Software Engineering - Analysis Project: E-Scooter Rental Service

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1 Introduction

In this project, we took the role of a start-up company building an E-Scooter rental business. For analyzing this project, we were encouraged to use the agile method *Scrum* [1] as a framework.

The main objective was to develop a high-level software architecture for the E-Scooter rental business. To be able to do this we had to gain a clear understanding of the system's requirements and to build a model which fulfilled these. We used the *Unified Modeling Language (UML)* [2] in conjunction with the modeling tool *MagicDraw* [3] to achieve this.

We also had to build user interface prototypes for relevant parts of the functionality. User interface prototypes help developers and customers "to better understand how the system will work and whether it would meet the requirements." [5] Concerning the customer, presenting her/him the prototypes, it is very important that she/he understands that these prototypes are not the finished product but are only illustrative examples to demonstrate functionality. We used *Axure RP 9* [4] to create our prototypes.

For our project, the artifacts consist of diagrams and documentation for describing the software functionality. The quality of these artifacts were ensured by a proper definition of "Done".

2   Definition of "Done"

The definition of "Done" (DoD) is part of the SCRUM metrics. All members of the Scrum Team must have a shared understanding of what it means when the work is complete, to ensure transparency. [6] It is a (check-)list of items which need to be validated to consider a backlog item being "Done". DoD is defined by the development organization to make sure that the results of multiple teams can be integrated into a releasable product. [7]

For our project, the result needs to match the following definition of "Done":

☐ Description of the requirement in form of a Use Case

☐ Categorization of requirement (functional/non-functional, client/server)

☐ Business value of the corresponding functionality

☐ Effort estimation for the implementation of the requirement

☐ For UI related functions: UI prototype

☐ UML Diagrams
  - Use case diagram
  - Activity diagram
  - Class diagram
  - Sequence diagram

☐ Detailed documentation (e.g. table) about who worked on the item and what has been done during the sprint.

☐ Overall quality of the documentation meets general industry standards.

☐ The results have been reviewed and accepted by another member of the team (tester). It needs to be documented who has performed the review.

3   High-level Software Architecture

As you can see in figure 1, our team decided to concentrate on analyzing the Software for the Mobile Application.
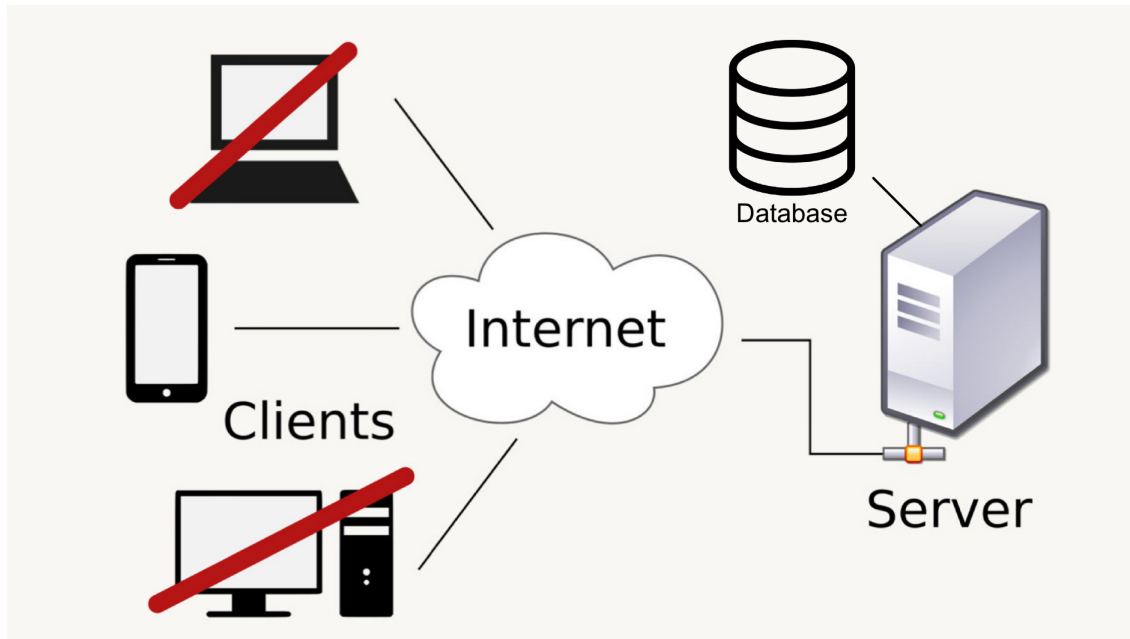
TODO: insert right picture pls

Figure 1: High-level software architecture

Source: https://commons.wikimedia.org/wiki/File:Client-server-model.svg (modified by Kendra Birringer)

4 Backlog Items

Backlog items are part of a product backlog. This is an ordered list of requirements which have to be satisfied according to the DoD for the product. The purpose of a backlog item is to take a requirement description, in form of a use case description, as input and build an analysis model of our software capability as result.

We used the "Volere Requirements Specification Template" [8] also known as "Volere Snow Cards" as a template to create a list of backlog items using Google Sheets where we collected all of our backlog items. This requirement matrix is shown in figure 4.

