Analysis of Charging Station Dataset

Name: Ajinkya Mangesh Mahalpure

Registration number: 20BCY10071

College: VIT Bhopal University

Pre-Analysis Process:

1. Explore the dataset to understand its structure, size, and basic statistics.

2. Check the data for possible inconsistencies. Eliminate duplicate entries and also nullify the empty entries in dataset.

3. As per the tasks we needed column of 'Active Hours' in our data base as one of our measures. To calculate it the following procedure was followed:

   - In the datasheet create a new column named 'Active Hours'.

   - Click on the cell below the column name.

   - Use formula "=COUNTIF(H2:AE2, TRUE)" to calculate the first result.

   - Drag the same cell till the last column.

4. Dataset provided for analysis was almost all ready for the analysis.

Tools Used: Tableau Desktop and MS Excel

Connecting Dataset with Tableau Desktop:

1. Open Tableau Desktop Application

2. In the 'Connect' select 'Microsoft Excel' and open the dataset from local storage.

Assignment Tasks:

1. **Daily and Hourly Uptime Analysis:**

   Examine the uptime of chargers across different days and hours. Identify any noticeable uptime patterns or trends.

   Results:

   From the horizontal bars, it is evident that certain stations consistently exhibit higher average active hours across multiple days, indicating their robust operational performance. Conversely, stations with lower average active hours may warrant further investigation into potential issues affecting uptime. Day-wise patterns may emerge, revealing trends such as increased usage on specific days or recurring downtimes.
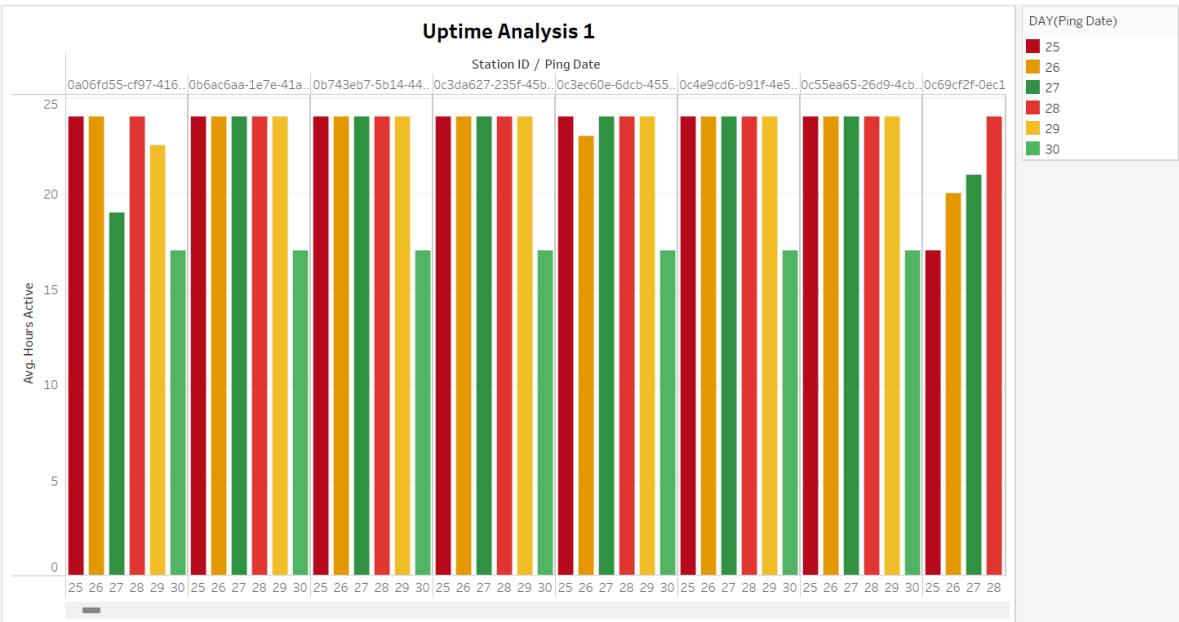

Figure 1: Horizontal Bar Chart

The box-and-whisker plot complements this analysis by illustrating the variability in active hours for each station. Stations with narrower interquartile ranges suggest more consistent uptime, while wider ranges may indicate fluctuating operational statuses.

