EcobikeRental

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Ecopark township has an hourly bike rental service with lots of docking stations (i.e., docks) for users to rent or return bikes automatically. Every time a user returns a bike, he or she puts the bike into an empty docking point at any docking station and closes the lock as shown in the figure below. Users are offered a free bike rental if they return the bikes within 10 minutes, even at a different docking station.

For journeys longer than 10 minutes, the user would be charged. The starting price for the first 30 minutes is VND 10,000. After that, the user has to pay VND 3,000 for each additional 15 minutes. For instance, renting a standard bicycle for 01 hour and 10 minutes or 70 minutes costs $10{,}000 + 3 \times 3{,}000 = 19{,}000\ (VND)$.

There are 03 types of bicycles: (1) a standard bicycle (or standard bike) has 01 saddle, 01 pedal, and 01 rear seat in the back, (2) a standard e-bike is like a standard bike, but it has an integrated electric motor for assist propulsion, and (3) a twin bike has 02 saddle, 02 pedal, and 01 rear seat with no integrated electric motor. Renting a standard e-bike or a twin bike costs 1.5 times more expensive than renting a standard bike.

In reality, users firstly need to create an account on the *EcoBikeRental application*, validate information, set up access permissions of the application, and set up at least one payment method to pay charges (by linking to interbank or e-wallet).

EcoBikeRental is a 24/7 platform-independent system which allows novice users to use

without any training. It is expected to serve 100 users at the same time without noticeable loss of performance and to operate in an average of 200 hours without failure. The system also can be repaired within 2 hours after any typical failure. The response time for the system is 1 second at normal and 2 seconds during a peak load if it is not explicitly stated.

The customers also can sign up for a normal user account in the app. To sign up, the customer has to provide his or her full name, phone number, date of birth, default delivery province/city, default delivery address, email address, and a password. The password must include 8 or more characters with a mix of letters, numbers, and symbols. After successfully validating the input, the system automatically sends an OTP (One Time Password) to verify the phone number of the customer. The customer can request the OTP again for every 60 seconds. When the customer enters the correct OTP, the system would automatically create a new account and send an email to notify the result.

After the customer succeeds in creating an account, he or she can sign in. After successfully signing in, the customer can update the info of the account. In case the customer forgets the password of an account, the customer can request for a link to reset the password by filling his or her email into the form for reset request. Then, the system will automatically send a link that forwards to the form for password reset to the customer email. After the customer resets the password, the system sends another email to the customer email to confirm the password reset.

When the app is launched, the user's current location along with the locations of nearby docking stations are marked on the map (the number of docks is relatively changed when the user changes the zoom level of the map).

User can select a dock marker on the map or search for a dock by its name/address to view detailed information about the dock, including: name of the dock, address, dock area, the number of available bikes, the number of empty docking points, distance, and walking time from user's location to this dock. Additionally, selecting a dock also shows the detailed information of available bikes. Especially, the information of e-bikes includes their electric motor's battery percentage and estimating how much time is left.

To rent a bike, a user needs to use the feature for bike renting in the EcoBikeRental app to scan the barcode on the lock. At this point, the information of the bike is shown (e.g., license plate, current battery percentage of electric bicycle, etc.), and then the user is asked to choose a payment method to make transactions. The user has to deposit an amount equal to 40% of the value of the bike (for a standard bike is VND 400,000, for a standard e-bike is VND 700,000, and for a twin bike is VND 550,000). After confirming the transaction, the system will automatically deduct the amount in the customer's card or account and save the transaction. Then, the lock automatically opens, allowing the user to use the bike.

While renting, a user can always use the app to view information about the bikes that he or she is renting, including: bike type, renting time, the amount to be paid up to now, and bike status (e.g., current battery percentage of e-bike).

When a user returns a bike, the user firmly pushes the bike into an empty docking point of a dock (usually the nearest dock from the user's current location) and closes the lock. At this time, the system will automatically return the deposit and deduct the amount of

money corresponding to the rental period. At the same time, the system saves the rental transaction. The response time for any transaction must not exceed 1 second.

Every time you make a transaction, customers need to provide card information (card info, including cardholder name, card number, issuing bank, expiration date, and security code) and transaction content. App will display and save transaction information in the system. Then the system sends an email of transaction info to the customer. b ?!?

You are asked to design and build an *EcoBikeRental* software simulating the bike rental system as described above. ***However, in this course, we will not consider features such as user authentication (e.g., sign up, sign in, sign out), but we focus on features related to bike renting and return.***

In the simulation, for simplicity, the user only pays via credit card, and one credit card can only be used for renting 01 bike.

When the system launches, a list of docks is shown on the screen instead of a map. Users can still see information about docks and bikes as described.

When renting a bike, in the feature for bike renting, the user enters the corresponding barcode of the bike that he or she wants to rent instead of scanning the barcode. Then the system will call an API to convert the barcode into a rental code.

For returning a bike, the application has a feature which allows the user to choose a dock instead of doing some actions as described in reality.

When displaying information of an e-bike, the system also needs to display information of its remaining battery life. For simplicity, we are not concerned about the changes of its battery life while it is rented or returned.

We use credit cards as our payment method. For credit cards, each group will be issued a virtual credit card with the following information:

- Card code: theoretical class code_groupSTT_2020 (e.g., 987152_group06_2020)
- Balance: VND 1,000,000 by default
- Secret token: this is a secret token that will be sent separately to each group to perform operations with their virtual credit card.

To perform operations with credit cards, the system will call some available APIs (which will be provided) as follows:

- Deduct money API (to deposit money when renting a bike and make payment)
- Add money API (used to return the deposit to customers)
- Reset account API reset (resets the original default amount of the token. This API was created to facilitate testing when dev, ensuring there is always enough money for students to conduct system testing)

- Check account API (used to view the balance on your credit card)

The additional requirements:

- *Add a new kind of bike*
    - Twin e-bike, like the twin bike, but integrated electric motors for assisting propulsion. Renting a twin e-bike is twice more expensive than renting a standard bike.
- *Changing the rental pricing:*
    - Allows customers to rent a bike for VND 200,000 for 24 hours (i.e., 24-hour pass).
        - If the user rents a bike for less than 12 hours, the user will be refunded VND 10,000 per hour early. To illustrate, when choosing 24-hour pass, a user has to pay after renting a standard bike for 10 hours and 59 minutes is

$$200{,}000\ VND - 2\ hours \times \frac{10{,}000\ VND}{1\ hour} = \ 180{,}000\ VND$$

        - Otherwise, the user will not be refunded.
        - After that, for each 15 minutes late, the user will have to pay an additional VND 2,000.
- Add new feature:
    - Allows users to pause the rental time.
        - Users can pause the rental time at any time by locking the bike. At this time, the system will pause the counting.
        - The system will automatically continue to count the rental time when the customer unlocks the bike.