

# **Software Requirements Specification**

**for**

## **EV Charging Statistics**

**Version 2.0**

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## Revision History

<b>Name</b>	<b>Date</b>	<b>Task</b>	<b>Version</b>
Aasawari Bagewadikar Rachna Gajre	04/22/2016	Initial Draft.	1.0
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Aasawari Bagewadikar	05/12/2016	Update with chart parameters.	2.0

## Document Approval

The following Software Requirements Specification has been accepted and approved by the following:

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# **1. Introduction**

## **1.1 Purpose**

The purpose of this document is to provide a detailed overview of the dashboard application being developed and its purpose. This document illustrates the details of the dashboard application, requirements, both functional and nonfunctional requirements, assumptions and constraints regarding dashboard application and its target audience. The document also provides a glimpse of the user interface, its software, hardware and other technical dependencies. The document provides the analysis model diagrams that illustrate the functionalities of the application to build in the future.

## **1.2 Scope**

The BMW Research Group has a large amount of data from various electric vehicle charge stations. These data are difficult to interpret and analyze in the raw form that they have available. BMW needs to build a dashboard application that can compile, analyze and graphically represent the charging data.

## **1.3 Glossary of Terms**

1. EV - Electric vehicle

## **1.4 Overview**

The following is overview of the system to be developed. This dashboard application, displays the data from EV Charging Stations which is stored in a database. The data is recorded from 13 charging stations. The charging stations are split into 2 categories public and private. The system has 5 private stations and 8 public stations. Among 5 private stations, 4 stations are of type AC and 1 is DC. Also, among 8 public stations, 5 stations are of type AC and 3 are DC. The data stored in the database needs to be rendered on a dashboard page depending upon the user's selection of charging station type.

# **2. General Description**

## **2.1 Product Perspective**

The dashboard application will be used by BMW Research Group (Mountain View) internally. The primary users of these dashboard pages will be the BMW decision makers and engineers. The customer is BMW themselves.

For EV charging statistics, user will select options like type of charging stations and time span. The data will be rendered as different graphs based on user's selection.

## **2.2 Product Functions**

The product functions for EV charging statistics are as follows:

1. The system shall display a set of graphs showing charging station usage over time with configurable time periods.
2. The system shall display the list of all the 13 charging stations to be selected as a station being shown in the graphs.
3. The graphs shall display all Private stations in yellow color, Public stations in dark blue color, DC station in green and AC station as light blue color.
4. The system shall be able to get energy data from ChargePoint API, process the data and display a graphical representation of this data for selected time period.
5. Sensors should be polled as often as once every 10 second to keep data fresh.

## **2.3 User Characteristics**

The users for this dashboard application are sophisticated, well educated and well trained software professional. The primary users of this dashboard application are BMW decision makers and engineers.

## **2.4 Assumptions and Dependencies**

The assumptions for the dashboard application are as follows:

TBD..

The dependency required by the dashboard application is as follows:

1. The data from ChargePoint API

## **3. Specific Requirements**

### **3.1 External Interface Requirements**

This section describes the external interface requirements for the EV Charging Statistics dashboard application.

#### **3.1.1 User Interfaces**

The user interface shall follow standard dashboard application interface as per the project document shared by BMW.

The user interface for the EV Charging Statistics dashboard application shall display a multi select box that will slice and dice the charging stations by attributes such as public, private, ac or dc etc. corresponding to each of the 13 charging stations. User shall select multiple or all charging stations. The user shall select a single date by choosing Start date and End date to fetch data. There shall also be buttons or links on UI each corresponding to values such as Today, Last Day, Last Week, Last Month, Last Quarter and Last Year. Upon user selection, a set of graphs showing station usage will be displayed.

### **3.1.2 Hardware Interfaces**

The supported devices shall be desktops, smartphones with internet connection, laptops, tablets and ipads. Data shall be communicated over the network to and from the database, APIs and charging stations.

