# NeoCharge:
# Software Requirements Specification
# version 2.0

The Juicerz
*Computer Science Department*
*California Polytechnic State University*
*San Luis Obispo, CA USA*

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# Contents

# Credits

| Name | Date | Role | Version |
|------|------|------|---------|
| Joshua Boe | October 23, 2019 | | 2.0 |
| Lauren Hibbs | October 23, 2019 | | 2.0 |
| Casey Daly | October 23, 2019 | | 2.0 |
| Pranathi Guntupalli | October 23, 2019 | | 2.0 |
| Hannah Kwan | October 23, 2019 | | 2.0 |

# Revision History

| Name | Date | Reason for Changes | Version |
|------|------|--------------------|---------|
| Team | October 9, 2019 | Initial version | 1.0 |
| Team | October 23, 2019 | Added additional information to complete all sections | 2.0 |
| | | | |
| | | | |

# 1  Introduction

## 1.1  Purpose

NeoCharge is a smart splitter designed to increase the availability of electric vehicle charging at home. Unlike other charging devices, Neocharge works with the 220V dryer outlet already present in most homes, so that an electrician is not needed to install a dedicated outlet. Currently, the vehicle is charged whenever it is plugged in. Some competitors to this product plug into the dryer socket, but are not 'smart', meaning the dryer cannot run at the same time the car is charging. Other competitors have similar charging apps but require an electrician to be installed. Neocharge is the only device which utilizes the dryer socket in an intelligent way and will come with an app that integrates with the charger.

## 1.2  Document Conventions

The conventions for this document are as follows :

- Important terms are defined in the glossary at the end of the document.

## 1.3  Intended Audience and Reading Suggestions

### 1.3.1  Developers

Developers should reference this document to guide the implementation of the application. The use cases and functional and nonfunctional requirements are especially important.
Suggested reading order :

- Product Perspective and Features
- Use Cases
- External Interface Requirements
- System Features
- Nonfunctional Requirements

### 1.3.2  Users

Although this document is not designed for users, they can use this document to understand the features that the app provides.
Suggested reading order :

- Purpose
- Overall Description

### 1.3.3   Customers : Akhil Veluru, Spencer Harrison

Akhil Verluru, CTO of NeoCharge, and Spencer Harrison, CEO of NeoCharge, will use this document to ensure that the development team understands the end product and has an appropriate vision about development work and releases.

Suggested reading order :

- Overall Description
- Use Cases
- External Interface Requirements
- System Features
- Nonfunctional Requirements

### 1.3.4   Supervisor : David Janzen

Dr. Janzen will review this document to ensure that the project meets the specifications required for the class. He will also review this document to ensure he is aware of major changes to the vision or scope of the project.

Suggested reading order :

- Overall Description
- External Interface Requirements
- System Features

## 1.4   Project Scope

The goal of this project is to create a cross-platform app for NeoCharge beta users to use with their NeoCharge device. The app allows users to schedule charging times and is focused on reporting green energy usage. As the app is being built for beta testers, the features the app includes will be subject to change based on user feedback.

## 1.5   References

Other design documents:

*Vision and Scope* : https://www.overleaf.com/read/xgpzxwpqjvff

# 2   Overall Description

## 2.1   Product Perspective

For EV (electric vehicle) owners, charging their vehicle comprises a significant part of their EV ownership experience. NeoCharge helps alleviate some of the overall cost for EV owners, creates a charge with less impact on the environment, and provides a simple and non-costly setup. Currently, NeoCharge only provides their customers with charging hardware that begins charging the car immediately after being plugged in. Our mobile application will give owners of NeoCharge EV chargers more insight into and control over the charging process. We want users of NeoCharge products to be able to control and view their products without needing to be anywhere near the hardware they have purchased.

