# Software Requirements Specification

for

**PedalPal** 

Version 1.0

Prepared by

**Group Name: Bit Brewers** 

## Group # 4

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# 1. Revisions

Version	Primary Author(s)	Description of Version	Date Completed
v1.0	Raghav Manglik Amogh Bhagwat Srishti Chandra Wadkar Srujan Nitin Pathe Nevish Ashok Debraj Kamakar Khushi Gupta Ananya Baghel Anaswar K B Kaneez Fatima	First version of the Software Requirement Specification (SRS) Document	25/01/23

## 2. Introduction

#### 2.1 Product Scope

Many individuals, from students to faculties, have embraced the lifestyle of cycling at the IITK campus. These cycles require timely maintenance and often get lost. A large number of lost cycles are never found by the owners and remain stacked like waste. Considering the temporary stay of students on campus, buying new cycles is not very cost-effective in such cases. In addition to that, during fests and other campus events, visitors from outside generally face problems in roaming around our huge campus.

This calls for a need for public cycle stands, from where the cycles can be rented using our software application. These cycle stands will be located at some of the most visited locations on campus, which can be accessed through our portal, making the transport easier. Specifying the location will inform them about the nearest stands along with the number of available cycles in it. It will also schedule maintenance on a regular basis, taking a record of the client's feedback. The app will keep track of the duration for which the cycle is used by the client and charge accordingly. We will also provide cycle booking facilities

#### 2.2 Intended Audience and Document Overview

#### 2.2.1 Intended Audience

**Software Developers** who will design the software as per the requirements given in the document, in this case, the group members. **Project Managers** who will supervise the planning and execution of the software development procedure, in this case, the TAs and the course instructor. **Testers and approvers** who will perform a quality check of the designed software and give their feedback on the interface, areas of improvement, etc. **Users** will be the customers of the software, in this case, our entire campus residents and visitors.

#### 2.2.2 Document Overview

- Revisions: This section contains information about the various versions that this document has gone through.
- 2. Introduction: In this section, we provide some basic information that would be useful in reading the SRS, such as document conventions, abbreviations, etc. The reader may choose to skip the section if they are familiar with the basic terminologies. In any case, this section will serve as a helpful collection of information to clarify any confusion that may occur while reading the document.
- 3. Overall Description: This section offers an overall view of the software system and its functionalities, assumptions, and dependencies. This will be a useful read for those seeking to familiarize themselves with the system at a quick glance. A reader is encouraged to read this part as it provides a good basis for understanding the next section of the SRS.
- 4. **Specific Requirements**: This section contains detailed information about the software and explains its functions in detail through the use of numerous tree diagrams. This proves indispensable for end-users, clients, and developers alike, serving as a roadmap during the development phase and a user manual for end-users.

5. **Other Non-Functional Requirements**: Important non-functional requirements are expounded here. This is of special importance to the developers of the software.

#### 2.3 Definitions, Acronyms, and Abbreviations

SRS	Software Requirements Specification
DBMS	Database Management System
UI	User Interface
API	Application Programming Interface
GPS	Global Positioning System
CSS	Cascading Style Sheets
SQL	Structured Query Language
OTP	One Time Password
HTTPS	Hypertext Transfer Protocol (Secure)
Subscribed Users	Users who avail services as per a prepaid subscription agreement
Guest Users	Users who avail services as per a postpaid agreement
Hubs / Stands	Places where the cycles will be present
Ride time	Total time between unlocking and locking a cycle

#### 2.4 Document Conventions

- The document is written using LaTeX (LaTeX) to ensure the consistency of the document and to make it easier to maintain.
- The document is written with the **Arial** font of size 11 with single spacing and 1-inch margins
- · Important keywords are highlighted in bold font and comments are italicized

