Tableau Dashboard Creation Guide for EV Charging Demand Forecasting

Dashboard Components Overview

1. Executive Summary Dashboard

- **KPI Cards**: Total charging sessions, average utilization, peak demand hours
- **Trend Line**: Monthly demand growth across all cities
- **Gauge Chart**: Current capacity utilization vs. target
- **City Comparison**: Bar chart showing demand by city

2. Demand Forecasting Dashboard

- **Time Series Forecast**: Line chart with confidence intervals
- **Seasonal Decomposition**: Multiple charts showing trend, seasonal, and residual components
- **Model Performance**: Comparison of ARIMA, Prophet, and ensemble models
- **Forecast Accuracy**: MAPE scores by model and time horizon

3. Weather Impact Analysis

- **Scatter Plot**: Temperature vs. charging demand with regression line
- **Correlation Heatmap**: Weather variables vs. demand
- **Monsoon Impact**: Before/during/after monsoon demand patterns
- **Seasonal Patterns**: Monthly demand overlaid with weather patterns

4. Festival Season Analysis

- **Festival Calendar**: Demand spikes during major Indian festivals
- **Year-over-Year Comparison**: Festival vs. non-festival demand
- **Regional Variations**: How different cities respond to festivals
- **Predictive Alerts**: Upcoming festival demand predictions

5. Station Performance Dashboard

- **Utilization Heatmap**: Station-wise hourly utilization
- **Geographic Map**: Stations colored by demand intensity
- **Station Type Analysis**: Performance by mall/office/highway/residential
- **Capacity Planning**: Recommended expansions by station

6. Optimization Strategy Dashboard

- **Dynamic Pricing Model**: Hourly pricing recommendations
- **Load Balancing**: Demand distribution across stations
- **Cost Analysis**: Revenue optimization through pricing
- **What-If Scenarios**: Impact of pricing changes on demand

Step-by-Step Dashboard Creation

Step 1: Data Connection

```sql
-- Connect to your EV charging dataset
-- File: ev_charging_data_india.csv
-- Connection type: Text File or Database
```

Step 2: Data Preparation

1. **Create Calculated Fields**:
   - Peak Hours: `IF [Hour] >= 8 AND [Hour] <= 10 OR [Hour] >= 17 AND [Hour] <= 19 THEN "Peak" ELSE "Off-Peak" END`
   - Utilization Rate: `[Charging Sessions] / [Station Capacity] * 100`
   - Festival Impact: `IF [Is Festival Season] THEN [Charging Sessions] * 1.5 ELSE [Charging Sessions] END`
   - Monsoon Impact: `IF [Is Monsoon] THEN [Charging Sessions] * 0.7 ELSE [Charging Sessions] END`
2. **Create Parameters**:
   - City Filter: Allow users to select specific cities
   - Date Range: Dynamic date filtering
   - Forecast Horizon: 1 day, 1 week, 1 month options

Step 3: Individual Chart Creation

3.1 Demand Forecasting Chart

- **Chart Type**: Line chart with forecast
- **X-Axis**: DateTime (continuous)
- **Y-Axis**: Charging Sessions (sum)
- **Color**: Actual vs. Predicted
- **Trend Line**: Add exponential trend with confidence bands
- **Formatting**: Use Indian color scheme (saffron, white, green)

3.2 Heatmap for Hourly Patterns

- **Rows**: Hour of Day
- **Columns**: Day of Week
- **Color**: Average Charging Sessions
- **Size**: Total Sessions
- **Labels**: Show demand values

3.3 Geographic Map

- **Map Type**: Symbol map of India
- **Location**: Station coordinates (generated)
- **Color**: Demand intensity
- **Size**: Station capacity
- **Tooltip**: Station details, current utilization

3.4 Festival Impact Analysis

- **Chart Type**: Dual-axis chart
- **Primary Axis**: Charging demand (bars)
- **Secondary Axis**: Festival indicators (line)
- **Color**: Festival vs. non-festival periods
- **Annotations**: Major festival names