## 2.2   Product Features

All of the major features that will be implemented into the NeoCharge app will fall into two basic categories, those that give the user insight into the charging process, and those that control and schedule charging sessions. Insight into the charging process will include features that will let the user view their charging history (including recently paid prices), their power usages, and how green their usage of power was. It will also have features that allow for viewing the status of current charging sessions. In addition, users can add their vehicles to the application which will give them more accurate information about how the charging process is going. In terms of control over the charging session, users will be able to schedule charging sessions through the server and set limits on when they would want to charge, whether this be by cost or by time of day. Users will also have the option to start a charging session right away from the application. All communication from the application to both the database and the hardware will be handled through the server, as is shown in the diagram below.
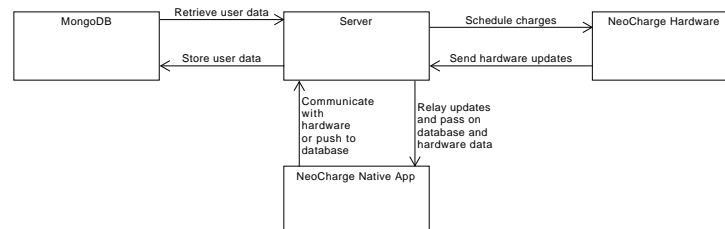


Figure 1: NeoCharge Data Flow Diagram

## 2.3   User Personas

**Jonathan Sinclair**

Age: 28
Author: Casey

Jonathan is a young software developer in San Francisco, who lives with his girlfriend of two years. Jonathan loves to immerse himself in nature, whether it be hiking, biking, or his new favorite hobby: kayaking in the San Francisco Bay. He has noticed more and more on these excursions the amount of pollution and trash there is on the coast and has decided to start volunteering for beach clean ups. Even though he already owns a Tesla due to his high paying salary, Jonathan loves to find new ways to be more environmentally conscious.

One problem he has been reading into recently is the fact that electric vehicles like his own are not always as green as they are made out to be. For example, if the electricity that charged the car was generated through non-renewable energy sources, it would not be as good for the environment as using energy produced from solar panels. As he does not know exactly where the power to his house comes from, he doesn't know if his car charging is as green as it should be.

Jonathan has done a lot of research into how he might be able to find where his energy comes from, but to little avail. He found out that the EPA provides certain tools to do this, but they are difficult to use and not always accurate. He wishes there was some way to easily see where the energy he uses to charge his Tesla comes from. If he found out his energy usage was green, he could put his mind at ease. If he found out it was not, he could try to receive his power from a greener source.

**John Miller**

Age: 25
Author: Pranathi

John recently completed 3 years of working as a software engineer at Apple. John is extremely invested in the environment and has been taking public transportation to get to work. Taking BART adds an extra 45 minutes to John's commute each morning, but John feels morally conflicted about buying a car due to the fact that carbon emissions negatively impact the environment.

Recently, John has been needing to go to work extremely early because his new project involves talking to a team in Europe. John decides that public transportation adds too much extra time to his commute and decides to buy an electric vehicle.

John spends the money he has been saving for the past few years to buy a Tesla. Initially, John planned on charging his Tesla through the standard 110v plug that already

exists in his home, utilizing the free adapter that comes with the car. Quickly, John realizes that it takes up to 4 days to fully recharge an empty Tesla car battery using the regular wall outlet and realizes that he needs his car every day and the standard outlet is too slow. Because he spent all his savings on attaining the car, John cannot afford to hire an electrician to install a specific wall connector for his Tesla. John is now looking for alternative, cheaper ways to charge his new vehicle.

**Ye Wenjie**

Age: 32
Author: Lauren

Ye Wenjie is a single mother who is a manager at a department store in Orange County. Her schedule is very busy. Before having her daughter, Ye would take public transportation to her job. It would take up to 45 minutes per commute, but she has little money and has less now that she has a new child. Ye lives close to her mother and grandmother who are happy to help care for her new child. However, Ye's family lives on the other side of the city from her job. After a few months, she decides to move in with her parents and face a commute of over an hour and a half a day. But as a hard worker, Ye isn't satisfied. Ye decides she would like to go to school so that she can get a higher paying job, in order to better provide for her daughter. A family friend offers to sell her a used Toyota Prius at a discount. Ye doesn't know much about electric cars but she jumps on the offer to have a cheap car.