#### 2.5 References and Acknowledgments

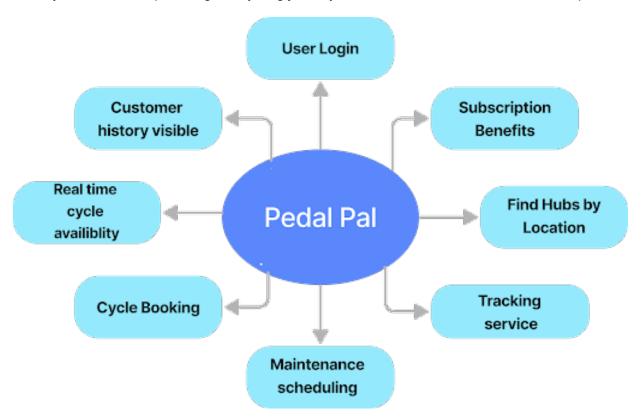
- We would like to acknowledge the help of our TA, Mr. Bharat, and our course instructor, Prof. Indranil Saha for guiding us through the document, and providing a template for the Software Requirements Specification document.
- We utilised Figma to craft visually compelling graphs, effectively translating our ideas into a concise and impactful pictorial representation.
- We used the tool Circuito.io to capture the electronic circuit of the hardware subsystem.

## 3. Overall Description

#### 3.1 Product Overview

Our product, PedalPal, is designed to enhance the cycling experience for IITK students through a convenient and efficient bicycle-sharing system on campus. Invaluable for students who have lost their bicycles or are facing cycling issues, PedalPal serves as a self-contained product, allowing easy bicycle issuance from strategically installed hubs across the university. Moreover, it caters to campus visitors, providing a seamless means to explore the campus on wheels.

The software streamlines the user interaction process by allowing users to book cycles for desired durations and receive real-time information about available cycles. PedalPal further enhances the experience by offering personalized details on the closest hub to the user's current location, ensuring convenient access. The user interface incorporates a history feature, allowing users to review past cycling sessions and track usage patterns. Thus providing a user-friendly solution and optimizing the cycling journey for both students and visitors on campus.



#### 3.2 Product Functionality

- Administrative access using designated usernames and passwords
- Provision for users to register to avail services and subscribe for enhanced features
- Availability of an advance cycle booking system exclusively for subscribed users
- Real-time visibility of available cycles at each hub
- Visibility of hubs in proximity to any specified location

- User location tracking for personalized service
- Implementation of a scheduled maintenance system for the upkeep of cycles.
- Customer feedback mechanism for maintenance or post-ride experiences.
- Access to **detailed analytics**, including ride and payment history.
- Implementation of a **notification system** to keep users informed about significant events and updates.

#### 3.3 Design and Implementation Constraints

- As the user database grows, the system must efficiently manage and store data related to bicycle bookings, user profiles, and cycles.
- To ensure real-time information about available cycles, the implementation of efficient communication protocols between the server, hubs, and user devices is crucial.
- The website, as of now, is available only in English.
- With a large user base, the system must handle simultaneous bicycle booking requests and cycle issuance requests from the hub to ensure smooth operations during peak usage.

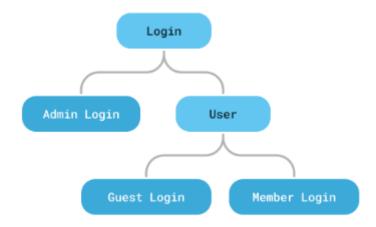
#### 3.4 Assumptions and Dependencies

- The app seamlessly integrates with local infrastructure, including cycle parking and lock systems.
- Users are held accountable for the bicycles they rent. In the event of theft due to negligence, users may be responsible for associated costs or penalties.
- The admins manage any changes or additions effectively.