The visualizations, comprising horizontal bars and a box-and-whisker plot, provide valuable insights into the daily and hourly uptime patterns of EV chargers across different days and hours. The horizontal bars allow for a quick comparison of average active hours for each station on different days, while the box-and-whisker plot provides a deeper understanding of the distribution and variability.
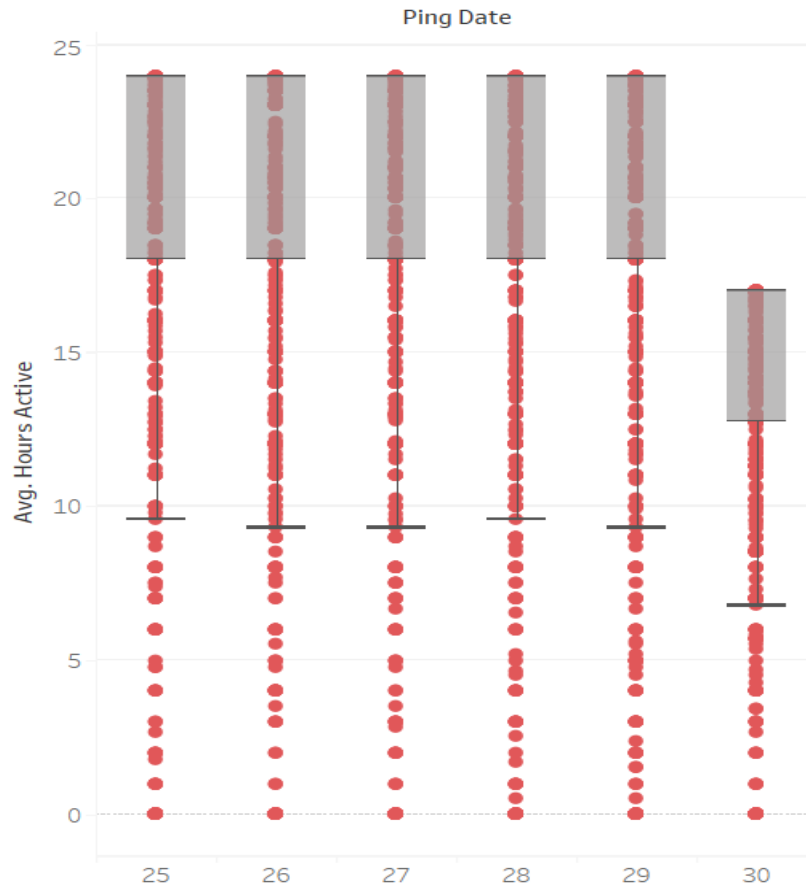
Uptime Analysis 2

Figure 2: Box and Whisker Plot

2. Performance Comparison of Charger Stations:

Compare the uptime performance of various stations. Highlight any stations with particularly high or low uptime and hypothesise potential reasons.

Results:

The combined utilization of horizontal bars and a side-by-side circles plot facilitates an in-depth comparison of charger station performance based on their average active hours. In the horizontal bars, the Station ID is set along the y-axis, offering a clear depiction of the average active hours for each station. This provides a direct means of identifying stations with consistently high or low uptimes, allowing for targeted performance evaluation.