Since Ye's family rents, she needs to find a way that she can quickly and easily install a car charger without hiring an electrician. Ye is not interested in the environmental savings of an electric vehicle. She is mostly looking for transportation as cheaply as possible. Additionally, Ye shares this car with her family members. She does not come home every night on a regular schedule, and sometimes the car does not have long to charge before it is needed again.

**Phoebe Hunter**

Age: 35
Author: Hannah

Phoebe is a lawyer who lives in Newport Beach with her husband, Todd. Phoebe practices business law and Todd is a finance manager. They like to be eco-friendly. They recently installed solar panels on their house and they tried to buy energy-efficient appliances when they moved into their home. Their friends have had a Tesla for a while, and Phoebe and her husband liked the luxury and its use of clean energy.

Recently, they purchased two Tesla Model S vehicles, and also hired an electrician to install an outlet for their electric vehicle charger. For the last few months, Phoebe and her husband have shared the electric vehicle charger, switching the charger between cars. Unfortunately, one night, they forgot to switch the charger and Phoebe did not have enough charge to get to work. Phoebe and her husband would have to pay thousands of dollars to get another charger installed. They are looking for a solution so that they can charge both of their cars at once.

### David Butler

Age: 66
Author: Joshua

David is a mechanical engineer who lives in Beaverton, Oregon alongside his wife of 43 years, Samantha. David and Samantha have three sons and one daughter, but all of whom dispersed throughout Oregon and California over 10 years ago. David works for Comcast Cable and assists in the planning, designing, integrating, testing, deploying and supporting of Comcast's X1 TV Box product. He considers himself a tech-savvy person and enjoys keeping up to date on the market's newest technologies.

David has always been fascinated by the autopilot technologies many electric cars have to offer, but it was not until recently that he and Samantha decided to sell David's current car and purchase one of their own. After ample research and comparing different companies and models, David and Samantha were most impressed with the value of the Tesla Model 3 and so they decided they would like to purchase one. Before making the purchase, they were researching the requirements of installing a charging outlet when they stumbled upon the NeoCharge website.

David and Samantha are now trying to determine whether the NeoCharge product would be a good fit for them. They have a water heater in their garage connected to a 220V outlet, so it is a viable option. They like the idea of a charger that is coupled with a mobile app for simple, remote scheduling maintenance. The Tesla will primarily be driven by David, since it is replacing his current car and Samantha has a nice car of her own. However, Samantha would sometimes like to drive it in order to cut down on fuel costs and emissions. David and Samantha would like if they could connect both of their phones to the same charger and each have the ability to receive notifications and adjust charger scheduling.

## 2.4 User Classes and Characteristics

| User Class | Description |
|---|---|
| Dedicated User | The dedicated user will take full advantage of all the services that our product offers. They will get much more use out of scheduling charges and making sure that they schedule charging sessions at optimal times, which will save them money. |
| Casual User | The casual user will mainly be using the app to start charging sessions immediately. Minor differences in charging price based on time of day are not big concerns to the casual user. The casual user would simply like a quick and easy way to start a charging session immediately. Occasionally, the casual user might check in on how much power they have been using and money they have been spending, but will not be using the scheduling functionality as much as the dedicated user. |

## 2.5 Operating Environment

As the end goal is to create a mobile application, this software will be operating on a mobile device. It will be run in both Android and iOS environments and requires the user to possess a NeoCharge charging device, as most of the data displayed in the app will come from the charger through the server.

## 2.6 Design and Implementation Constraints

Developers will be using a cross platform development environment throughout the development process. Because the NeoCharge hardware has limited RAM and direct communications between the hardware and app would be overly-complicated, developers will be interacting with the hardware through a server-hosted database. This server will serve as an interface to all communication from the mobile application to the charger hardware. All communication from the server to the hardware is out of the scope of this project, and the development will center around only communication between the mobile application and the server (see Figure 1 above for data flow visual).

## 2.7 User Documentation

Near the end of development, one of the last features to be implemented will be the user tutorial. This user tutorial will take first time users through the experience of using the mobile application. There will also be a reference to the mobile application and a brief

description of its features in the user manual that comes with the NeoCharge charger hardware.