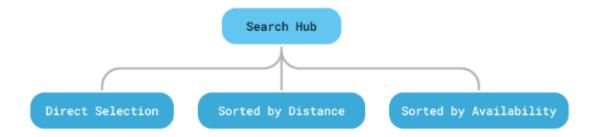
## 4. Specific Requirements

#### 4.1 External Interface Requirements

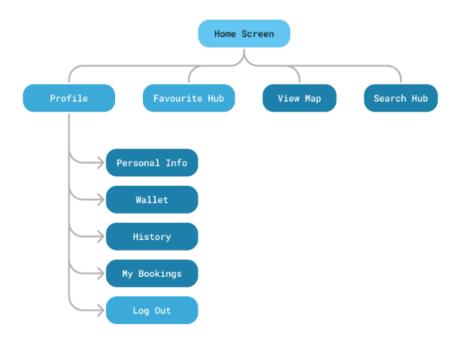
#### 4.1.1 User Interfaces



The application offers a login interface catering to both administrators and users, including guests and members. Users are required to register themselves and further undergo additional authentication processes.

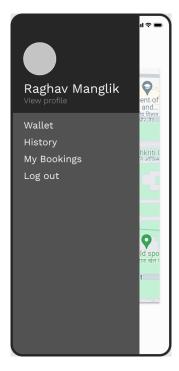


Hubs can be directly searched or sorted based on either distance or availability. The interface also provides a map view of the hubs, allowing users to select the most convenient option.



The home screen presents several options, such as a profile sidebar that features additional choices like Personal Info, Wallet, History, My Bookings, and a Log Out button. Additionally, the home screen displays the user's preferred hub along with functions for viewing the map and searching for hubs.







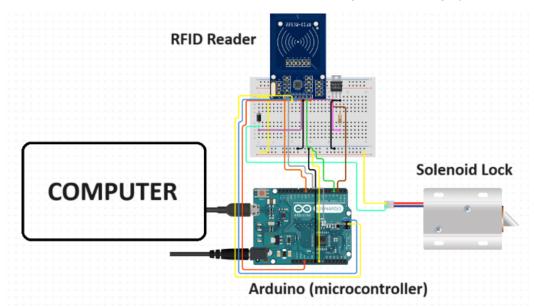
The main screen of the app will present a map view of the campus, with the hubs marked on it. The user can select a hub to view the number of available cycles at that hub. The user can also search for the nearest hub from their location.

The user can also view their booking history, which will contain details like the hub from which the cycle was booked, the time of booking, the duration of the ride, etc.

The navigation bar has various options like viewing user profile, wallet, history, and future bookings. The user can also log out from the app using the navigation bar.

#### 4.1.2 Hardware Interfaces

- **User devices**: The software would be available for use in devices with internet access, using which the users can directly book their cycles. This will include smartphones, tablets and laptops. Accessibility of the software on mobile devices like smartphones would make the process of cycle booking easy and handy for the user.
- Cycle Locking mechanism: The cycle locking mechanism would be made using solenoid locks present at the cycle hubs. The locks will be accessed by the server using an Arduino microcontroller, and its communication will be bridged using the Python pyserial library.
- Keeping track of parked cycles using RFID: Each bicycle will be equipped with an RFID tag, and RFID readers will be present at hubs along with each lock. This RFID-based system will keep track of which cycles are parked, enabling a quick and hassle-free cycle issuing and submission system. The unique identification of RFID tags will provide our users with a reliable and convenient solution for renting and returning cycles.



#### 4.1.3 Software Interfaces

- The server-side components, including the database, must be hosted in a Linux-based operating system environment
- The client-side components must be functional on modern web browsers as well as their mobile versions, like Google Chrome, Safari, Mozilla Firefox, Microsoft Edge, and Brave
- The database management system used by us will be PostgreSQL. The following databases will be created:
  - \* The user database will store all users' data, including authentication details and personal information

- \* The rides database will store all trips' data, including the duration and user associated with the trip
- \* The hubs database will store all cycle hubs' data number of available cycles and location of the hub
- \* The cycles database will store all cycles' data age, location, usability
- \* The payments database will store all the information related to payments
- \* The maintenance database will store the maintenance history of all cycles
- \* The booking database will store all past and future bookings

