her, also in the event that the parking spot in which she was stopped is reserved for another member, the parking spot of the second member will be changed and she will be notified by a message that her parking spot has been updated due to the violation by another member.

How this system will be implemented in the real world?



In the latter case, the member stopped in the same spot she reserved, but stopped illegally and obstructed the parking of the other member. In this case, also, a message will be sent to her to notify her, and if she did not respond within 10 minutes, an initial warning will be raised to her, and similarly, if the other spot was reserved for another member before, another spot will be reserved for the second member and she will be informed of this. If it is not reserved, the system will make it unavailable so that it will not be reserved by other members.

How this system will be implemented in the real world?



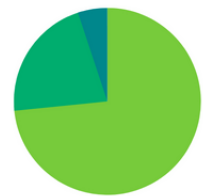
# Analysis Method for gathering the information

We choose the Personal interviews methodology that took place at a Qassim University-College of computer to fully understand a person's opinions about the current state of the system, and points of view, and to get additional information to a questionnaire.

The interviews are a valuable time to explore key HCI (human-computer interaction) concerns, including the ergonomic aspects, the system usability, how pleasing and enjoyable the system is, and how useful it is in supporting individual tasks.

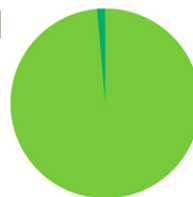
The interview's close-ended questions are easier & Quicker to Answer and give a better understanding through answer options but don't cover all possible answers & options and cannot help in getting users' opinions and comments so we also added an open-ended question.

In total ,we get 86 responses, in the next section we will provide the details of each question.



## First question

For the first question is to know the target users, most of them are students (73.4%), then lecturers (21.5%), and the least staff (5.1%).



## Second question

For the second question is to measure the percentage of drivers in the College of computer (98.8%) who said yes.



## Third question

For the third question is to know if they face any difficulty to find a parking spot (85.7%) said yes.

# Analysis Method for gathering the information

## Fourth question

For the fourth question, we choose to put it as an open question because every driver arrives at different times from another. We notice that the average time is between 10 minutes to 5 minutes. Some Drivers suffer to find a spot, sometimes they take around 20 minutes or even 30 minutes.

## Last question

The last question was asking about the additional service that the drivers wish to be provided by our application besides booking a parking spot. A few wishes were out of our scope such as adding parking spots or applying a fee for parking, but almost all the drivers wish to provide a real-time application that shows the available spot and traffic at a specific time, an interval for each parking spot, the penalty for wrong parking, showing the name and number of the parking spot, the possibility to extend the booking if they were late for some reason, and priority for drivers with a health problem or disabilities in booking the nearest parking spots to the gate.