## 2.8   Assumptions and Dependencies

One assumed factor for the development of this product is the correct functioning of the NeoCharge hardware. The accuracy and quality of our software will be very dependent on the ability of the hardware to give correct and reliable status updates to the server. In addition, the assumption that the user enters in accurate mileage is critical to notifying them the status of their charging session. If they enter incorrect data into the application, then the bad input will produce inaccurate output back to the user.

## 2.9   Business Rules

Some variables in the business domain that might have to be accounted for include using the WattTime API and varying power prices for users. Regarding the WattTime API, this is how the NeoCharge mobile application would be able to calculate green energy usage, but the caveat is that it requires a subscription. The use of it then might require users of the app to be charged for this functionality. In terms of the varying power prices for users, power will cost different prices depending on the area, time of day, and time of year. The application must be able to deal with changing prices and reflect these changes easily to the users.

# 3 Use Cases

## 3.1 Use Case 1: View Power Usage

| | |
|---|---|
| Use Case ID: | 1 |
| Use Case Name: | View Power Usage |
| Created By: | Casey Daly |
| Last Updated By: | Casey Daly |
| Date Created: | October 6, 2019 |
| Date Last Updated: | October 23, 2019 |
| Actors: | User |
| Description: | A user accesses the NeoCharge application from their mobile device. They navigate to the Power Usage page, select the time period which they would like to view power usage over, and then the user can view how much power their electric vehicle has been using by kWh or by USD for that time period. |
| Preconditions: | 1. User has downloaded the NeoCharge mobile application.<br>2. User has set up their NeoCharge mobile application with their charger. |
| Postconditions: | 1. User has knowledge of how much power, or money, their electric vehicle has used to charge over the period of time chosen. |
| Normal Flow: | 1.0 View Power Usage in kWh<br><br>1. User navigates to the power usage tab.<br>2. System displays an initial graphical representation of the users power usage for the last week in kWh.<br>3. User optionally selects a different period of time to view their power usage.<br>4. System displays updated graphical representation with new period of time.<br>5. User optionally selects a different graphical representation of the power usage.<br>6. System displays updated, new graphical representation of the data.<br>7. User can adjust graph's settings and scales to better picture the data being viewed. |
| Alternative Flows: | 1.1 View Power Usage in USD (after step 2) |

|  |  |
|---|---|
|  | 1. User selects option to display power usage in USD as opposed to kWh |
|  | 2. System reflects this change in the data being displayed. |
|  | 3. Return to step 3. |
| Exceptions: | 1.0.E.1 Time period selected is longer than user has owned NeoCharge charger (at step 3) |
|  | 1. System chooses longest period of time possible to user that is less than the period of time requested. |
|  | 2. System displays power usage metrics for this period of time. |
| Includes: | None |
| Priority: | High |
| Frequency of Use: | Approximately 100 users, average of 3 uses per week |
| Business Rules: | If we decide to use WattTime's API, we will also be able to provide graphics on clean energy usage. |
| Special Requirements: | 1. User shall be able to change time intervals and types of data (USD and kWh). (Priority = medium) |
| Assumptions: | User has used the charger and has data to be displayed. |
| Notes and Issues: | 1. The default time range is the last week's worth of data, and the default graph displayed is a line graph. |
|  | 2. If user doesn't have any data to be displayed then a message will appear to the user stating such. |

## 3.2   Use Case 2: Schedule Charge Session

|  |  |
|---|---|
| Use Case ID: | 2 |
| Use Case Name: | Schedule Charge Session |
| Created By: | Pranathi Guntupalli |
| Last Updated By: | Pranathi Guntupalli |
| Date Created: | October 7, 2019 |
| Date Last Updated: | October 23, 2019 |
| Actors: | User |