#### 4.2 Functional Requirements

#### 4.2.1 Administrative access using usernames and passwords

- Usernames and passwords, known only to authorized users, authenticate their identity during login and grant them administrative access control for system management, including notifying users
- Administrative access allows users to authenticate or deactivate user accounts, including resetting passwords and managing user access.
- Administrative access allows users to update the inventory of available bicycles, add new bicycles to any operating hub, or remove bicycles that are no longer available
- Administrative access allows users to adjust rental and membership prices and see users with negative balances

#### 4.2.2 Provision for users to create accouts

- The system allows users to create their profiles by providing essential information, password, and identification proof, IITK campus email for campus residents, and contact numbers for visitors
- After successful authentication, the system allows users to update their personal information, reset their passwords, and avail of bicycle rental services
- The system allows users to become members and avail of enhanced features by paying a monthly subscription fee

#### 4.2.3 Availability of an advance cycle

- Subscribed users gain exclusive access to a bicycle booking system, offering them early access to available bicycles
- Subscribed users can define their booking window by providing necessary information such as date, time, and location for their advanced bookings, allowing them to reserve bicycles for a specified period in advance by paying a booking fee charged according to the time for which the bicycle was booked
- The system offers flexibility in booking options, allowing subscribed users to modify or cancel their advanced bookings based on their changing plans

#### 4.2.4 Real-time visibility of available cycles at each hub

- The system allows the display of real-time data on available bicycles at each hub
- Users can use the map interface integrated into the system, providing a visual representation of cycle hub locations and the number of available bicycles at each site
- The system automatically refreshes after a specific time period for real-time updates to ensure that users have the latest information on cycle availability

#### 4.2.5 Visibility of hubs in proximity to any specified location

- The system allows users to input a specific address landmark or use their current location as the basis for finding nearby hubs
- The system, if given permission, utilizes location-based services (LBS), like GPS or Wi-Fi positioning, to determine the current location of the user or any specified location

#### 4.2.6 Implementation of a scheduled maintenance system

- The system defines a regular maintenance schedule for each cycle, considering factors such as total usage time and customers' feedback
- The system automatically sends maintenance reminders to maintenance service providers
- The system provides customer support for handling emergency maintenance situations, such as breakdowns or safety-related issues

#### 4.2.7 Customer feedback mechanism

- The system allows users to report any issues with bicycles through the dedicated reporting system
- The system defines a feedback form where users can report any issues and give feedback by including fields for specific details, such as cycle ID, Hub location, and/or a description of the problem
- The system provides a rating system (5 stars rating system) for users to quickly express their overall satisfaction with the ride and the bicycle itself

#### 4.2.8 Access to detailed analytics

- The system provides a user-friendly dashboard where users can access and review detailed analytics of their ride history, including
  - \* Total number of rides
  - \* Date and time of each ride
  - \* Source and destination of each ride
  - \* Duration of each ride
  - \* Cost charged for each ride
  - \* Average ride duration

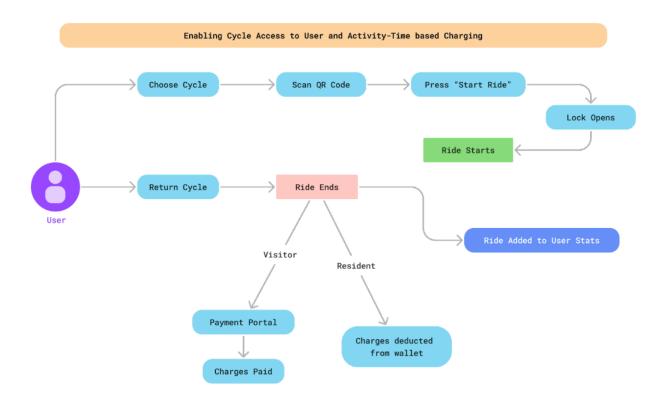
- The system provides a dashboard where users can access and review detailed analytics of wallet activities of users, including
  - \* Subscription charges (if any)
  - \* Current balance
  - \* Transaction history
  - \* Payment methods used

