Rhea Bhattacharjee
6.1800 DP Prep Assignment

The city of Newplace would like to implement a bike sharing system, similar to the Bluebike system of Boston, to aid in local transportation. Newplace also hopes to add additional features to further improve the experience. To that end, our team is tasked with designing the bikeshare system desired by Newplace in order to provide the best possible experience to its users (pg. 2).

This paper describes the key elements of the enhanced bike share system specifications and poses specific questions for its design. It begins with a summary of the system's components, then gives use cases and design properties, followed by a discussion of potential impacts, both positive and negative. The paper concludes with a list of further questions about the specifications.

System Summary

The system is composed of six components: kiosks and docks (grouped together in stations), bikes, a website, a mobile app, and the central computing server (pg. 2). The city of Newplace will build stations around town so that each station is within 1,000 feet of each other (pg. 3). The station will have a kiosk, which allows riders to interact with the system, and docks, which store bikes. The kiosk allows riders to rent bikes and see bike availability at other stations, and allows members to manage their account and make reservations (pg. 8).

There are three types of bikes: basic, standard, and e-bikes, each with different capabilities. Our system needs to at least provide support for standard bikes (pg. 3). Bikes are equipped with GPS receivers, and standard and e-bikes have in addition more advanced communication features. Our team needs to decide whether to implement Bluetooth, cellular data, or WiFi communication depending on the tradeoffs of each (pg. 10). We also need to determine how the bike communicates with its rider (pg. 11).

Riders can also interact with the system through a website and a mobile app. The website is available to all users, and displays information about bike availability. It also allows members to reserve bikes and manage their accounts. The mobile app, on the other hand, is available to members only. Members on the app can do the same things as on the website, but can also use additional features such as calculate routes for their rides (pg. 8).

The final component is the central computing system. This system is responsible for managing the flow of information and storing the overall system's data. It receives and sends information to and from other components, performs all necessary processing, and stores all necessary data. Our team needs to decide what information goes through the central server and what information is stored there (pg. 13).

Use Cases & Properties

The most important use case is allowing users to rent and ride bikes from one station to another (pg. 5). As a result, our team needs to ensure the basic functionality of all components. Riders can also choose to use an experimental camera module, which they can use to record personal videos. Our system needs to figure out how to store and distribute those videos. If a user chooses to use a camera and as an accident, the camera will record a video of the accident that the central system stores and makes available to the city (pg. 10-11).

Riders can also become members, identifiable by the account they create with the system and a bike card issued to them (pg. 4). There are additional use cases that are available to members only. Members can reserve bikes for pickup or docks for dropoff. Our system needs to process and ensure that these reservations are able to be made. If a bike is lost, or if there are not enough bikes in high-demand areas, members can become Angels (riding bikes from low-demand areas to high-demand areas) or Heroes (retrieving lost bikes). Members can manage these in the app (or on a kiosk, in the case of Angels) and will receive rewards for doing either of these (pg. 6).

Finally, the city of Newplace will need to collect information about ridership, ride routes, any accidents that occur, and the overall performance of the system, which will allow the city to improve bike infrastructure (pg. 7).

Two desired properties of the system are fault tolerance and privacy. In the case of any outage of the system, unaffected parts should be able to continue functioning at some percentage of normal. In addition, the system needs to protect users' privacy regarding what user data our system collects as well as what data our system gives out to the city of Newplace, while still providing the best user experience.

Potential Impacts

The desired impact of the system is to improve users' transportation experience around the city (pg. 2). Commuters will be able to have a simple and accessible mode of travel, and visitors will be able to tour the city without walking or driving from place to place. Commuters using bikes instead of cars also has an environmental benefit. Furthermore, there could also be a positive impact to local businesses, as more biking means more people who can stop and shop at stores along their commute.

There are also potential negative consequences of the bikeshare system. An increased number of bikes in the roads, especially without specific bike lanes, could lead to more accidents between cars and bikes. The addition of bike lanes to major roads could also lead to frustration on the part of drivers who resent having fewer lanes to use. Increased bike usage can furthermore pose a danger to pedestrians, especially when inexperienced bike rides disregard road rules or fail to pay attention to their surroundings.

Questions

- Do power and communications failures occur globally (through the entire system), or can they just be limited to a few stations?
- How much increased storage does a standard bike have over a basic bike? How much information can a standard bike's storage contain?
- How rigid are the time limits in regards to a ride's cost (for example, is it possible to give grace time if a bike arrives at a station with no available docks)?
- Do abandoned bikes still accrue charge for their ride? Is the system able to/responsible for implementing any consequences for abandoning bikes?