TODO: FIX Requirements-Matrix as a figure to be able to reference it. Possible workaround: convert pdf to images and insert them as figures.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
1	Registration	Functional	Customer	Register	Customers need to register to get personal information, payment method etc.	Customers must register to use the E-Scooter rental service	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the customer can register successfully	5	5	Registration success	None		High	8	Done	As a new customer, if I want to use the service, I must be able to register and create a new account.
2	Log-in	Functional	Customer	Manage Account	Customers must log-in if they want to rent an E-Scooter	Customers must log-in to use the E-Scooter rental service	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the customer can log-in	4	4	Register	None		High	5	Done	As a customer, if I want to use an E-Scooter, I must be able to log-in into my account.
3	Log-out	Functional	Customer	Manage Account	Customers must have the possibility to log-out	Customers should be able to log-out from our service	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the customer can log out	3	3	Register, Log-in	None		High	2	Done	As a customer, if I finished the ride and do not need the E-Scooter anymore, I must be able to log-out of my account.
4	Change Account Details	Functional	Customer	Manage Account	Change personal information or payment	Customers should be able to change their personal information	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the customer can change account details successfully	3	5	Register, Log-in	None		Medium	3	Done	As a customer I would like to be able to change my account information if something has changed, like personal information or payment method.
5	Delete Account	Functional	Customer, Admin	Manage Account	Customers and Admins can delete a customer's account	Customers should be able to delete their account if they do not want to use the E-Scooter Service any further. Also, if the customer is not following the Terms and Conditions, the Admins also should be able to remove the customer's account	Svetozar Stojanovic	Fits if the customer's account no longer exists	3	3	Register, Log-in	None		Medium	2	Done	As a customer, I want to be able to delete my account if I do not want to use the service anymore. / As an Admin I want to be able to delete a customer's account, if she/ he violates the Terms and Conditions.
6	Choose Subscription Plan	Functional	Customer	Manage Account	Three membership types: Gold, Silver and Bronze. Customers without a membership get their prices calculated per km or min/ h while the customers with a membership pay more affordable prices on a monthly/ yearly basis.	Customers should be able to choose to pay on a monthly or yearly basis	Nader Cacace, Svetozar Stojanovic	Fits if the customer has applied to a membership successfully	3	3	Register, Log-in, Device supporting GPS	None		Low	3	Done	As a customer, I want to be able to choose the Subscribtion plan which fits my needs.
7	Change Subscription Plan	Functional	Customer	Manage Account	Customers can change their membership type whenever they want	To give Customers the possibility to adapt to their needs as soon and flowed as possible	Nader Cacace	Fits if the customer can change the membership type easily and without any disruption	5	4	Choose Membership	None		Low	1	Done	As a customer I would like to change my membership type according to my needs.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
8	Cancel Subscription	Functional	Customer	Manage Account	Customers can cancel the membership type without deleting their whole account	If a Customer knows she/ he will not use the service for a certain period of time, she/ he can cancel the membership without deleting the whole account.	Nader Cacace	Fits if the Customer can cancel her/ his membership when the service is not needed for this customer but nevertheless could keep the account	3	4	Choose Membership	None		Low	2	Done	As a customer I like to cancel my subscription plan to save money if I know that I will not use this service in the next time.
9	Check statistics (customer)	Functional	Customer	Manage Account	Customers can check their own statistics	The customer can see the total price for all rides or only for a specific ride or check the total distance covered etc.	Nader Cacace	Fits if the customer gets a nice and easy to understand overview of all rides he/she ever done with the service	3	2	Register, Log-in	None		Low	5	Done	As a customer I would like to see my own statistics, like how much money spent, distance covered etc., so I can possibly adjust my subscription plan.
10	Day Pass System	Functional	Customer	Manage Account	Customers can pay for a daily pass	If a customer knows, she/ he will use our Service extensively throughout a day	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the customer can purchase a Day Pass in the app	2	1	Register, Log-in	None		Low	3	Done	As a customer, if I know I need an E-Scooter most of the day, I would like to purchase a Day Pass.
11	Purchase Gift Cards	Functional	Customer	Manage Account	Customers can purchase gift cards and send them to other people via E-Mail	If the customer wants to recommend the service to other potential customers and pay for them, they can do that through gift cards	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the customer is able to purchase gift cards and send them to other people via E-Mail	3	1	Register, Log-in	None		Low	8	Done	As a customer I would like to purchase gift cards and be able to send them to other people.
12	Redeem Promo Codes, Gift Cards	Functional	Customer	Manage Account	Customers can redeem promo codes/ vouchers/ gift cards in the app	Promo Codes and vouchers should attract new customers to our service	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the customer can redeem promo codes/ vouchers/ gift cards in the app	5	5	Register, Log-in	None		High	5	Done	As a customer, if I have a promo code/ voucher/ gift card, I would like to be able to redeem it in the App.
13	Check-out E-Scooter	Functional	Customer	Check-out	Check-out represents the state in which the customer scans the QR Code of the E-Scooter and starts the ride.	Customers should be able to rent an available E-Scooter whenever they need	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the E-Scooter checks-out and the customer can ride it	5	5	Register, Log-in, valid payment	None		High	5	Done	As a customer, if I want to ride an E-Scooter, I scan the QR Code of a Scooter and tap the "Check-out E-Scooter" button in the App.
14	Reserve an E-Scooter	Functional	Customer	Check-out	Customers should have the possibility to pre-book an E-Scooter for later or for another day	To make sure that customers can take an E-Scooter from a specific place at a specific time	Nader Cacace	Fits if the customer can reserve an E-Scooter and so she/ he can be sure that it is ready and charged at the given place and time	3	3	Register, Log-in	None		Medium	13	Done	As a customer, I would like to be able to reserve a Scooter so that I can take the ride at a specific time and I want to be sure, that the Scooter is ready at the given place and time.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
15	Show allowed use area for E-Scooter	Functional	Customer	Check-out	Shows a map of the area where customers are allowed to ride the E-Scooters	To prevent that the customer does not drive too far away from the "legal area". To give customers a better experience, the E-Scooter should not slow down if they leave the "legal area" so that they are possible to check-in the E-Scooter	Nader Cacace	Fits if the customer can see a map with the exact area where the E-Scooter can be driven and checked in after the ride	2	5	Check-out E-Scooter	None		Medium	5	Done	As a customer I need to know the area in which I am allowed to ride and return the Scooter.
16	Check-in E-Scooter	Functional	Customer	Check-in	Check-in represents the state in which the customer has finished the ride.	Customers should be able to finish the E-Scooter usage to pay just for what she/ he needs	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the E-Scooter checks-in and the amount of costs are fixed	5	5	Register, Log-in, valid payment	None		High	5	Done	As a customer, when I finished the ride and do not need the E-Scooter anymore, I tap on the "Check-in E-Scooter" button in the App.
17	Cancel E-Scooter reservation	Functional	Customer	Check-in	Customers should have the chance to cancel a reserved E-Scooter if they do not need it anymore	To bring this E-Scooter back to the "available" mode so that other customers could rent this E-Scooter	Nader Cacace	Fits if the reserved E-Scooter is available after cancellation	5	5	Reserve E-Scooter	None		Medium	1	Done	As a customer I like to cancel my E-Scooter reservation if I do not need the Scooter anymore.
18	Warn user about approaching border of allowed use area	Functional	Customer	Check-in	Send a warning to the customer if she/ he is leaving the area where the E-Scooters can be checked-in	Used to prevent the Customers having a bad experience with the check-in process because she/ he will not be able to check-in the E-Scooter at any point of the city	Nader Cacace	Fits if the customer gets a push notification before she/ he leaves the "legal area"	2	5	Check-out E-Scooter	Lost GPS could be an issue		Medium	8	Done	As a customer I would like to get a warning, if I almost leave the area where I can bing back and check-in the Scooter.
19	Get GPS Location of the Customer	Functional	Customer	Find an E-Scooter on the map	Displays the customer's position on the map using GPS	Customers should be able to see their relative position to the nearby available E-Scooters	Svetozar Stojanovic	Fits if the customer can see her/his position on the map in the App	5	4	Register, Log-in, GPS enabled device	No GPS location provided		High	8	Done	As a customer I would like to see my position on a map and all available Scooters nearby.
20	Get GPS Location of the E-Scooter	Functional	Customer, Maintenanceman	Find an E-Scooter on the map	Displays all available E-Scooters on the map using a built-in map and GPS locator	Customers should see nearby E-Scooters on the map	Svetozar Stojanovic	Fits if the customer sees the available E-Scooters on the map in the App	5	2	Register, Log-in	None		High	13	Done	As a customer, I need to see the GPS Location of an available Scooter to find it and rent it. / As a Maintenanceman, I need to see the GPS Location of a Scooter to collect them and recharge them.
21	Download offline maps	Functional	Customer	Find an E-Scooter on the map	Customers can download an offline map of their area	In order to speed up the usage of the App, the map of the customer's area can be downloaded	Svetozar Stojanovic	Fits if the customer has downloaded the map for the offline use	5	2	Register, Log-in	None		Low	8	Done	As a customer I would like to be able to download an offline map, to speed up the App or to save data volume and batterylife of my phone.