#### 4.2.9 Implementation of a notification system

- The system sends regular notifications to users to inform them about upcoming maintenance activities or system updates that might affect bike availability
- The system sends reminders to users about upcoming subscription renewals

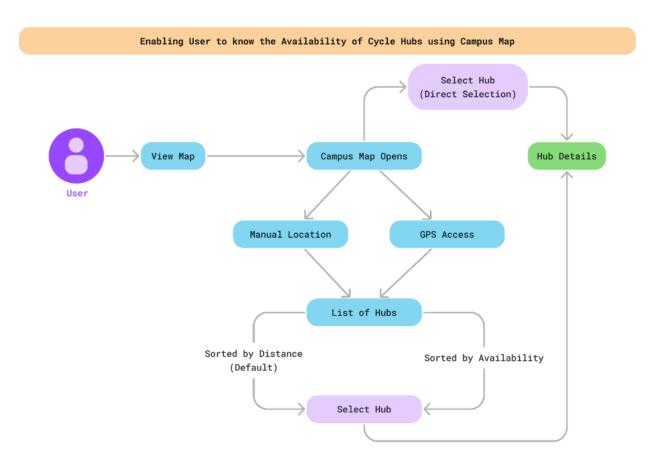
#### 4.3 Use Case Model

#### 4.3.1 Use Case 1



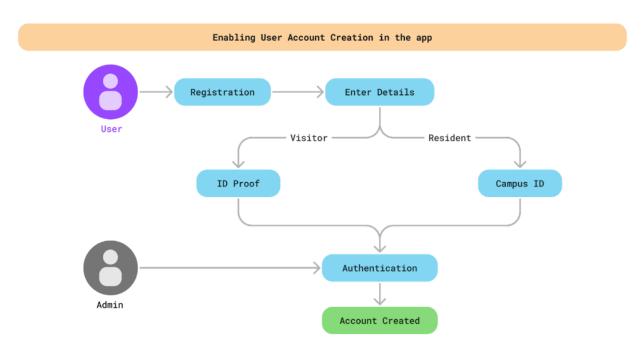
Author	Pathe Nevish Ashok	
Purpose	To let the resident/visitor access cycles from a cycle hub	
	and charge them based on their activity time	
Requirements Traceability	User should be logged in to the app and should have access	
	to the Internet	
Priority	The priority of this use case is high as it is the feature of ut-	
	most importance and Is one of the major reasons for making	
	this app	
Pre Conditions	The user should be physically present at one of the cycle	
	hubs on campus	
Post Conditions	The user will get access to the desired cycle until they return	
	it to another cycle hub, and they will be charged based on	
	the time of the ride	
Actors	The actors involved in this use case are the campus res-	
	idents/visitors who want access to cycles to travel across	
	the campus	

#### 4.3.2 Use Case 2



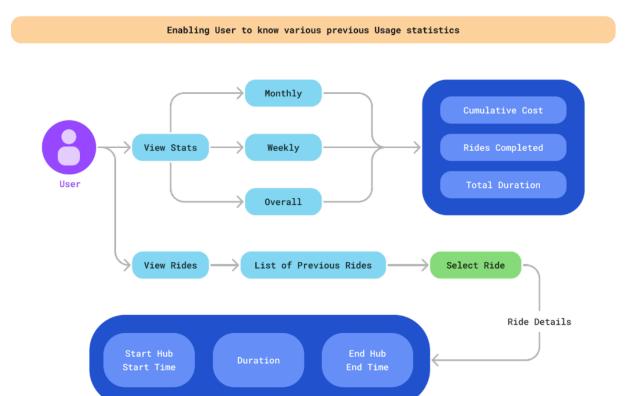
Author	Raghav Manglik, Srishti Chandra	
Purpose	To let the user know the availability of cycles at strategically	
	placed different cycle hubs with the help of a campus map	
Requirements Traceability	The user should be logged in and should give access to the	
	location if possible	
Priority	The priority of this use case is medium as it provides a fea-	
	ture for increased convenience and is not highly important	
	for campus residents in particular	
Pre Conditions	The user should either give location access to the app or	
	select a checkpoint manually from the app	
Post Conditions	The user will get to know the availability of the cycles in the	
	nearby/desired cycle hubs	
Actors	The actors involved in this use case are the campus resi-	
	dents/visitors who want to know the availability of cycles of	
	the campus	