The side-by-side circles plot further enriches the analysis, employing the Station Name on the x-axis and Average Active Hours on the y-axis. Larger circles represent higher uptimes, offering a visual representation of both the average performance and variability among stations. Notably, stations with larger circles and minimal variability present an opportunity for a deeper exploration of consistent and reliable charging services.
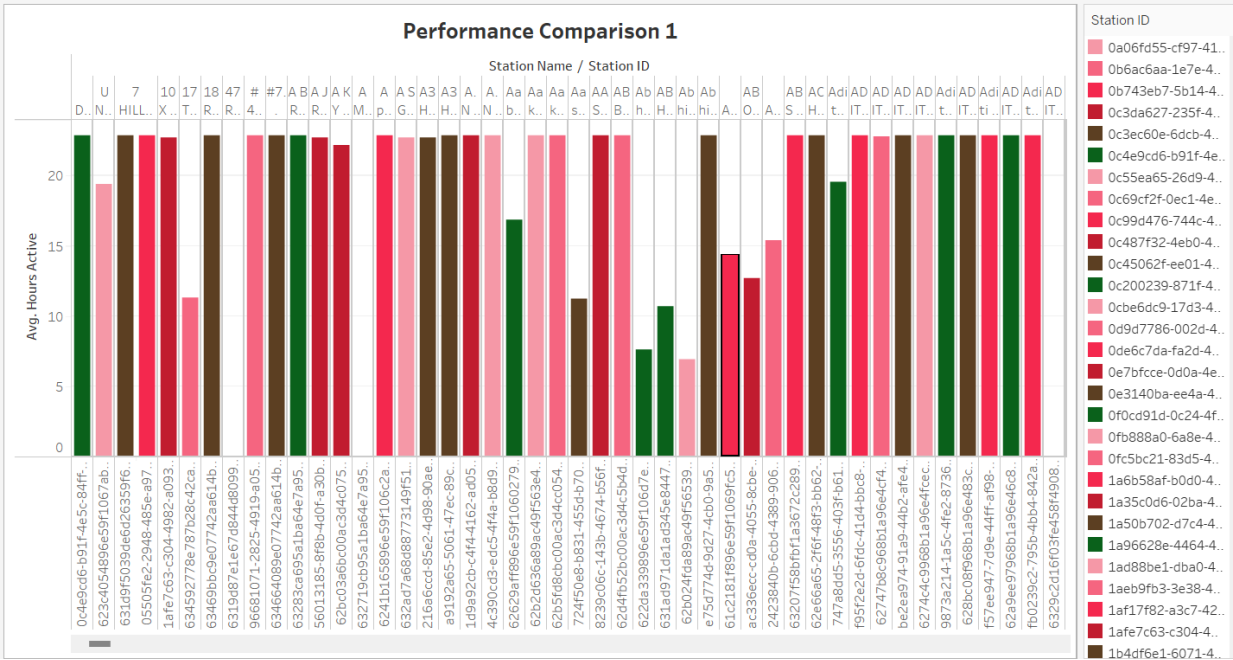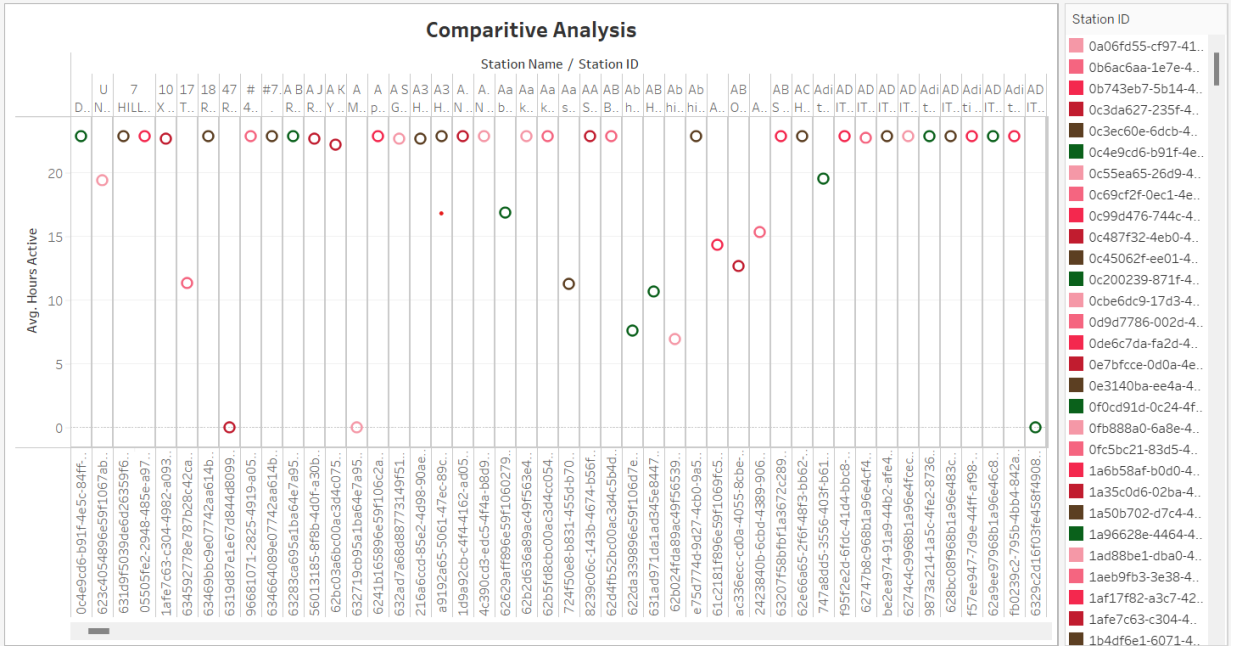

Figure 3: Horizontal Bar Chart

Figure 4: Side-by-side Circle Chart

3. Correlation with Station Characteristics:

Analyse if the uptime is influenced by the station's characteristics (type, category, access). Does the nature of the station affect its operational status?