22	Generate QR Code	Functional	Admin	Scan QR Code	QR Code is generated from an external source	For each new E-Scooter there is a need for a newly generated QR Code	Svetozar Stojanovic	Fits if the QR Code is generated as an unique code	3	3	External QR Code Generator	None		Medium	2	Done	As an Admin I want that every E-Scooter has an unique QR Code.
23	Display QR Code	Functional	Admin	Scan QR Code	QR Code which is unique for each E-Scooter is being displayed on each of them	QR Code should be displayed on each E-Scooter in order to connect the E-Scooter with the App	Svetozar Stojanovic	Fits if the QR Code is displayed correctly on the E-Scooter	4	3	An E-Scooter with a charged battery	E-Scooter's battery is dead		Medium	2	Done	As an Admin I want that an QR Code, which is unique for each E-Scooter, is displayed on each of them.
24	Scan QR Code	Functional	Admin, Customer	Scan QR Code	QR Code is being scanned in order to book an E-Scooter	Customer scans the E-Scooter so the ride can start	Svetozar Stojanovic	Fits if the customer has scanned the QR Code with her/ his E-Scooter App successfully	5	5	Register, Log-in, Find an E-Scooter on a map	Customer's device does not have a camera, E-Scooter App does not scan the code correctly		High		Done	As a customer, if I would like to ride an E-Scooter, I need to be able to scan the QR Code of the Scooter via the App, so that I can check it out and start the ride.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
25	Push Notifications	Non - Functional	Admin	Get Notifications	Send a push notification to the customer's device	Customers should be able to get notifications	Svetozar Stojanovic	Fits if the notification is sent successfully	3	3	Register, Log-in	None		Medium	5	Done	As an Admin I would like to be able to send notifications to the customer's device via the App.
26	Show Driving Rules	Functional	Admin	Get Notifications	Driving rules are displayed to the customer's device	Before driving an E-Scooter, each newbie to driving an E-Scooter should be presented with driving rules (i.e. on which lane to drive, speed limit when driving next to pedestrians, basic traffic rules, etc.)	Svetozar Stojanovic	Fits if the brief driving rules are displayed successfully to the display of the customer before the ride	2	4	Register, Log-in	None	Some driving rules basic handout/ rule list	Low	1	Done	As an Admin, I want to show all new customers, before they ride an E-Scooter for the first time, the driving rules. This includes the allowed lanes, speed limit, basic traffic rules, etc.
27	Show Safety Risks	Functional	Admin, Customer	Get Notifications	Show safety risks from driving the E-Scooter inappropriately are displayed to the customer	Safety risks when driving under influence (drugs, alcohol, certain medications), medical conditions, etc.	Svetozar Stojanovic	Fits if all safety risks/ health hazards associated with the inappropriate usage of the E-Scooter are displayed to the customer	2	4	Register, Log-in	None	Some kind of basic safety risks when misused	Low	1	Done	As an Admin I want to show the safety risks of diving an E-Scooter to the customers.
28	Show Legal Information	Functional	Admin, Customer	Get Notifications	Legal constraints are displayed to the customer	If the Customer tries to misuse the E-Scooter, the risks should be presented to her/ his device's display	Svetozar Stojanovic	Fits if the Customer sees the legal risks when misusing the E-Scooter in the App	3	3	Register, Log-in	None	Some kind of a basic legal notice	Low	1	Done	As an Admin I want to show the legal constraints of using an E-Scooter. If a customer misuses a Scooter, she/ he will be presented with the risks on her/ his display.
29	Send E-Mail Newsletter	Functional	Customer	Get Notifications	Customer receives an E-Mail with news about the App, company or special offers etc.	Customers should be able to learn about the news	Svetozar Stojanovic	Fits if the customer has received an E-Mail containing the news about the software and company, etc.	2	2	Register, Log-in	None		Low	1	Done	As a customer , if I agree, I would like to receive the newsletter to get the latest news about offers, promo codes, etc.
30	Wallet to manage account balance	Functional	Customer	Pay the Service	Wallet is an in-app virtual money storage system designed for the convinient use by the customer	A wallet is needed for managing the customer's money balance for the ride	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the wallet functionality exists and the customer can send her/ his money to the wallet	5	3	Register, Log-in	None		High	8	Done	As a customer, I would like to have an easy way to pay for the service with a nice overview about my account balance.
31	Refund Customer to wallet	Functional	Admin	Pay the Service	Admin refunds the ride to the in-app wallet of the customer	Admins may need to refund his ride directly to the wallet if the customer cannot drive the specific scooter	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the customer has her/ his money refunded to the wallet	5	5	Register, Log-in	Refund to the original payment method		High	8	Done	As an Admin, I would like to have the possibility to refund the price for a ride if something went wrong for the customer.
32	Refund Customer to original payment method	Functional	Admin	Pay the Service	Service refund if the Scooter does not start. The service fee is then sent to the original payment method used for paying the fee.	Customer should get her/ his money back if the Scooter does not drive	Svetozar Stojanovic, Nader Cacace, Marco Peluso	Fits if the refund is sent to the original payment method	4	1	Register, Log-in, Check-out, Check-in	Refund to the Customer wallet		High	13	Done	As an Admin I need to pay back the money to the customer if a Scooter does not drive.
33	Send Payment Confirmation	Functional	Payment Service	Payment	Payment confirmation is sent to the rental service's bank account notifying them that the customer has paid his service charges	Customers should be able to pay in their favorite payment service	Steffen Hanzlik, Marco Peluso, Kendra Birringer	Fits if the payment was successful	4	4	Register, Log-in	None		High	3	Done	As Payment Service I will send a notification to the rental service's bank account, to inform that a customer has paid her/ his service charges.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
34	Ask for feedback	Functional	Admin, Customer	Give Feedback	Customer is prompted with a menu asking for a feedback in the App	Customers should be asked to give a feedback because many forget or are not bothered to give a feedback	Svetozar Stojanovic	Fits if the the UI panel with the 'Ask for a feedback' question is displayed and the customer can give an immediate feedback	2	4	Register, Log-in	None		Medium	2	Done	As an Admin I would like to be able to ask customers to give feedback. / As a customer I would like to be able to give feedback.
35	Give feedback	Functional	Customer	Give Feedback	Customers should be able to give feedback to the company if they have suggestions to improve the service	Customers should have the possibility to give good or bad feedback to the company who provide the service	Nader Cacace	Fits if the customer is able to send feedback to the company	4	4	Register, Log-in	None		Medium	8	Done	As a customer, I need the possibility to give feedback if I have any suggestions to share.
36	Analyze customer feedback	Functional	Admin	Analyze Customer Feedback	The company should be able to collect customer satisfaction and suggestions for improvements	The company can improve the service with the suggestions from the customers and keep their satisfaction on a high level	Nader Cacace	Fits if the Admin can see the suggestions from the customers	5	5	Register, Log-in	None		High	8	Done	As an Admin I like to analyze the customer feedback to improve our service.
37	Check numbers of customers	Functional	Admin	Check statistics	Shows the company the number of customers	To check the amount, age, gender etc. of customers. This could help to better target the ordains for advertising	Nader Cacace	Fits if the company can check the number of customers in a given period	3	3	Register, Log-in	None		Meidum	1	Done	As an Admin I would like to see the amount of customers, their ages, genders etc. The statistics could help to better target the ordains for advertising.
38	Check overall revenue	Functional	Admin	Check statistics	The company should be able to check the earnings per day/ month/ quarter or year	To plan future investments	Nader Cacace	Fits if the company can check their earnings	5	5	Register, Log-in	None		High	1	Done	As an Admin I would like to see all earnings over a certain period of time.
39	Check revenue per customer	Functional	Admin	Check statistics	Shows revenue per customer in a given period or all in one	To help the company to build the right pricing model for them and the customers	Nader Cacace	Fits if the company is able to check revenue per customer. Maybe per specific ordinance or age groups	4	5	Register, Log-in	None		Medium	1	Done	As an Admin I want to check the revenue of specific/ all customers in a given period of time or all in one. This helps the company to build the right pricing models for the customers
40	Report problems	Functional	Customer, Maintenanceman/ Admin	Report problems	Send information about specific problems from an E-Scooter or the App	To help the Maintenanceman/ Admin to find the problems of an E-Scooter faster and make it easier to fix the relevant E-Scooter or the App	Nader Cacace	Fits if the Maintenanceman/ Admin gets Information about the problem	3	5	Register, Log-in	None		High	8	Done	As a customer, I want to be able to report a problem with an Scooter or the App if something is not working. / As a Maintenanceman I want to get information if something is wrong with a Scooter or the App.
41	Show E-Scooter status	Functional	Maintenanceman	Maintain the scooters	Shows the current status of a specific E-Scooter	To check in which state the different E-Scooters currently are (Batterylife cycles, total distances, last checkup, etc.)	Nader Cacace	Fits if the Maintenanceman can check all parameters of any E-Scooter	5	5	Database with information about all E-Scooters	None		High	1	Done	As a Maintenanceman I would like to see the current status of a specific Scooter, like batterylife, total distances, last check-up etc.
42	Show Battery status	Fuctional	Admin, Customer	Maintain the scooters	Check battery status of any E-Scooter	To find all empty E-Scooters to recharge them	Nader Cacace	Fits if the company could check the battery status of every E-Scooter to find the empty ones and charge them	5	5	Software on the E-Scooter	None		High	2	Done	As a customer I would like to know if the battery of the Scooter is sufficient so that I can decide if it has enought power to bring me to my destination. / As an Admin, I want to know the battery level of the Scooters to know which ones have to be collected by the Maintenanceman and recharge them.