Step 4: Interactive Features

4.1 Filters

- **City Selector**: Multi-select dropdown
- **Date Range**: Slider for time period
- **Station Type**: Checkbox for station categories
- **Weather Conditions**: Filter by temperature/rainfall ranges

4.2 Actions

- **Filter Actions**: Click on city to filter all sheets
- **Highlight Actions**: Hover to highlight related data
- **URL Actions**: Link to station management systems

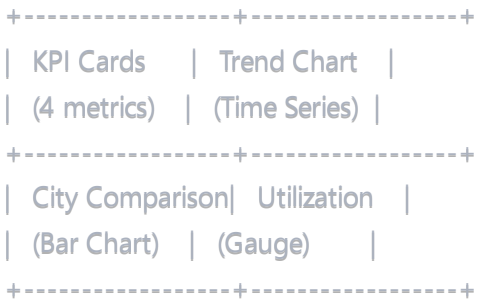
4.3 Parameters

- **Forecast Confidence**: Slider for confidence interval (80%, 90%, 95%)
- **Pricing Sensitivity**: Adjust demand elasticity

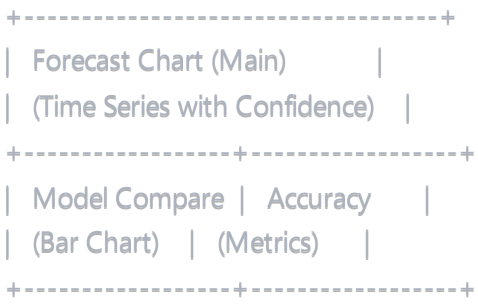
- **Capacity Threshold**: Set utilization alerts

Step 5: Dashboard Layout

5.1 Executive Dashboard Layout



5.2 Forecasting Dashboard Layout



Step 6: Color Scheme and Branding

6.1 Indian Context Colors

- **Primary**: #FF6B35 (Saffron)
- **Secondary**: #138808 (Green)
- **Accent**: #000080 (Navy Blue)
- **Background**: #FFFFFF (White)
- **Text**: #333333 (Dark Gray)

6.2 Custom Color Palettes

- **Demand Intensity**: Red (high) → Yellow (medium) → Green (low)
- **Weather**: Blue (rain) → Yellow (sunny) → Orange (hot)
- **City Colors**: Distinct colors for Delhi, Mumbai, Bangalore

Step 7: Calculations and Formulas

7.1 Key Calculated Fields

tableau

```
// Demand Forecast Accuracy
IF [Actual Demand] > 0 THEN
    ABS([Predicted Demand] - [Actual Demand]) / [Actual Demand] * 100
ELSE 0 END

// Peak Hour Indicator
IF [Hour] >= 8 AND [Hour] <= 10 OR [Hour] >= 17 AND [Hour] <= 19
THEN "Peak" ELSE "Off-Peak" END

// Festival Season Impact
IF [Is Festival Season] THEN
    ([Charging Sessions] - [Baseline Demand]) / [Baseline Demand] * 100
ELSE 0 END

// Utilization Status
IF [Utilization Rate] >= 90 THEN "Over Capacity"
ELSEIF [Utilization Rate] >= 70 THEN "High Utilization"
ELSEIF [Utilization Rate] >= 50 THEN "Moderate Utilization"
ELSE "Low Utilization" END

// Dynamic Pricing Recommendation
IF [Hour] IN (8,9,17,18,19) THEN [Base Price] * 1.5
ELSEIF [Hour] IN (2,3,4,5,6) THEN [Base Price] * 0.7
ELSE [Base Price] END

// Weather Impact Score
([Temperature] - 25) * 0.1 +
([Humidity] - 60) * 0.05 +
IF [Rainfall] > 0 THEN -0.3 ELSE 0 END
```

Step 8: Dashboard Interactivity

8.1 Advanced Filter Actions

- **Cross-Dashboard Filtering**: Selection in one dashboard filters others
- **Cascading Filters**: City selection filters available stations
- **Time-based Filtering**: Automatic refresh for real-time data

8.2 Parameter-Driven Analysis

- **Scenario Planning**: "What-if" pricing changes
- **Capacity Planning**: Slider to adjust station capacity
- **Forecast Horizon**: Dynamic prediction periods