Results:

The utilization of horizontal bars and a side-by-tree map in the visualizations effectively investigates the correlation between charging station characteristics and uptime performance. In the horizontal bars, entities such as Station Type, Station Access, and Station Category are plotted against the Average Active Hours, offering a clear representation of how these characteristics influence operational status.

Analysing the horizontal bars reveals patterns in uptime associated with different station characteristics. For instance, certain Station Types may exhibit consistently higher uptimes, indicating potential efficiency advantages. Similarly, variations in uptime across Station Access types or categories become apparent, allowing for targeted insights into the factors influencing operational status.

The side-by-tree map provides a comprehensive overview, incorporating all entities related to Charging Station characteristics. Each branch of the tree map represents a unique combination of Station Type, Station Access, and Station Category, with the size of the rectangles indicating the average active hours. This visualization method allows for a hierarchical exploration of the impact of station characteristics on uptime.
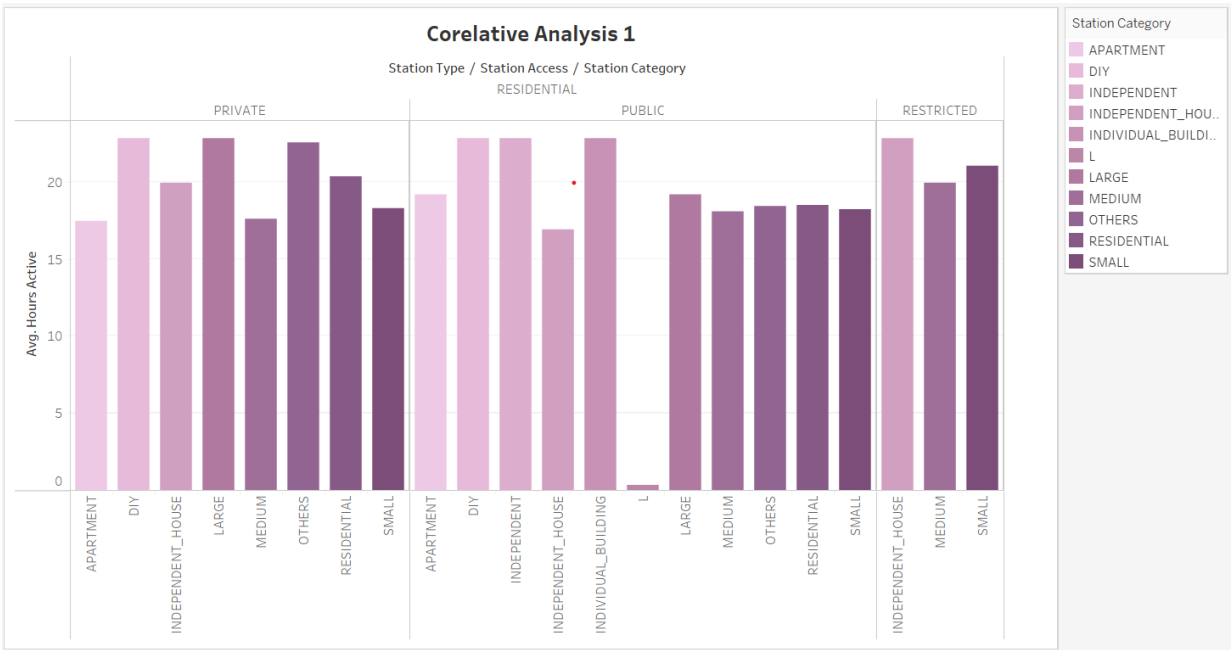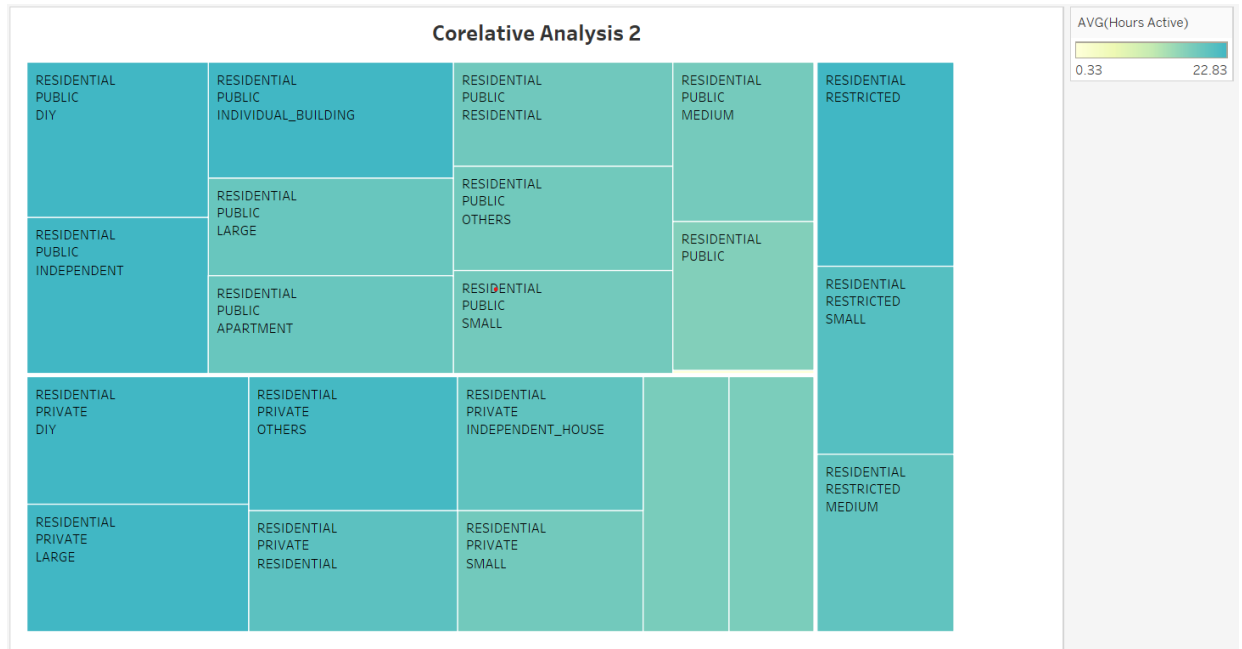