ID	Name	Requirement Type	Associated Roles	Event/ use case #	Description	Rationale	Source	Fit Criterion	Customer Satisfaction	Customer Dissatisfaction	Dependencies	Conflicts	Supporting Materials	Priority	Estimation	Status	User Story
43	Add E-Scooter to the System	Functional	Maintenanceman	Add E-Scooter to System	If a new E-Scooter arrives, the stock has to be updated and the number of avalible E-Scooters has to be increased	To keep an overview about available E-Scooters	Nader Cacace	Fits if the maintenance database got an update (+1)	2	2	QR Code Generation	None		High	3	Done	As a Maintenanceman I like to add a new Scooters to the system to administrate the amount of available Scooter for the rental service.
44	Delete E-Scooter from System	Functional	Admin	Delete E-Scooter from System	If an E-Scooter is not longer in use, the stock should be updated (decreasing the number of avalible E-Scooters)	To keep an overview about available E-Scooters	Nader Cacace	Fits if the maintenance database got an update (-1)	2	2		None		Medium	3	Done	As an Admin, I need to delete an old or broken Scooter from the system to maintain the system and clean up the database.
45	Easy to use	Non-Functional	Customer	App handling	The complete UI design should suggest an easy and logical operation of the App	Every customer should be able to understand every part of the App and be able to use it	Nader Cacace Svetozar Stojanovic	Fits if the customer uses the app with full understanding	5	1	App installed	None		Medium		Done	As a customer I would like to have an App that is easy to understand and easy to use
46	Reliable	Non-Functional	Customer	App handling	The service should work anywhere and anytime	In order to keep the customer's satisfaction high, the App should work as reliable as possible	Nader Cacace	Fits if the customer can be sure that the service works in a comprehensive way	5	5	Register, Log-in	None		High		Done	As a customer I want an Application which is as reliable as possible.
47	App Language	Non-Functional	Customer	Choose Language	Languages we want to display for the customer in our App: English, German	The language variety is important to attract new Csustomers for our Service, the more language options we have, the more Csutomer we would attract	Steffen Hanzlik	Fits if the customer sees the language on the Application Screen	5	5	Register, Log-in	None		Medium	5	Done	As a customer I would like to be able to change the App language.
48	Get the amount of E-Scooters in System	Functional	Maintainanceman	Maintain the scooters	Shows the amount of E-Scooters in the system	To check if there is a need for new E-Scooters and if so to purchase them	Nader Cacace	Fits if the Maintenanceman/ Admin can see the number of avalible E-Scooters (In Use, Charging, under repair, etc.)	4	4	Database with information about all E-Scooters	None		Medium	2	Done	As a Maintenanceman/ Admin I would like to see the amount of all E-Scooters in the system and to check if there is a need for new E-Scooters