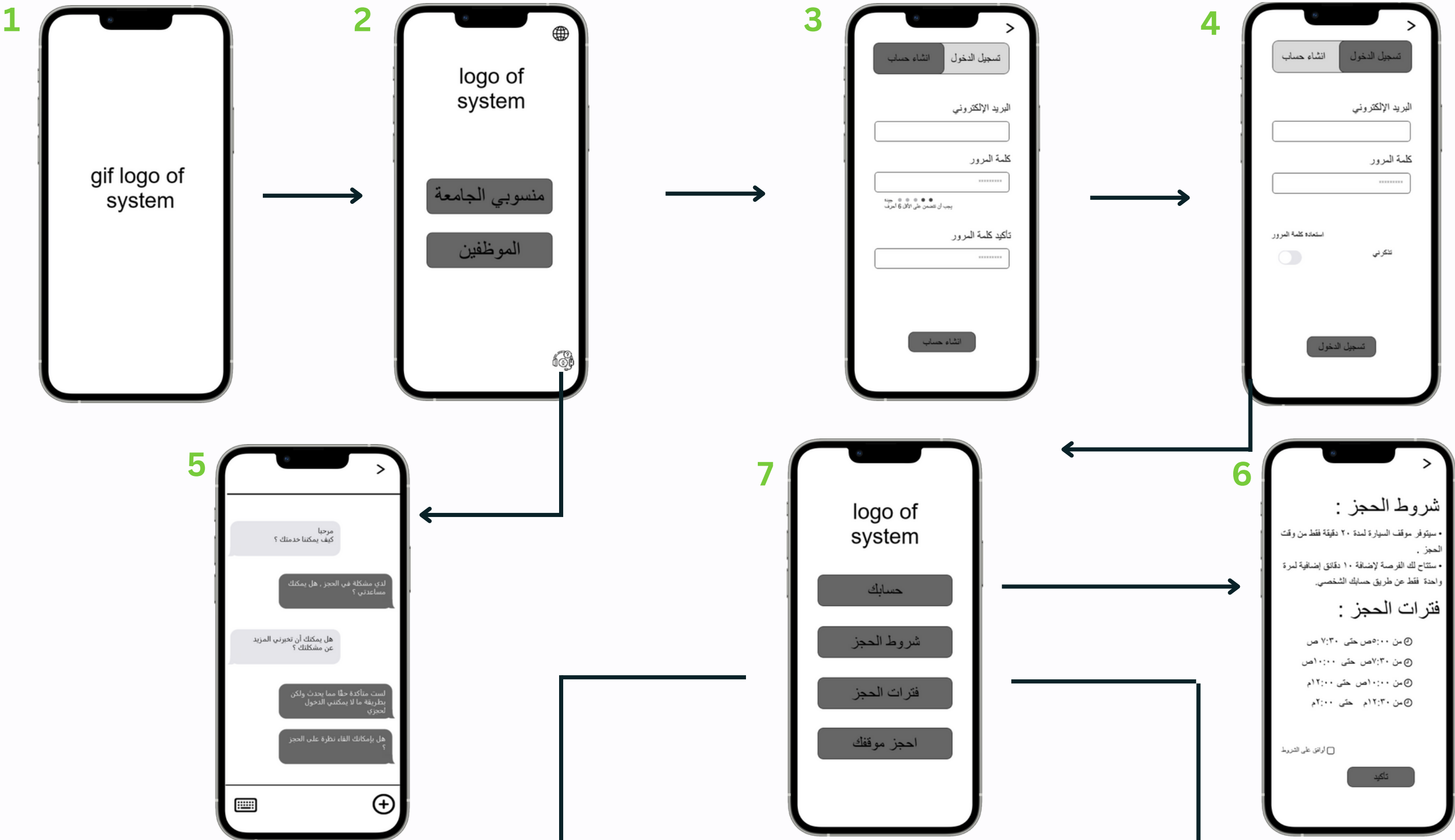
## Fifth question

For the fifth question, we asked the drivers for their opinion about our application. The largest portion goes to "An excellent idea" while "Very good idea" and "acceptable idea" about the same.