Figure 5: Horizontal Bar Chart

Figure 6: Treemap

4. Predictive Analysis for Future Uptime:

Using the provided data, attempt to predict the uptime for the next day for a selected charger station. Explore the feasibility of forecasting potential downtimes.

Solution:

The timeline chart, segmented by Station Access and Date of Pinging, coupled with forecasted active hours, provides a robust approach to predicting uptime for a selected charger station. The utilization of Tableau's forecasting feature enhances the analysis by projecting potential active time on the next day, offering valuable insights into future operational states.

The forecasting process in Tableau involves selecting the target variable (Average Active Hours), applying the forecasting algorithm, and configuring settings such as confidence intervals. The resulting forecasted line is superimposed on the timeline chart, providing a visual representation of predicted future uptime. Evaluating the forecast against actual data can assist in assessing the accuracy and reliability of the predictive model.
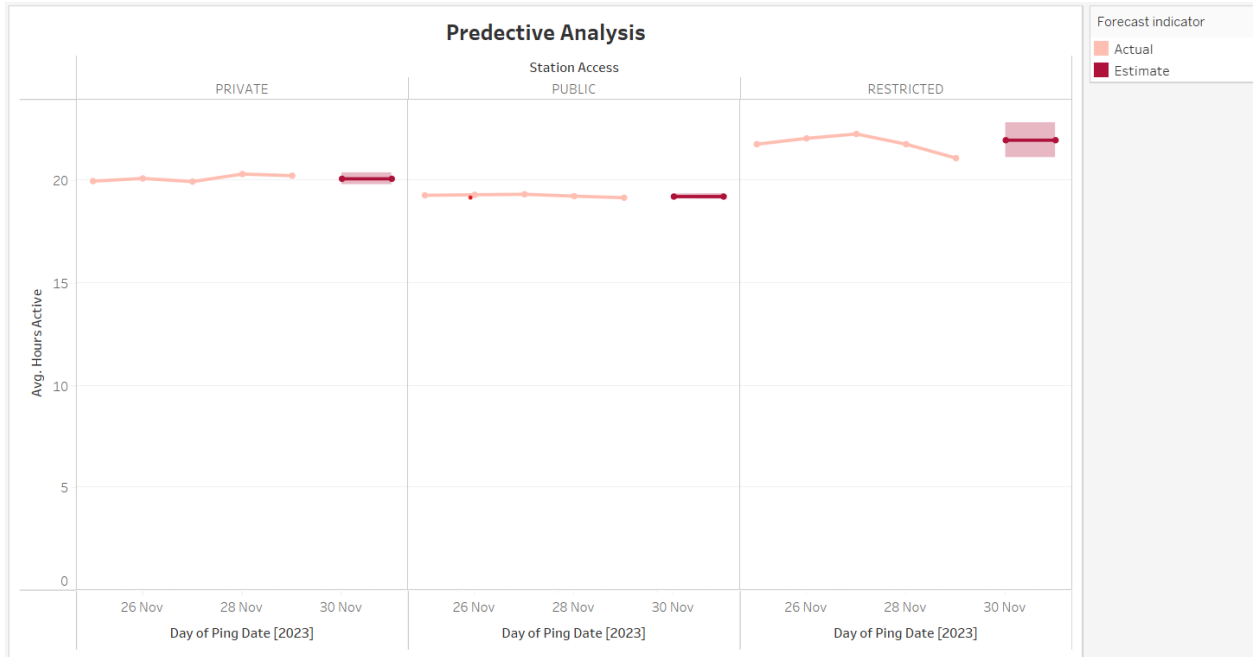
Figure 7: Timeline Chart