TODO: AUF DIE WOCHEN VERTEILEN, AUSFORMULIEREN, BEGRÜN-
DEN WIESO DIESE MODDELIIERT WURDEN UND DAZU SCHREIBEN
WER DARAN GEARBEITET HAT UND WELCHE PROBLEME ES GAB
UND WIE SIE GELÖST WURDEN UND WIESO SIE AUF DIESE ART
UND WEISE SIE GELÖST WURDEN!!!

- Activity Diagrams:

- Check-in E-Scooter

- Check-out E-Scooter

- Give Feedback

- Log-in

- Log-out

- Manage Account

- Pay the Service

- Register

- Report problems with the Scooter

- Sequence Diagrams:

- Check-in E-Scooter

- Check-out E-Scooter

- Add E-Scooter to System

- Find an E-Scooter on the Map

- Pay the Service

- Reserve an E-Scooter

- Regsiter

- Report Problems with the Scooter

- Wallet Management

- UI Protypes:

- Start Menu

- Scan QR Code

- Drving

- Menu Dropdown

- Account Management

- Change Account Details

- Payment Information

- Payment Methods

- Payment Methods: Credit/Debit Card

- Payment Method: Wallet

- Check Drive Statistics

- Check Spent Money

- Other

- Ask for feedback

- Register/ Sign Up

- Log-in

- Loading Screen

5   Week One

In the first week a few of our team members rented an E-Scooter from the company "Lime" to gain a better understanding of the process of renting an E-Scooter. That really helped us to find additional requirements for our E-Scooter rental service project. As we already mentioned before, we collected those requirements in a Google Sheets document. That way we could easily collaborate on them, even if we sometimes could not meet at the same location. We also started to talk about the requirements' estimations, satisfactions conditions, priorities, and fit criteria.

The estimation of the effort required to complete the backlog items, was difficult for our team, since we were all inexperienced in that regard. That's why we decided to play "Planning Poker", which is "[. . .] a consensus-based estimating technique. Agile teams around the world use Planning Poker to estimate their product backlogs. Planning Poker can be used with story points, ideal days, or any other estimating unit." [9] This proved to be very helpful and was also a lot of fun for our team.

We mostly spent the rest of the week with the collection of more requirements for the project.

Because finding dates for further meetings turned out to be difficult, we decided to hold our meetings weekly instead of daily and whenever there would occur any problems which needed to be discussed, via "Discord". Discord is an "All-in-one voice and text chat [. . .] that's free, secure, and works on both your desktop and phone."[10]

5.1   Division of Work: Week One

K. Birringer	N. Cacace	S. Hanzlik	M. Peluso	S. Stojanovic
%	%	%	%	%

6   Week Two

Since we decided to use the agile method Scrum for analyzing the E-Scooter rental service project, the team members were assigned the following roles:

- Scrum Master: Kendra Birringer

  As Scrum Master she was responsible for the organization of the whole team: she organized and moderated the team meetings and wrote the protocols.

  Another task was to check and correct the spelling, grammar and contents of everything that was written.

- Development Team: Nader Cacace, Steffen Hanzlik,
  Svetozar Stojanovic

  The Development Team was responsible for modeling all neccessary UML diagrams and sketching UI prototypes.

- Tester: Marco Peluso

  The Tester mainly reviewed, documented and accepted the resulting artifacts.

In the second week the team discussed each of the collected requirements, and we decided which of them fit and which are not necessary for the software. During this discussion we gathered more requirements.

Then we started to talk about the UML diagrams and built a first use case diagram which was too big and complex and needed some adjustments. So, the task for the Development Team was to simplify the diagram and make it clearer.

Also, we built a main structure for the documentation of the project and started writing the documentation with LaTex.

6.1 Division of Work: Week Two

K. Birringer	N. Cacace	S. Hanzlik	M. Peluso	S. Stojanovic
%	%	%	%	%

7 Week Three

In week three the Development Team modified the use case diagram which was too big. They also modeled further use case diagrams which we then discussed, to find out if they needed further adjustments. At the end of this week, we finished the use case diagrams and finally added the use case documentation to each use case.

Also, after we thought about where it could be necessary, some activity and sequence diagrams were modeled.

Regarding the sequence diagrams there were some problems. For example, the "Check-in" diagram:

We asked ourselves how to calculate the price for a ride. After some discussion we decided to let the wallet calculate the price for the ride information from the Scooter. First, the payment also was included in this diagram, but after reconsidering, we decided that the payment also needed its own, more detailed diagram.

Considering the activity diagrams, we decided to not model a diagram for "Give feedback", because it seemed too simple.

Then we started to think about the class diagram and asked ourselves which classes we needed and which relations the different classes could have to each other and started modeling the class diagram.

Furthermore, a first UI prototype was built with the software design tool "Axure".[4]

7.1 Division of Work: Week Three

K. Birringer	N. Cacace	S. Hanzlik	M. Peluso	S. Stojanovic
%	%	%	%	%

8 Week Four

During week four we refined the state of the project by doing a lot of adjustments and modifications to everything we had done so far. We updated the requirements, checked spelling and grammar, put the requirements in a proper order and checked what was still missing.

On the basis of the backlog items list we finished all UML diagrams and UI prototypes. After we heard the lecture, in which Prof. Dr.-Ing Peter Thoma talked about UML diagrams, we noticed, that all our activity diagrams lacked a cancelation mode. Therefore, we had to adjust all these diagrams and add a cancelation mode to them.

We also finished most of the documentation, so that almost only the appendices needed to be added.