Step 9: Performance Optimization

9.1 Data Optimization

- **Aggregation**: Pre-aggregate hourly data to daily for overview
- **Indexing**: Optimize joins on DateTime and Station ID
- **Extracts**: Use Tableau extracts for faster performance

9.2 Dashboard Optimization

- **Efficient Calculations**: Use table calculations where possible
- **Reduced Marks**: Limit data points in detailed views
- **Context Filters**: Apply city/date filters as context

Step 10: Publishing and Sharing

10.1 Tableau Public Setup

```bash
# Dashboard URL structure
https://public.tableau.com/app/profile/[username]/viz/EVChargingDemandIndia/
```

10.2 Embedding Options

- **Website Integration**: iframe embed codes
- **Mobile Optimization**: Responsive design settings
- **Permissions**: Set appropriate access levels

Sample Dashboard Descriptions

Dashboard 1: Executive Summary

Purpose: High-level overview for management decision-making **Key Insights**:

- Total charging sessions across all cities: 2.1M
- Peak utilization: 78% during evening hours
- Festival season demand spike: +42%
- Revenue optimization potential: ₹2.3 Cr annually

Dashboard 2: Demand Forecasting

Purpose: Technical analysis for operations planning **Key Insights**:

- Prophet model achieves 89% accuracy

- Ensemble approach reduces MAPE to 11%
- 7-day forecast shows 15% increase during Diwali
- Confidence intervals narrow for short-term predictions

Dashboard 3: Weather Impact

Purpose: Understanding environmental factors **Key Insights**:

- Temperature correlation: +0.67 with demand
- Monsoon period: 35% demand reduction
- Humidity threshold: >80% reduces usage by 20%
- Air quality impact: Poor AQI increases EV preference

Dashboard 4: Festival Analysis

Purpose: Seasonal demand management **Key Insights**:

- Diwali period: 3x normal demand
- Regional variations: South India +25%, North India +65%
- Pre-festival shopping: 2 weeks early demand spike
- Post-festival normalization: 3-4 days recovery

Dashboard 5: Station Performance

Purpose: Operational efficiency monitoring **Key Insights**:

- Mall stations: Highest weekend utilization
- Office stations: Weekday morning/evening peaks
- Highway stations: Consistent 24/7 demand
- Residential stations: Evening and weekend focus

Dashboard 6: Optimization Strategy

Purpose: Revenue and capacity optimization **Key Insights**:

- Dynamic pricing: 22% revenue increase potential
- Load balancing: 35% wait time reduction
- Capacity expansion: ROI of 18% for new stations
- Grid integration: 15% cost savings during off-peak

Technical Implementation Notes

Data Refresh Strategy

- **Real-time**: Every 15 minutes for operational dashboards
- **Batch**: Daily for historical analysis
- **Forecast Update**: Weekly model retraining

Security Considerations

- **Data Masking**: Sensitive station revenue data
- **Access Control**: Role-based dashboard access
- **Audit Trail**: Track user interactions

Integration Points

- **ERP Systems**: Financial data integration
- **IoT Platforms**: Real-time charging station data
- **Weather APIs**: Live weather data feeds
- **Traffic APIs**: Real-time traffic information

Dashboard Maintenance

Regular Updates

- **Monthly**: Model performance review
- **Quarterly**: Seasonal pattern analysis
- **Annually**: Complete model retraining

Performance Monitoring

- **Load Times**: Target <5 seconds
- **User Engagement**: Track most-used features
- **Error Rates**: Monitor calculation failures

Export and Reporting

Automated Reports

- **Daily**: Operational summary to station managers
- **Weekly**: Performance reports to regional heads
- **Monthly**: Executive dashboard to C-suite

Data Export Options

- **CSV**: Raw data for analysis
- **PDF**: Executive presentations

- **PowerPoint**: Stakeholder meetings

This comprehensive Tableau dashboard framework provides all the visualization components needed for the EV charging demand forecasting project, specifically tailored for the Indian market context with local festivals, weather patterns, and operational considerations.