#### 4.3.3 Use Case 3



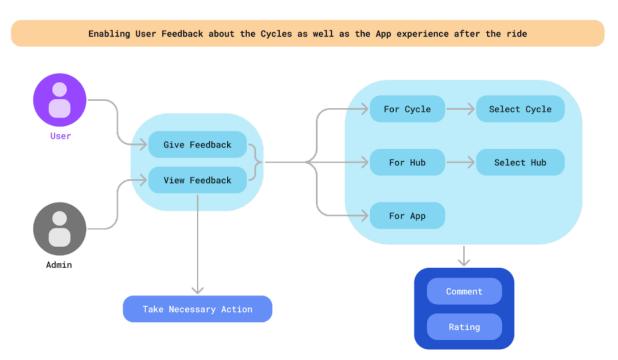
Author	Anaswar K B	
Purpose	To let the user create an account on the portal	
Requirements Traceability	The user should have a valid ID proof for the administrator	
	to authenticate the user	
Priority	The priority of this use case is high as if the user does not	
	have an account, they can not use the app	
Pre Conditions	The user should possess the required details along with an	
	ID proof for the admin to authenticate	
Post Conditions	An account will be created for the user on the app	
Actors	The actors involved in this use case are the users who want	
	to create an account on the app and the administrator who	
	authenticates the user	

#### 4.3.4 Use Case 4



Author	Khushi Gupta, Ananya Singh Baghel, Kaneez Fatima	
Purpose	To let the user know their previous usage statistics, such	
	as the date of the trip, the duration for which the cycle was	
	accessed, pickup hub, drop hub, etc.	
Requirements Traceability	The user must have an account on the app	
Priority	The priority of this use case is medium, as knowing the stats	
	is also an additional feature of this app and not a major fea-	
	ture	
Pre Conditions	The user must have completed at least one ride using their	
	account on the application	
Post Conditions	The user will receive the statistics of all the previous rides	
	along with the option to get to know the statistics in a cumu-	
	lative manner too	
Actors	The actors involved in this use case are users who want to	
	know their ride statistics	

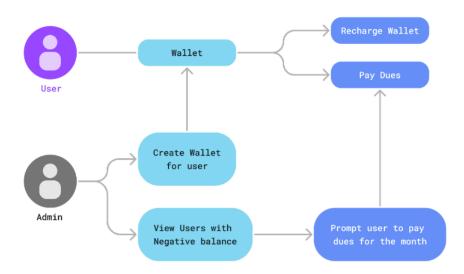
#### 4.3.5 Use Case 5



Author	Wadkar Srujan Nitin	
	,	
Purpose	To let the user have a virtual wallet from which the charges	
	will be deducted and allow them to recharge their wallet	
Requirements Traceability	The user must have an account on the app and also have	
	a UPI/bank account to recharge the wallet	
Priority	The priority of this use case is high as it is necessary to	
	maintain a digital wallet to pay for the rides	
Pre Conditions	The user must have created a wallet on the app for the ex-	
	penses to be deducted from the user's wallet	
Post Conditions	The wallet will show the remaining balance or the amount	
	required to pay when a ride is completed, when the wallet	
	is recharged, or whenever the user demands	
Actors	The actors involved in this use case are users for whom the	
	wallet is maintained and the admin	

