Section-1

Firebase

Section-2

Phase 1: in this phase the main functionality for the system was implemented.

Reservation Free Parking Module (available for VIP users and Normal users)

Check Availability:

* It gives the ability for both users to view the current parking area status by displaying the parking area map with a status shown for each parking spot. It required a hardware and software implementation.
* The installed sensor in each spot will keep listen if any user entering or leaving the spot and then the value will be sent to the NodeMCU which is in term updating the Firebase Database. On the other hand, the application or website will keep listen to any change in the spot status in the Firebase Database and reflect any changes directly to the map without needing to refresh the page.

Reserved Parking Module (available for VIP users only)

Reserve a parking:

* It gives the ability for VIP user to reserves a parking spot for several hours. VIP user can reserve starting from one day before the reserving time and they can reserve up to 6 hours per day. Also, the VIP user will be charged 5 QR per hour and if they exceed the reserved time, triple price penalty will be applied.
* In order to reserve, VIP user should select the date, start time and the duration. Whenever the date is selected the status for each hour will be changed based on the number of reservations in each hour. The application displays the status of each hour through colors. Blue for “available” and red for “not available”. Hardware part ( Exiting after reservation time:))

Extend a reservation:

* It gives the ability for VIP user to extends a reservation and the extension time is by default one hour. VIP user will be charged 5 QR per extension. Additionally, VIP user can extend only in the last hour of the reservation.

Cancel a reservation:

* It gives the ability for the VIP user to cancel a reservation. 50% of the reservation price will be refunded to the VIP user. VIP user can start cancelling the reservation from the reserving time to the start time of reservation.

Show reservations:

* It gives the ability for VIP user to view a list of current and upcoming reservations. Each one of the reservations has 2 options which are “Extend” and “Cancel”.

Request car care:

* It redirects user to the Servesni application that provide a various car care service.

Phase 2: to improve the system, some of the main functionality was improved and additional functionality was implemented.

Reservation Free Parking Module (available for VIP users and Normal users)

Get Directions:

* This feature was added to the check availability service to give the user the ability to get directions for specific spot. It required a software implementation only.
* Each spot is associated with specific (latitude, longitude) coordinate. By using google map we were able to get the location and the directions from current location of the user (device location) to the spot location.

Availability percentage:

* Also, this feature was added to check availability service to tell the user the availability percentage of spots in each zone.
* Progress bar is used to illustrate the availability percentage. The progress bar color will be changed based on the percentage. Green if more than 75% of spots are available, orange if 50% of spots are available and red if 25% of spots are available.

Reserved Parking Module (available for VIP users only)

Reserve a parking:

* This service is already implemented in the phase-1. Additional feature was added which is knowing how many spots left in each hour.
* The application displays the status of each hour through colors. Green if >75% left*,* orange if 50% left, red if 25% left and gray if 0% left. For knowing the left percentage, for each hour the code will loop through all the reservation that are not cancelled and count how many reservations in this hour. Now the left percentage is computed by (number of reservation in specified hour/ total allowable reservation per hour) \* 100.

Cancel a reservation:

* This service is already implemented in the phase-1 however in the phase-1 the user can cancel the whole reservation only, so we improved this service by letting the user to cancel part of the reservation. 50% of the price of each cancelled hour will be refunded to the VIP user.

Notification:

* Providing this feature will help VIP user as many of them might forget about the expiring time of their reservation. It is mainly about notifying the VIP user 30 minutes before expiring time.

Automatic cancellation without using application or website:

**Features that are available in both modules**

Currently looking:

* It gives the users the ability to know how many people are viewing certain zone in the current moment.
* It was quite challenging to implement this feature as the implementation logic in the application was different from the website. In the website, it was a bit easy to know how many one visit specific page by using IP address. However, this logic is impossible to be implemented in the application.
* To implement this feature, we were thinking about adding an attribute called currently looking in the zone node in the database. This attribute acts as a counter whenever people visit the page this counter will be incremented and vis versa.
* For application implementation, we benefit from a concept called "activity life cycle" where each activity goes through several stages. we benefited from onStart () and onStop (). whenever the activity gets started, onStart () method will be invoked so we should place the logic needed for increasing the number of people looking inside the onStart () method. In contrast, the logic needed for decrementing the number of people looking was placed in onStop () as this method will be called whenever the user leaves the page (activity).
* After implementing this logic, we figure out that it will not work properly in the case that the user lost internet connection. Logically if the user lost the connection the number of people looking should be decremented by 1, however in reality the number stay as it is. The reason behind that was the database has not been updated as there is no internet connection.
* To solve this issue, we thought about adding new relation called “currently looking” in the database to store zone name, login time and temporary id for each access. Whenever the user closes the page, the stored record for this user will be removed. Whenever other users visiting page, 2 things will happen:

1. All the records that are older than 10 minutes will be removed.
2. Show users how many people are currently looking.

By applying this logic, we can give an approximate number of how many currently looking, as in some rare cases the user might stay looking in the page more than 10 minutes.

Current Occupancy Trend:

Switching zones:

Phase-3 the aim of this phase is to improve the design and to implement the prototype and connect it with hardware

* Realistic photos were added to the zone list
* Minimize the number of clicks (app case => where to put histogram, website case=> ??)
* Consistency between website and application design
* Prototype

Section-3

Challenges