| | |
|---|---|
| Description: | A user accesses the NeoCharge application from their mobile device. The user navigates to the Schedule Charge page in order to schedule a charge session by inputting start and end times and the days of the week the charge should take place. The car will start charging at the specified times automatically. |
| Preconditions: | 1. User has downloaded the NeoCharge mobile application.<br>2. User has set up their NeoCharge mobile application with their charger. |
| Postconditions: | 1. User will have a vehicle that has been charged during the specified times. |
| Normal Flow: | 1.0 Schedule a Charging Session<br><br>1. User navigates to the schedule charge tab.<br>2. User taps '+' icon to schedule a new charge time.<br>3. System displays boxes to enter start and end times and a repeat option for scheduling the charging time as 'daily,' 'weekly,' 'monthly,' or 'custom.' Also, days and times are color coded to display the most and least cost effective times.<br>4. User selects a start time, end time, and the repeat option for the charging period.<br>5. System displays the selected time period in order to get a confirmation from the user.<br>6. User can optionally adjust the times presented and confirm the selected schedule by clicking 'save.'<br>7. System sends the information to the server and the charge will start automatically at the specified time.<br>8. User is returned to the default page of the schedule charge tab and can view their newly scheduled charge.<br>9. System notifies the user when the charge session begins.<br>10. System notifies the user when the charge session ends. |
| Alternative Flows: | 1.1 User decides to cancel while scheduling a charge (branch at any point during steps 3-6) |

|  |  |
|---:|:---|
|  | 1. User taps the 'cancel' button. |
|  | 2. User is returned to the default page of the schedule charge tab. |
| Exceptions: | 1.0.E.1 Scheduled charging session unable to start because user did not connect the charger to the vehicle (at step 9)<br>1. System notifies the user that the charging session will not begin until the user connects the car with the charger.<br>2. User connects the charger to the car correctly.<br>3. System notifies the user that the charge session is in progress. |
| Includes: | None |
| Priority: | High |
| Frequency of Use: | Approximately 100 users, average of one usage per day |
| Business Rules: | TBD |
| Special Requirements: | 1. User shall be able to cancel the charging session at any time. (Priority = medium)<br>2. User shall be able to view history of previous charging sessions scheduled. (Priority = low)<br>3. System shall notify the user if scheduled charge session is disrupted for any reason. (Priority = high) |
| Assumptions: | None |
| Notes and Issues: | 1. If scheduled charge session is modified while car is actively being charged, how will the system react? |

## 3.3   Use Case 3: Adjust Settings

|  |  |
|---:|:---|
| Use Case ID: | 3 |
| Use Case Name: | View/Adjust Settings |
| Created By: | Joshua Boe |
| Last Updated By: | Joshua Boe |
| Date Created: | October 8, 2019 |
| Date Last Updated: | October 23, 2019 |
| Actors: | User, NeoCharge Device |

| | |
|---|---|
| Description: | A User navigates to the Settings page within the NeoCharge mobile application, views the settings currently in place (cost/kWh of their area, WattTime API settings and notification settings), and makes any preferred adjustments to them. |
| Preconditions: | 1. User has downloaded the NeoCharge mobile application.<br>2. User has associated their NeoCharge mobile application with a NeoCharge charger. |
| Postconditions: | 1. Changes to the settings are saved within the app and persist until edited again.<br>2. Changes to the the settings are immediately reflected on the displayed Settings page.<br>3. Edits to settings are written into a JSON (or other standard) format and delivered to database over REST request for use by the NeoCharge charger. |
| Normal Flow: | 1.0 View Settings<br><br>1. User taps the gear icon to navigate to the settings page.<br>2. App displays the settings page with a list of categories (cost, Notifications, and possibly WattTime).<br>3. User selects category of settings they would like to view by tapping it.<br>4. App displays various adjustable settings for the selected category with the values they are currently set at. |
| Alternative Flows: | 1.1 Adjust Setting(s) (branch after step 4) |