#### 4.3.6 Use Case 6

Enabling the User to have a virtual wallet for paying charges as well as recharging it



Author	Debraj Karmakar, Amogh Bhagwat	
Purpose	To let the user give feedback about the cycles as well as the	
	app experience after the ride	
Requirements Traceability	The user must have an account on the app and must have	
	used the app for a sufficient amount of time	
Priority	The priority of this use case is medium, as maintenance of	
	cycles will not be fully dependent on feedback and compre-	
	hensive testing of the app will be done to ensure no bugs	
	are found by the user	
Pre Conditions	The user should have checked the condition of the cycle at	
	the time of giving feedback about it as well as they should	
	have used the app for a sufficient amount of time	
Post Conditions	The app will record the feedback of the user and the admin	
	will take actions by viewing the feedback if necessary	
Actors	The actors involved in this use case are the users who will	
	provide the feedback to the app and the admin who will view	
	it	

## 5. Other Non-Functional Requirements

#### 5.1 Performance Requirements

The software should maintain a 99.9% uptime, allowing users to access cycle rental services without significant disruptions, excluding scheduled maintenance windows.

The system should support a minimum of 500 concurrent rental transactions per minute to ensure efficient and timely processing of user requests. The system should respond to user requests for cycle rentals within 3 seconds under normal operating conditions. The software should be designed with built-in fault tolerance mechanisms to mitigate the impact of hardware or software failures, ensuring uninterrupted service availability.

#### 5.2 Safety and Security Requirements

- User Authentication: The system must employ robust user authentication mechanisms, such as strong password policies or multi-factor authentication, to verify the identity of users before granting access to rental services. Proper login mechanisms should be used to avoid hacking.
- Data Encryption: All sensitive user information, including personal details and payment data, must be encrypted during transmission to prevent unauthorized access and data breaches. Information should be securely transmitted to the server without any changes in information. Secure storage of passwords will be done after salting and hashing the passwords. In other words, the system admin can only verify if the password is correct but won't know what the password submitted by the user was. On maintenance complaints, the cycle's information will be sent to the admin. The complainant users' information is not sent to the server.
- **Secure Transactions**: Payment transactions within the software must be conducted through secure channels. The API of a safe payment gateway, like Razorpay, will be used for the same. A notification will be sent to the concerned people whenever a transaction is added.
- Physical Security: Implement physical security measures for any hardware components
  of the system to prevent unauthorized access. The cycle locks will only be opened when
  the user scans the QR code on the cycle.

#### **5.3 Software Quality Attributes**

#### 5.3.1 Usability

- **Intuitiveness**: The software should have a user-friendly interface, allowing users to navigate through the rental process without confusion easily.
- **Response Time**: Provide quick response times for user interactions, such as renting a cycle or viewing available options.

#### 5.3.2 Availability

In case of a server crash, the system state must be restored within two hours.

• **Performance Scalability**: The number of users will increase in large numbers during campus fests. The system availability needs to be enough for this purpose. Ensure the software can handle an increased load as the user base grows.

#### 5.3.3 Reliability

- The MTTF (mean time to failure) shall be more than one week.
- The system must undergo extensive feature testing, load testing, and regression testing prior to release and/or deployment.
- The system should be reliable in giving correct results consistently.

#### 5.3.4 Portability

We are using Django with bootstrap and inline CSS to design the front-end part of our application, thus our application is portable, responsive and can run on most of the modern web browsers.

## 6. Other Requirements

#### 6.1 Legal Requirements and Copyright

User data collected should be stored in the country's regional data center. This is to comply with data protection and privacy rules that may be enforced by the Government of the nation. Copyright of the source code and the documents must be retained by the developers of the system.

#### 6.2 Authentication

Permission will be required for utilising OTPs for the authentication process as this will require sending automated emails to the user's email id.