The goal of our team was, to finish everything until the end of this week, so that in the following week, we would be able to fully concentrate on the presentation of the project.

8.1 Division of Work: Week Four

K. Birringer	N. Cacace	S. Hanzlik	M. Peluso	S. Stojanovic
%	%	%	%	%

9 Week Five

In week five, we checked everything again and finished everything. We generated the report from MagicDraw and added it to the documentation. Also, we added all protocols from the team meetings.

Then we thought about a way, how to integrate the UI prototypes. We decided to screenshot each prototype and added them as an appendix to the documentation of the project.

Once the documentation was finished, each team member proofread it again and made any necessary improvements, corrections and additions.

Then, finally we started to talk about the presentation and started to build it.

9.1 Division of Work: Week Five

K. Birringer	N. Cacace	S. Hanzlik	M. Peluso	S. Stojanovic
%	%	%	%	%

10 Appendix

10.1 MagicDraw Report

TODO: INSERT MAGICDRAW REPORT HERE!

10.2 UI Prototypes
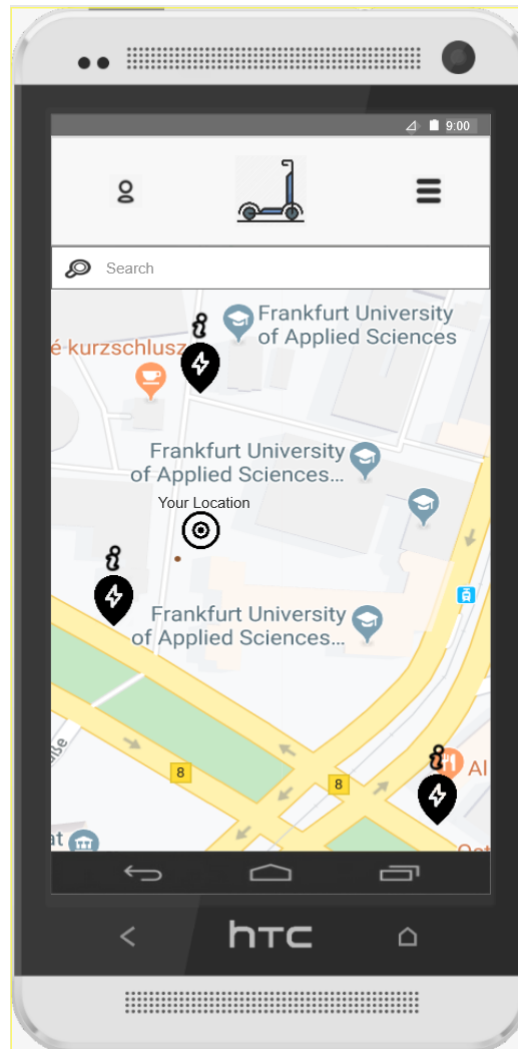
Figure 2: Start Menu
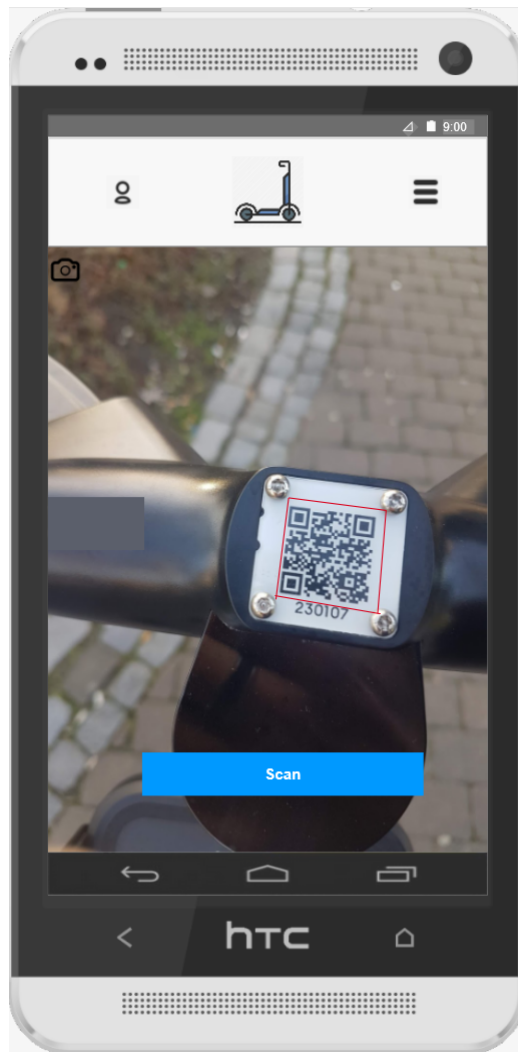
Figure 3: Start Menu → Scan QR-Code
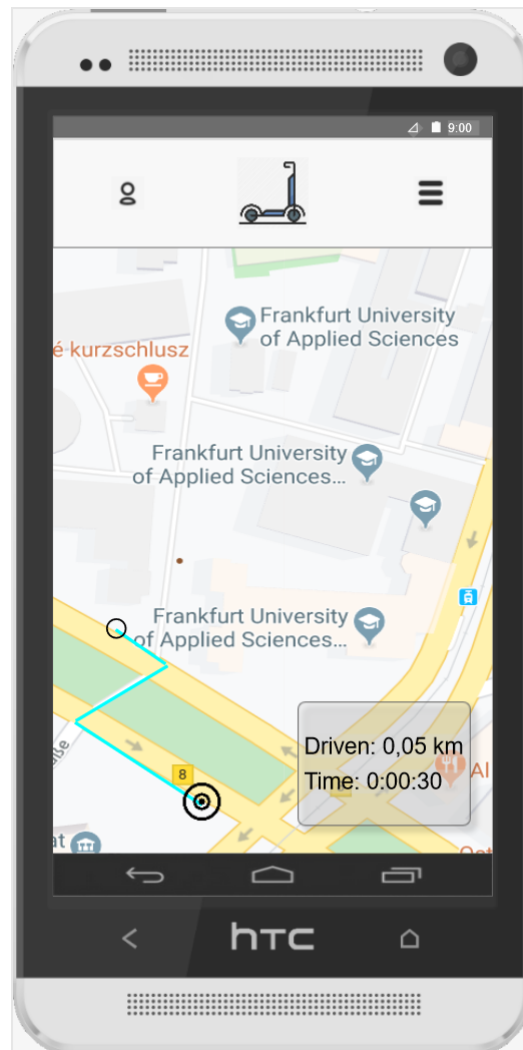
Figure 4: Start Menu → Driving
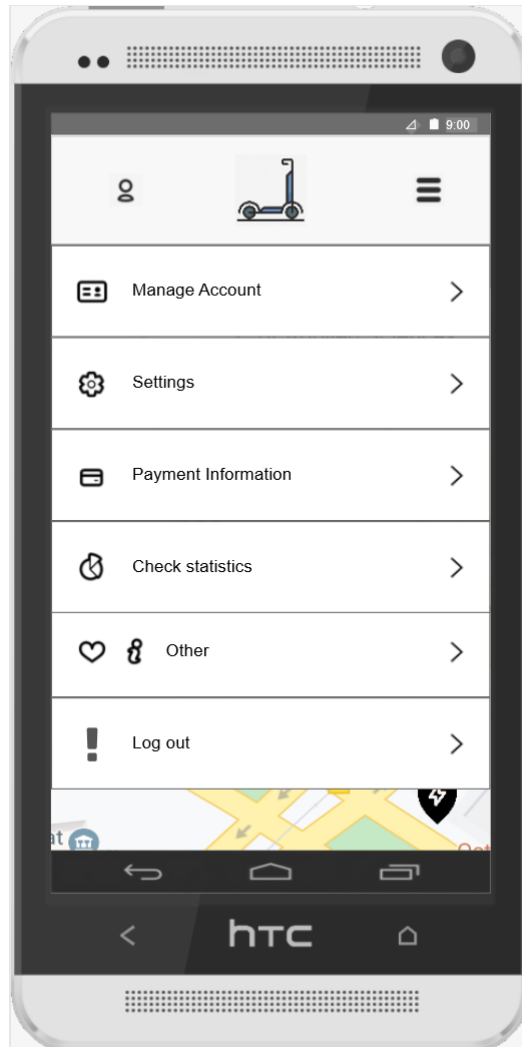
Figure 5: Menu Dropdown
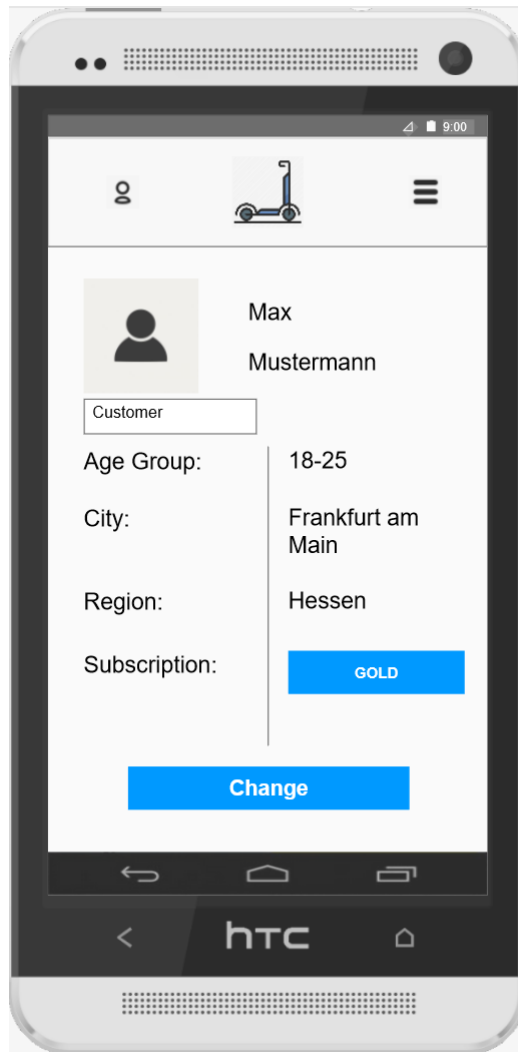
Figure 6: Menu Dropdown → Account Management
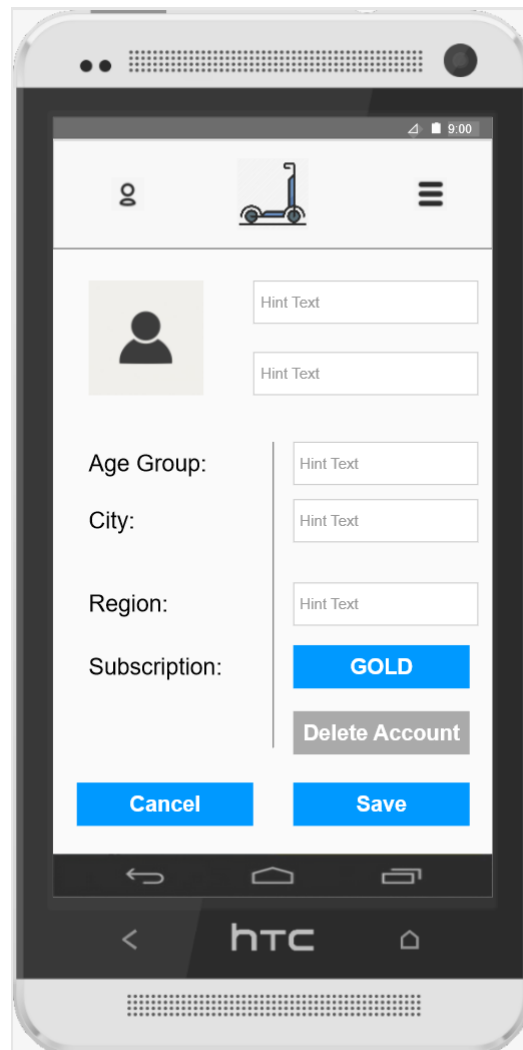
Figure 7: Menu Dropdown → Account Management → Change Account Details
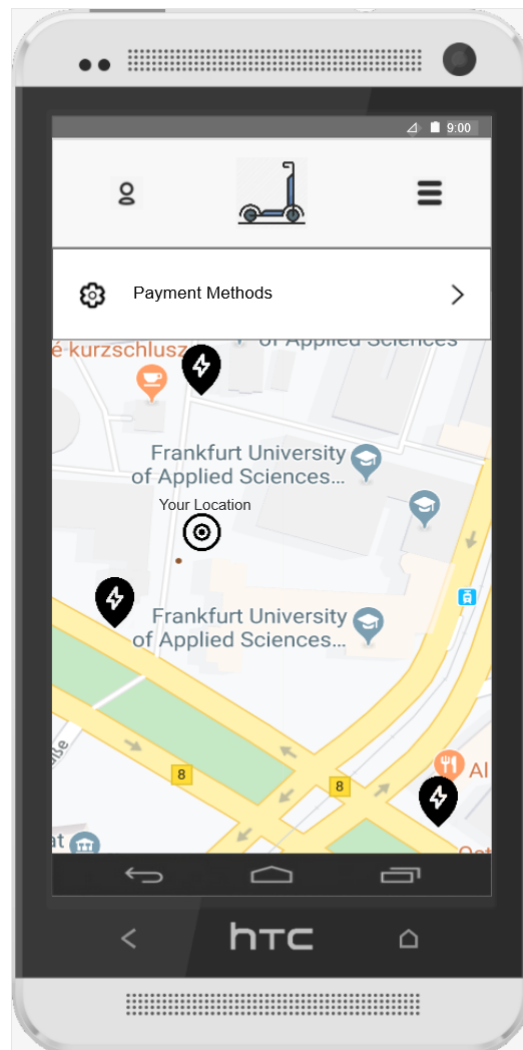
Figure 8: Menu Dropdown → Payment Information
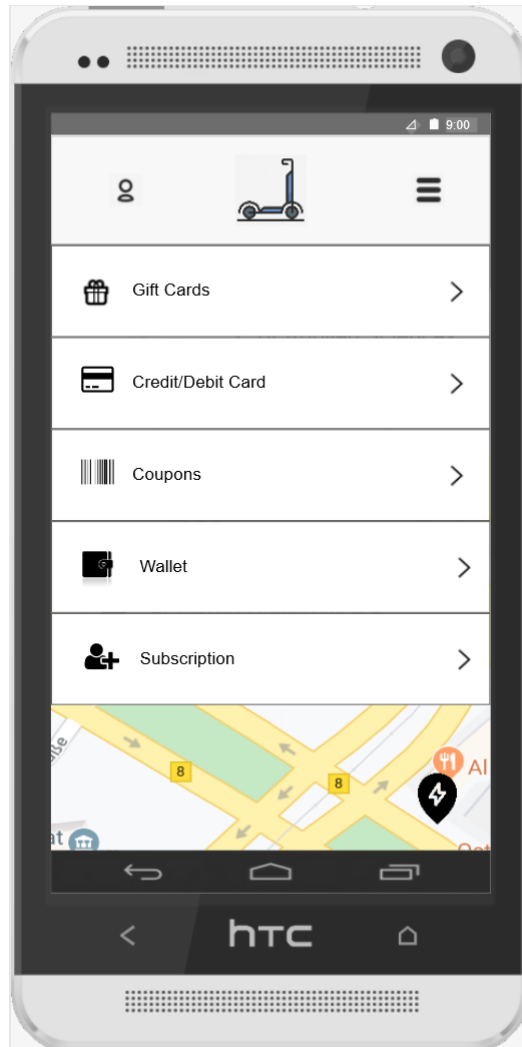
Figure 9: Menu Dropdown → Payment Information → Payment Methods
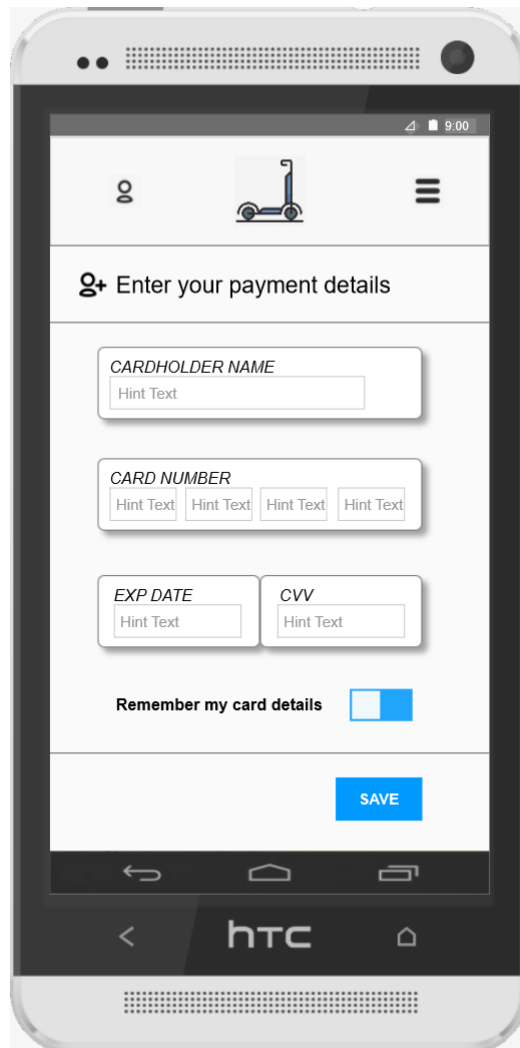
Figure 10: Menu Dropdown → Payment Information → Payment Methods → Credit/Debit Card
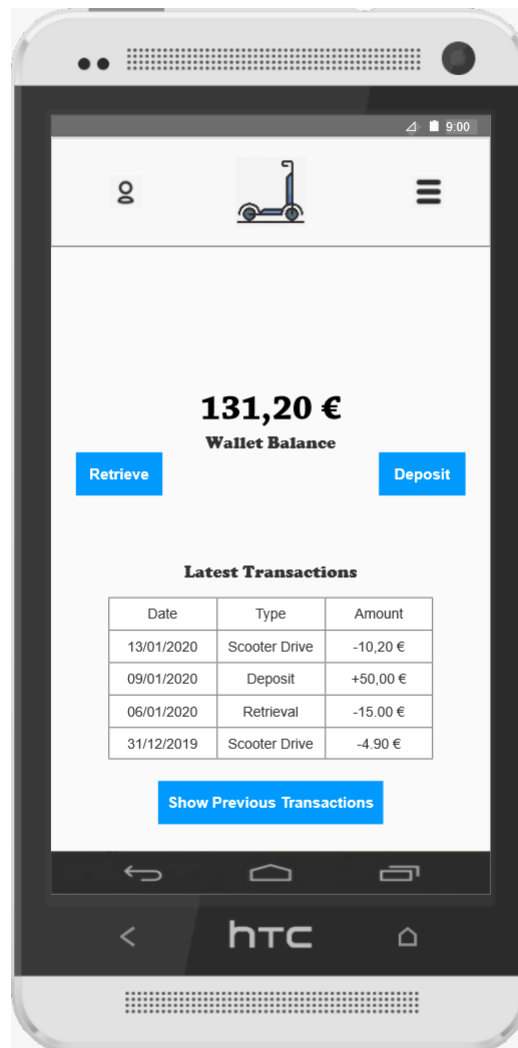
Figure 11: Menu Dropdown → Payment Information → Payment Methods → Wallet