|  | 1. User taps a setting they would like to edit.<br>2. App toggles the setting to be enabled/disabled or gives a list of options for the user to select from.<br>3. Repeat the previous 2 steps for as many settings as the user would like to change.<br>4. User taps "Apply Changes" button to save the current settings state.<br>5. App writes the setting changes into a JSON (or other standard) format.<br>6. App sends the setting changes over REST request to a server to be read and used by the user's NeoCharge charger in real time. |
|---:|:---|
| Exceptions: | 1.0.E.1 Server is down (at 1.1 step 6)<br>1. App informs User that connection to the server was not reached and the settings changes won't be sent and take effect until a connection can be established.<br>2. App saves the settings data and continually tries to establish a connection.<br>3. App sends the most recent settings data as soon as a connection is established.<br><br>1.0.E.2 User has no internet connection (at 1.1 step 6)<br>1. Same procedure as 1.0.E.1. |
| Includes: | None |
| Priority: | High |
| Frequency of Use: | Approximately 100 users, average of less than one usage per day |
| Business Rules: | TBD |
| Special Requirements: | 1. None |
| Assumptions: | None |
| Notes and Issues: | 1. The user must click "Apply Changes" button for any setting edits to be written to the server and take effect.<br>2. What settings are available and their default values are still TBD.<br>3. If the server is down or the user's phone or charger does not have internet connection, setting changes will not take effect until a connection to the server can be established. |

## 3.4  Use Case 4: Receive Notifications

| | |
|---:|:---|
| Use Case ID: | 4 |
| Use Case Name: | Receive Notifications |
| Created By: | Hannah Kwan |
| Last Updated By: | Hannah Kwan |
| Date Created: | October 8, 2019 |
| Date Last Updated: | October 8, 2019 |
| Actors: | User |
| Description: | A user receives notifications to their device when charging is interrupted. |
| Preconditions: | 1. User has the NeoCharge application.<br>2. User registered their device with the NeoCharge application.<br>3. User has connected their phone and their device to Wifi.<br>4. User has notifications turned on for the NeoCharge application.<br>5. User has plugged their electric vehicle into the NeoCharge device. |
| Postconditions: | Notification is added to phone. |
| Normal Flow: | 1.0 Receives a notification that charging has stopped.<br><br>1. System receives feedback from device that charging has stopped.<br>2. System informs User that charging was interrupted.<br>3. User opens the NeoCharge application to view the cause of the interruption.<br>4. System displays a description of the issue.<br>5. User fixes the issue.<br>6. System notifies User when charging has resumed. |
| Alternative Flows: | 1.1 Interruption was caused by a incorrectly configured device (branch after step 4)<br><br>1. System displays instructions to reconfigure their device.<br>2. Return to step 5. |
| Exceptions: | 1.0.E.1 User is unable to fix the issue (at step 5)<br>5a. System informs User that vehicle is still not charging. |

|  | 5b. System restarts use case. |
| ---: | :--- |
| Includes: | None |
| Priority: | High |
| Frequency of Use: | Approximately 100 users, average of five usages per day |
| Business Rules: | TBD |
| Special Requirements: | None |
| Assumptions: | Assume User stays connected to Wifi. |
| Notes and Issues: | None |

## 3.5   Use Case 5: First time setup

| | |
| ---: | :--- |
| Use Case ID: | 5 |
| Use Case Name: | First time setup |
| Created By: | Lauren Hibbs |
| Last Updated By: | Lauren Hibbs |
| Date Created: | October 8, 2019 |
| Date Last Updated: | October 8, 2019 |
| Actors: | User, Phone, Neocharge device |
| Description: | A User with a Neocharge device and smartphone pairs the two devices using the device's serial number. After pairing, the user enters relevant car information for setup and the app displays a tutorial of how to use the device. |
| Preconditions: | 1. User has downloaded the Neocharge app. <br> 2. User has not yet registered a Neocharge device. |
| Postconditions: | 1. Neocharge application will automatically connect to the Neocharge device without setup. <br> 2. Neocharge application will have basic information about the User's car and configuration. <br> 3. User will have a basic understanding of how to use the Neocharge app. |
| Normal Flow: | 1.0 First time app setup |