### **3.1.3 Software Interfaces**

Data that will be shared between the dashboard application and the database shall include charging statistics on basis of date. The dashboard application will communicate to an external interface to get energy data. This data will be represented in the form of bar graphs and pie chart.

## **3.2 Functional Requirements**

This section describes specific features of the EV Charging statistics portals.

### **3.2.1 EV Charging Statistics**

The functional requirements for EV Charging Statistics are as follows:

#### **3.2.1.1 Functional Requirement 1 - Display Detailed Statistics**

**INTRODUCTION:** The user shall be able to see the detailed statistics for all the nine charging stations on the dashboard.

**INPUTS:** Charging Stations and Date

**PROCESSING:** Read the data from the file and represent that data as Stacked Bar Charts and Pie Charts on the dashboard

**OUTPUTS:** All the charts that gives information for charging stations for the specified range of day, month and year will be displayed on the dashboard.

**ERR. HANDLING:** TBD..

#### **3.2.1.2 Functional Requirement 2 - Settings File for configuring inputs to chart.**

**INTRODUCTION:** The user shall be able to see the detailed statistics for all the 13 charging stations on the dashboard.

**INPUTS:** Charging Station such as public, private, AC, DC etc., Date, Number of bins to which hours are mapped, how often the ChargePoint API shall be polled.

**PROCESSING:** Read the data from the file and represent that data as Stacked Bar Charts and Pie Charts on the dashboard

**OUTPUTS:** All the charts that gives information for charging stations for the specified range of day, month and year will be displayed on the dashboard.

**ERR. HANDLING:** Unsuccessful reads in Bin.

### **3.3 Non-Functional Requirements**

The non-functional requirements for dashboard application are as follows:

#### **3.3.1 Backup**

The system shall have backup of energy data.

#### **3.3.2 Extensibility**

The system shall be extensible for adding new functionalities.

#### **3.3.3 Availability**

The system shall be available 24x7 i.e. all the days for 24 hours.

#### **3.3.4 Security**

The data and graphs shall be within BMW's LAN network. The system shall not function without valid login and ChargePoint API authentication.

#### **3.3.5 Maintainability**

The dashboard application shall be maintained to have continuous support on newer versions of dashboard browser, operating systems, screen sizes and resolutions.

### **3.4 Other Requirements**

#### **3.4.1 UI Requirements**

1. User Interface shall be one page view without scroll for PC's, TV's and Laptops.
2. User Interface shall have scrollview for devices such as tablets, ipads and smartphones.

#### **3.4.2 UI Contents**

##### **3.4.2.1 Parameters**

The parameters that are inputs in dashboard application to display statistics are as follows:

1. All 13 charging stations - On selection of this parameter, all six graphs for selected range of date for all nine charging stations shall be displayed on dashboard.
2. All Public - On selection of this parameter, all six graphs for selected range of date for all public charging stations with both AC and DC public charging stations shall be



displayed on dashboard. For this parameter the charging data from four public charging stations will be taken as input to display graphs.

3. All Private - On selection of this parameter, all six graphs for selected range of date for all private charging stations with both AC and DC private charging stations shall be displayed on dashboard. For this parameter the charging data from five private charging stations will be taken as input to display graphs.
4. All AC's - On selection of this parameter, all six graphs for selected range of date for all AC's charging stations with both public and private charging stations shall be displayed on the dashboard. For this parameter the charging data from three public and four private charging stations will be taken as input to display graphs.
5. All DC's - On selection of this parameter, all six graphs for selected range of date for all DC's charging stations with both public and private charging stations shall be displayed on dashboard. For this parameter the charging data from one public and one private charging stations will be taken as input to display graphs.
6. Individual Charging Stations - On selection of this parameter, all six graphs for selected range of date for that particular charging station will be displayed on dashboard.
7. Date - For this input, user can select start date and end date i.e. period for which the user wants to see the charging statistics. Date shall include time from Midnight to current time. Current time is the time at which user requests for charging station statistics.
8. Date Range Buttons - These are separate buttons to select date range directly. User can click on these buttons to get statistics instead of specifying start and end date. There shall be buttons specifying range as - Today, Last Day/Yesterday, Last Week, Last Month, Last Quarter and Last Year.