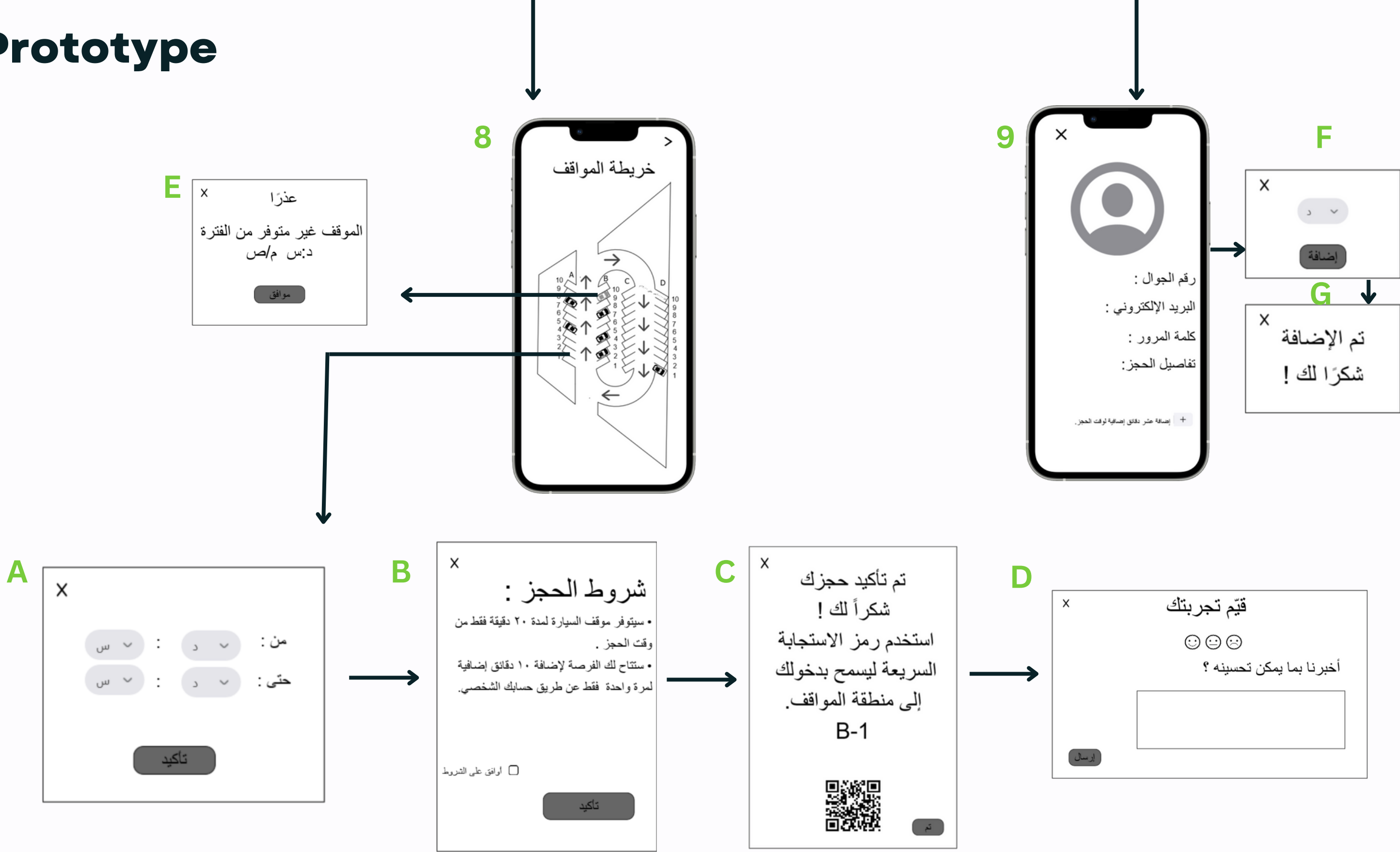
## Conclusion

In conclusion, interviewing drivers helps us feel and understand their suffering and urge us to build our application to help them as soon as possible. We will ensure to provide the services they wish for and apply what we learn in the HCI course.

# Prototype



# Prototype





# Explanation of Prototype

Most of our interfaces depend on a direct manipulation style .for example, on the 8th interface, we used the map of the parking lot which enable users to click on a specific spot to be booked. Also, we used a form fill-in style in 3rd and 4th interfaces and pop-up window(D) to simplify data Entry. In addition, the menu selection was used on pop-up windows (A, F) that represent a clear structure to decision making and allow easy support of error handling.

<p>In the 2nd , 3rd and 4th interfaces, we standardized task sequences which allow university staff and employees to create accounts and sign-in in the same manner.</p>	<p>In the 4th interface we used a descriptive embedded link that allow users to re-setting passwords.</p>
<p>We made sure that the data displayed is consistent by using the same formats and terminologies .</p>	<p>Our interfaces support English &amp; Arabic language.</p>

# Explanation of Prototype

We used some methods to prevent errors, such as in the 8th interface that greyed out unavailable spots and when we click on them it will show a pop-up window that inform users of inability to book the chosen spot. In addition, in the 3th interface we add a password Strength checker to avoid creating a weak password .

In the 3rd and 4th interfaces, we made sure that the format of displayed information is linked clearly to the format of data entry.	To permit easy reversal of actions, we add an Arrows In 3th and 4th interfaces.
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We made sure to inform the user that he accomplish sequences of actions successfully .for example, in pop-up windows (C).

**Scan the QR code to see the design**





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