| | |
|---|---|
| | 1. User opens the Neocharge app for the first time. <br> 2. App displays a page offering options to sign in or register a device. <br> 3. User selects 'register a device'. <br> 4. User is prompted to enter the device serial number, email, and create an account. <br> 5. System creates an account in on the server and checks that the device serial number has not been claimed. <br> 6. App displays when an account has been successfully made. <br> 7. User is prompted to enter car information such as make, model, and battery capacity. This information is persisted to the server. <br> 8. User is presented with an image demonstrating various features of the app. <br> 9. User can tap the right side of the screen to progress to the next screens of the tutorial. <br> 10. User finishes the tutorial. <br> 11. The home page of the app is displayed to the user. |
| Alternative Flows: | 1.1 Neocharge device number entered incorrectly (branch after step 5) <br><br> 1. System displays "This Neocharge device number is invalid or already activated. Please re-enter the number or contact support." <br> 2. Return to step 4. <br><br> 1.2 Enter information about multiple cars (after step 7) <br><br> 1. User clicks the option for "add multiple vehicles" on the setup screen and is prompted to enter more vehicle information. |
| Exceptions: | 1.0.E.1 Neocharge device number is invalid because it is already in use (at step 1) <br> 1. System checks database of claimed serial numbers and determines this serial number is already registered to an account. <br> 2. App informs user that only one account can be made per Neocharge device. <br> 3 . App prompts the user to login to an existing account or resend a password to the account email. |

| | |
|---:|:---|
| | 3a. System sends an email with a password reset link if requested. |
| | 4. User successfully logs in to account. |
| Includes: | None |
| Priority: | High |
| Frequency of Use: | Approximately 100 users, approximately one usage per device owned |
| Business Rules: | TBD |
| Special Requirements: | None |
| Assumptions: | Assume that the app is sufficiently complicated that a tutorial would be of benefit to users. |
| Notes and Issues: | 1. Peak usage load for new account creation and logins will be when the product is first released. |

# 4 System Features

## 4.1 Scheduling

### 4.1.1 Description and Priority

1. This feature will enable users to choose when to allow charging via a calendar-based scheduling page.

2. The scheduling feature is of high priority. This functionality is one of the main reasons for building the application and is currently not supported through manually charging the car.

### 4.1.2 Functional Requirements

1. REQ-1: The user shall be able to schedule a charge session based on cost-data provided by the system.

2. REQ-2: The user shall be able to cancel a scheduled charge session through the mobile app.

3. REQ-2: The user shall be able to set up charge sessions at repeated times.

## 4.2 Notifications

### 4.2.1 Description and Priority

1. This feature will enable users to receive notifications for instances such as when a charge is about to begin or when it is complete and if a charge has been interrupted due to some technical reason.

2. The notifications feature is of medium priority. It is important to alert the user when a charge has been interrupted so that they can verify the reason behind the interruption and act accordingly.

### 4.2.2 Functional Requirements

1. REQ-1: The system shall receive feedback from the device when charging stops.

2. REQ-2: The system shall notify the user when charging is interrupted.

3. REQ-3: The system shall report what caused the interruption.

## 4.3 Settings

### 4.3.1 Description and Priority

1. The settings feature allows users to register his or her car details within the app and will allow users to manage multiple cars.

2. The settings page is of low priority. It will allow users to input car details in order to manage the devices synced with the charger but will not add any new functionality.

### 4.3.2 Functional Requirements

1. REQ-1: The user shall be able to input the car's make, model, and battery type.

2. REQ-2: The user shall be able to have multiple cars stored one one device.

3. REQ-3: The user shall be able to change the units that rates are displayed in.

## 4.4 Dashboard

### 4.4.1 Description and Priority

1. The Dashboard screen gives users important metrics about the car, its charging rate, as well as provide critical functionality such as the immediate starting and stopping of a charge.

2. The dashboard feature is of high priority because it is the first screen that the user will encounter upon opening the application and will provide immediate details about the car's current charging status.

### 4.4.2 Functional Requirements

1. REQ-1: The user shall be able to see the car's current charging rate.

2. REQ-2: The user shall to initiate a charge immediately.

3. REQ-3: The user shall be able to stop a charge immediately.

4. REQ-4: The user shall be able to set the car to wait for a scheduled charge.

## 4.5 Setup

### 4.5.1 Description and Priority

1. The setup feature will walk the users through how to use the application as well as enable users to register their NeoCharge device and set up their car information.