# A. Data Dictionary

#### A.1 User Database

Variable	Description	Requirements
ID	Unique ID of the user	Unique for each user
Information	Personal information of the user	String
Password	Password of the user	Encrypted string
Email	Email of the user	IITK Email
Phone Number	Phone number of the user	String

#### A.2 Rides Database

Variable	e Description Requirements		
ID	ID Unique ID of the ride Unique for each ric		
User ID	ID of the user who booked the ride Must be a valid ID		
Cycle ID	Cycle ID ID of the cycle used for the ride Must be a valid		
Start Time	t Time Time at which the ride started Time		
End Time	Time at which the ride ended	Time	
Start Hub	Hub from which the ride started	Must be a valid hub	
End Hub	End Hub Hub at which the ride ended Must be a valid hub		
Cost	Cost of the ride	Integer	

#### A.3 Hubs Database

Variable	Description	Requirements	
ID Unique ID of the hub Unique for		Unique for each hub	
Location	Location of the hub	String	
Number of Cycles	Number of cycles available at the hub Intege		
List of cycles		List of cycle IDs	

## A.4 Cycles Database

Variable	e Description Requirements		
ID	Unique ID of the cycle Unique for each cycle		
Location	Location of the cycle	the cycle String	
In Use	se Whether the cycle is in use or not Boolean		
Age	Age Age of the cycle Integer		
Usability	Usability of the cycle	Boolean	
Maintenance	Maintenance history of the cycle List of maintenance IDs		
Last servicing	Time at which the cycle was last serviced	Time	

## A.5 Payments Database

Attribute	Description	Requirements		
ID	ID Unique ID of the payment Unique for each page 100 and 100 are 100 and 100 are 100 a			
User ID	ID of the user who made the payment	Must be a valid ID		
Ride ID	ID of the ride for which the payment was made	Must be a valid ID		
Amount Amount of the payment Integer		Integer		
Time	Time at which the payment was made	Time		
Payment Method	Method         Method used for the payment         String			
Status	Whether the payment was successful or not	Boolean		

#### A.6 Maintenance Database

Attribute	Description	Requirements	
ID	Unique ID of the maintenance	Unique for each	
טו		maintenance	
Cycle ID	ID of the cycle which was serviced	Must be a valid ID	
Time	Time at which the maintenance was	Time	
	done		
Description	Description of the maintenance	String	

## A.7 Booking Database

Attribute	Description Requirements		
ID	Unique ID of the booking	Unique for each booking	
User ID	ID of the user who booked the cycle	Must be a valid ID	
Cycle ID	ID of the cycle which was booked	Must be a valid ID	
Booking Time Time at which the booking was done		Time	
Start Time	Time for which the cycle was booked	Time, must be no further than 30 minutes from booking time	
Start Hub	Hub from which the cycle was booked	Must be a valid hub	

# B. Group Log

S.No	Date	Timings	Venue	Description
1	07/01/2024	14:00 to 16:00	RM Building	Brain-stormed various possible prospective ideas for the project. Main ideas presented were: Bicycle Rental Services Hall Management Used goods Buy/Sell Portal
2	09/01/2024	14:30 to 17:00	Google Meet	Finalized the idea for the project and discussed various aspects of it.
3	11/01/2024	22:00 to 00:00	Google Meet	Studied the SRS template given and distributed the work amongst the team members.
4	17/01/2024	21:00 to 21:30	Google Meet	First meet with the Teaching Assistant Mr. Bharat. Discussed about project and the SRS documentation.
5	20/01/2024	15:00 to 18:00	Google Meet	Brainstorming of final ideas and discussion on use cases, features, data flows.
6	21/01/2024	14:00 to 15:00	Google Meet	Decided to use Django with bootstrap and inline CSS to build the front end part of our application and PostgreSQL as our DBMS.
7	22/01/2024	23:00 to 00:00	Google Meet	Explored more functionalities for the product and progressed with the SRS document.
9	25/01/2024	14:00 to 17:00	RM Building	Finalized the SRS Document and completed typesetting in LATEX