5. Open-Ended Exploration:

Feel free to conduct any additional analysis that you find insightful. You might explore correlations with external factors like local events, weather conditions, or other variables not included in the dataset.

Solution:

The stacked bar chart, utilizing Ping Date, Station Access, and Average Active Hours, is a meaningful visualization that compares actual and estimated uptimes. This chart provides insights into the accuracy of uptime predictions and highlights potential discrepancies.

To further enhance your open-ended exploration, consider incorporating additional external variables that might impact charging station performance. For instance, integrating weather data can reveal correlations between uptimes and weather patterns. Extreme temperatures or adverse weather conditions may influence charging station usage, affecting both demand and operational efficiency.

Moreover, exploring local events, holidays, or community gatherings can uncover unique patterns in charging station activity. Integrating a calendar of significant events into your analysis might unveil uptimes associated with increased user demand during public gatherings or special occasions.
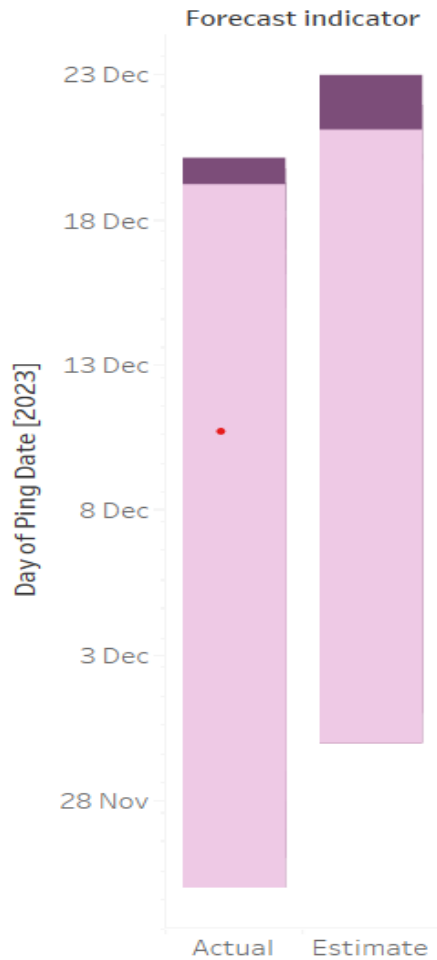
Figure 8: Stacked Bars

Conclusion:

In order to wrap up, the comprehensive examination of the charging station dataset using various Tableau visualisations has produced insightful results. Using box-and-whisker plots and horizontal bars, daily and hourly uptime trends were identified, highlighting stations with reliable performance. Through the use of horizontal bars and a side-by-side circle plot, stations with notable uptimes and lower variability were highlighted in the performance comparison. Through the use of horizontal bars and a side-by-tree map, the link between station attributes and uptime revealed unique patterns related to station types and categories. A timeline chart with predictive analysis incorporated allowed stakeholders to forecast future uptimes and possible downtimes. A stacked bar chart was used to illustrate the open-ended investigation, which compared estimated and real uptimes and offered creative solutions such combining sentiment analysis, local events,

and meteorological data. This holistic approach provides actionable insights for optimizing infrastructure, improving user experience, and ensuring the reliability of EV charging services.

Project URL: https://github.com/Uranium43/Analysis-of-Charging-Stations-Dataset