Figure 12: Menu Dropdown → Check Drive Statistics
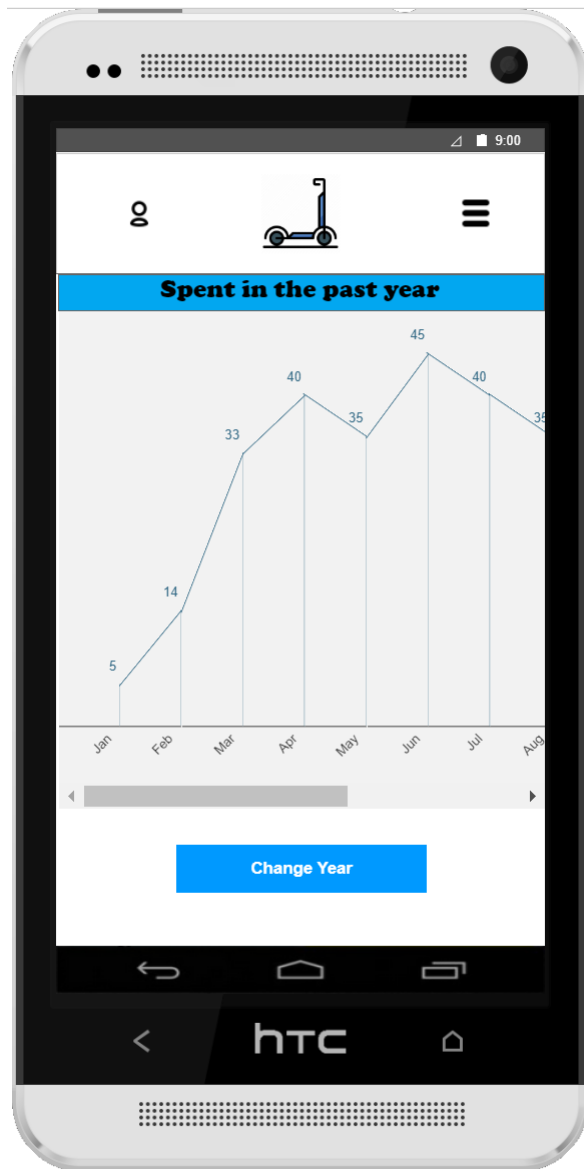
Figure 13: Menu Dropdown → Check Spent Money
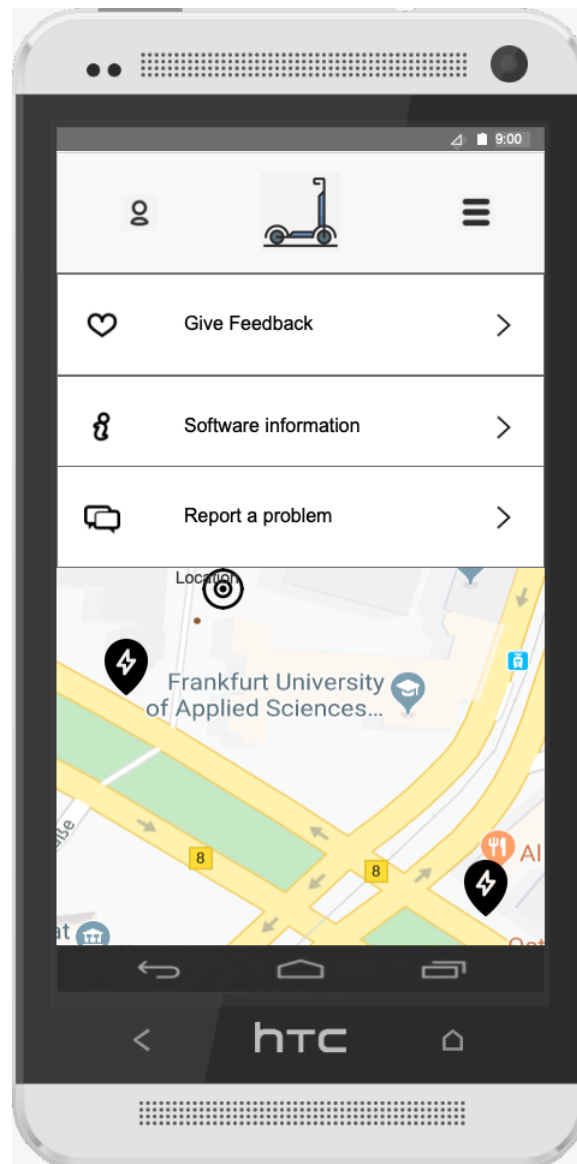
Figure 14: Menu Dropdown → Other
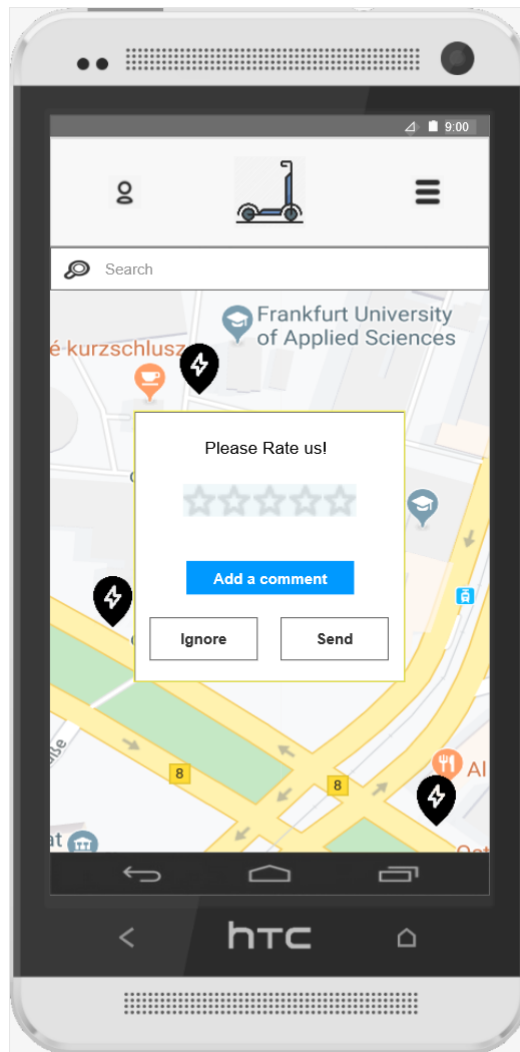
Figure 15: Ask for Feedback
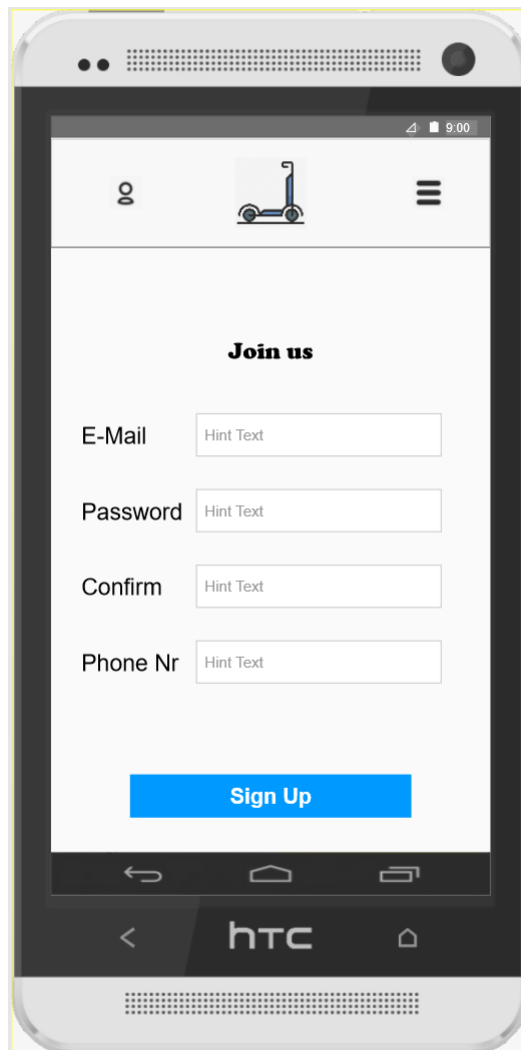
Figure 16: Register/Sign Up
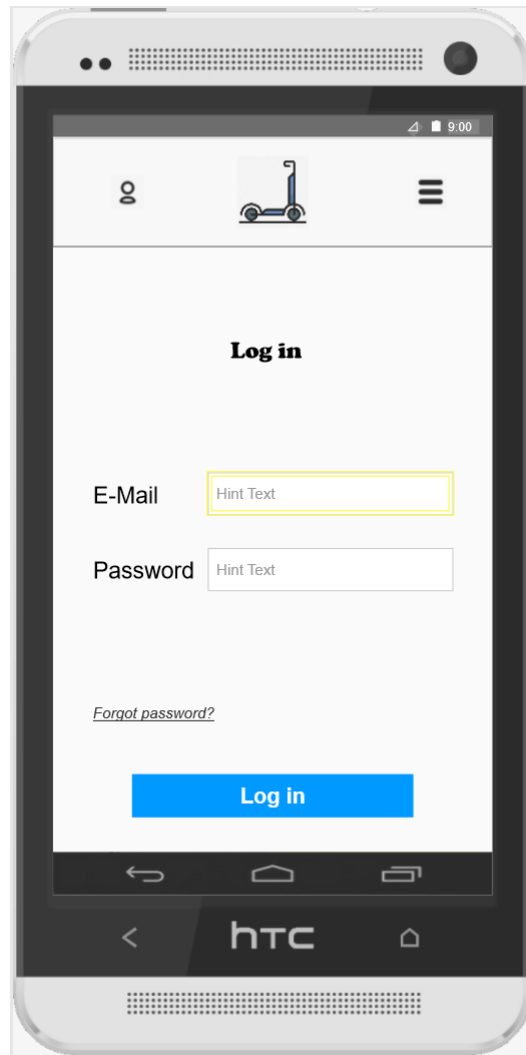
Figure 17: Log in
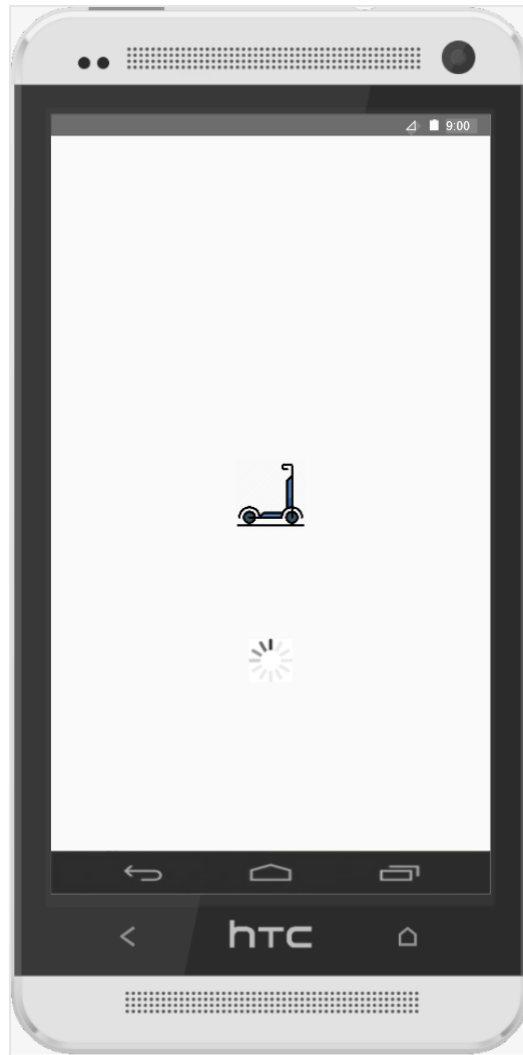
Figure 18: Loading Screen

10.3 Meeting Protocols

TODO: INSERT PROTOCOLS HERE!

List of Figures

References

[1] https://www.scrum.org/resources/what-is-scrum

[2] https://www.omg.org/spec/UML/

[3] https://www.nomagic.com/products/magicdraw

[4] https://www.axure.com/

[5] Prof. Dr.-Ing Peter Thoma *05 Software Engineering Analysis (Software Models and UML)*

[6] https://www.scrumguides.org/scrum-guide.html

[7] Prof. Dr.-Ing Peter Thoma *02-3 Software Engineering Analysis (Scrum)*

[8] http://www11.informatik.uni-erlangen.de/Lehre/SS2015/PR-SWE/Material/volere-template.pdf

[9] https://www.mountaingoatsoftware.com/agile/planning-poker

[10] https://discordapp.com/