

## OBJECTIVE

To estimate driver's behavior from the collected data.

## METHODOLOGY

1. Step 1=> Plot Histogram of Current (Column B) and then,
  - a. count when it reaches 54 Amp.
  - b. count how many times it crossed 40 Amp.
  - c. count how many times it crossed 20 Amp.
  - d. count how many times it was 0 Amp.
2. Step 2 => Plot time series of Current (Column B) and then,
  - a. calculate the duration (in seconds or hours) when current withdrawal was 20 amp, 40 amp, and 54 amp.
  - b. calculate the duration ((in seconds or hours) when battery was charging (when state = 1)
  - c. calculate the duration ((in seconds or hours) when battery was charging (when state = 0)
3. Step 3 => Calculate median of current withdrawal for only state id = -1 (only for discharging)
  - a. State id = -1 (discharging)
  - b. Estimate the median of the current withdrawal based on state id (-1)
4. Step 4 => Calculate total KMs for discharging only in last two days =>
  - a. Total KM for state id = - 1
5. Step 5 => Calculate KM/capacity => Divide "a" to "b"
  - a. Total KM for state id = - 1 from above Step 4
  - b. Capacity withdrawn for that values of KMs range (Tedious)

## Parameters for Real Data

1. **Battery ID**
2. **Distance Trip Log (Distance logo?)**
  - a. **Distance**  
Distance traveled => 20 KMs, Mon, 5:39 PM  
Distance left => 10 KMs
  - b. **Trip history**  
Access the historical data
3. **Charge Log (Battery ion as a logo?)**

- a. **Energy**
    - Total kWh left
    - Total kWh Used
- 4. **Average economy**
  - a. Mileage (Wh/km)
- 5. **Drivers behavior**
  - a. Brake score –
  - b. Driving score – out of 100 (6 categories- excellent, above average, average, below average, poor, aggressive)
- 6. **Location**
  - a. Nearest battery swap/charge - (eg. 2 miles from nearest battery swap)
  - b. Nearest service center – (not needed as of now)
- 7. **Ambient condition**
  - a. Temperature
    - i. Low: 0oC – 10oC
    - ii. Moderate: 11oC – 34oC
    - iii. High: 35oC – 40oC
    - iv. Very high: 41oC – 50oC
  - b. Infrastructure conditions
    - i. Waiting time at red light
    - ii. Slope of roads
- 8. **Seasonality** (months wise)
  - a. Electric vehicle (EV) efficiency with months (unit: w-hr/km)

## Formulas (?)

Drive score =  $f(\text{efficiency, Safety, Behavior}) \Rightarrow$  to measure behaviors that impact battery SOH.

Efficiency =  $(\text{idling} + \text{hard braking} + \text{hard accelerations}) / \text{Distance driven}$

Safety =  $(\# \text{excessive speed} * A + \text{night time driving}) / \text{Distance driven}$

Driver preferred path =  $f(\text{location, path chosen})$

Driving score = Average of Efficiency, Safety, and driver behavior

Braking score =

Vehicle score =  $f(\text{type, make/model, vehicle age})$   
 Motor curve with time?