### **3.4.2.2 Stacked BarCharts**

Each Stacked Bar chart shall have a heading which describes to user the purpose of that particular chart. Each of the charts below needs to have clear labels for both x-axis and y-axis. Also, these charts should highlight data automatically.

1. Stacked BarChart 1 - This chart shall be named as, *kwh Charging and Maintaining Charge by Hour*. It shall be displayed on Left corner of the dashboard below parameters. It shall display station usage [kWh] over selected date distinguished for charge ( $\geq 1\text{kW}$ ) and maintain ( $< 1\text{kW}$ ).
2. Stacked BarChart 2 - This chart shall be named as, *Hour Charging and Maintaining Charge by Day*. It shall be displayed on Right side of the Stacked BarChart 1 and below parameters. It shall display station usage [charge duration in h] over selected date distinguished for charge ( $\geq 1\text{kW}$ ) and maintain ( $< 1\text{kW}$ ).
3. Stacked BarChart 3 - This chart shall be named as, *kwh Charging and Maintaining Charge by Hour*. It shall be displayed on Left side of the dashboard and below Stacked

BarChart 1. It shall display station usage in [kW] and [events] over day-of-week distinguished for AC and DC charging.

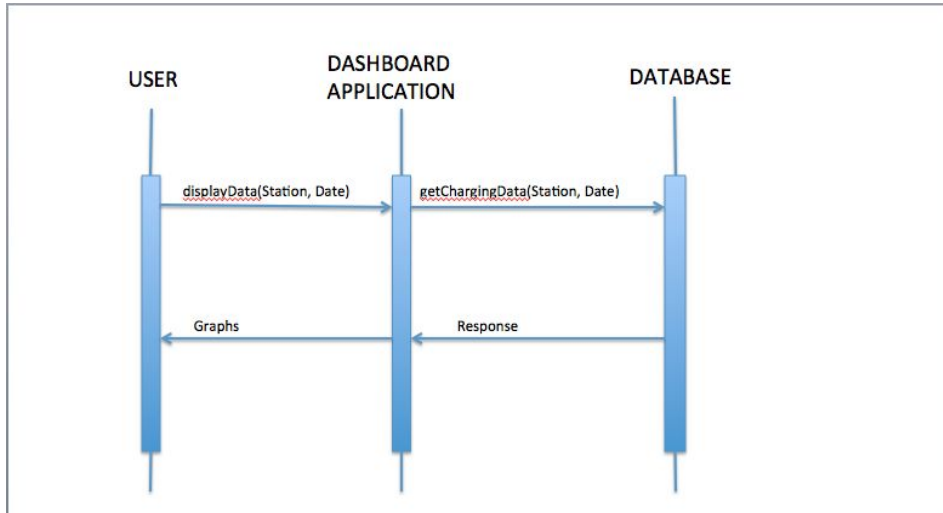
4. Stacked BarChart 4 - This chart shall be named as, *Hour Charging and Maintaining Charge by Day*. It shall be displayed on Right side of the Stacked BarChart 1 and below Stacked BarChart 2. It shall display Charge events per day over selected time period (default 1 month).

### **3.4.2.3 Pie Charts**

1. Pie Chart 1 - Displayed on Right side of the Stacked BarChart 2 and below parameters. This shall display charger usage in [kWh] over selected time period.
2. Pie Chart 2 - Displayed on Right side of the Stacked BarChart 4 and below Pie Chart 1. This shall display charger usage in [charge events] over selected time period (find high-usage stations).

## 4. Analysis Models

### 4.1 Sequence Diagrams



### 4.2 Activity Diagram