2. The setup feature is of medium priority. This feature enhances already existing features, but does not add new functionality.

### 4.5.2 Functional Requirements

1. REQ-1: The user shall be able to register their charging device with their app.

2. REQ-2: The user shall be taken through a tutorial upon opening app for first time.

3. REQ-3: The user shall be prompted to input their car's make, model, and battery type upon opening the app for the first time.

# 5   External Interface Requirements

## 5.1   User Interfaces

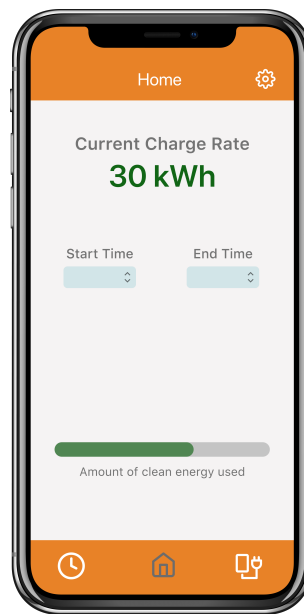| Id | Requirement |
|---|---|
| UI-1 | The application will have a screen to schedule charging sessions. |
| UI-2 | The application will have displays that will adjust to the device. |
| UI-3 | The application will pop-up notifications when there are errors with charging. |
| UI-4 | The application will have a navigation bar, a settings button and a title for each screen. |



Figure 2: Example Screen

## 5.2   Hardware Interfaces

| Id | Requirement |
|---|---|
| HI-1 | The application will communicate with the NeoCharge device via WiFi. |
| HI-2 | The application will run on both iOS and Android devices. |

## 5.3   Software Interfaces

| Id | Requirement |
|---|---|

| SI-1 | The application will be integrated with the WattTime V2 API to measure the user's carbon footprint. |
|------|------|
| SI-2 | The application will be written on a cross-platform framework, such as React Native, so that it can be used on both iOS and Android devices. |

## 5.4 Communications Interfaces

| Id | Requirement |
|------|------|
| CI-1 | The application will send user data for each user account to the server. |
| CI-2 | The application will receive signals from the NeoCharge device on charging. |

# 6 Other Nonfunctional Requirements

## 6.1 Performance Requirements

1. The system shall send the scheduling information that the user inputs to the servers within two seconds.

2. The chosen server host shall possess a reliable up time of at least 99.5% in order for the app to write and the device to reflect real-time scheduling and settings changes.

## 6.2 Safety Requirements

1. The system shall display the battery percentage of the car as accurately as possible, given what the user has entered.

2. The system shall notify the user if the charger is interrupted unexpectedly due to problems with power usage.

## 6.3 Security Requirements

1. Each device shall have a unique serial number that allows the user to register with the NeoCharge application.

2. Device serial numbers shall be secure, not easily accessible or able to be discovered through brute-force, in order to prevent unintended users from connecting to a charger.

3. Database queries shall have security measurements in place to prevent attacks (SQL injection).

## 6.4   Software Quality Attributes

1. The system shall have sufficient usability, where the user can start charging their vehicle in a few screen taps or less.

# 7   Other Requirements

1. The system shall have a scaleable database in order to store data for an indeterminate amount of time.

2. The system shall have security protocols in place in order data loss, leakage, or unauthorized access to the database.

# A   Glossary

| Term | Definition |
|---|---|
| Splitter | Device that provides multiple connection points to one outlet. The NeoCharge product is a smart splitter. |
| User | Anyone that uses the app. Using the app requires possession of a NeoCharge electric car charging device. |

# B   Analysis Models

(To be added later)

# C   Issues List

1. Our choice of database is still TBD.

2. Our choice of cross-platform technology is still TBD. However, there is heavy consideration for React Native because of the strong community support and the positive experiences a couple of our team members have had using it.

3. TBD whether our application will integrate with WattTime API. WattTime will be able to provide us with carbon emissions data which we can use to give charge time recommendations during the cleanest hours. However, use of the API requires a subscription fee (rates are not listed on the website).