Battery Selection

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Electric Subsystem

Jibebe

Overview

This report focuses on the comparison of different batteries choices and the recommendation of one of the batteries for use in the final implementation.

Goals

1. Compare different batteries based on several criteria
2. Recommend battery choice based on project requirements

Specifications

Mass:

Mass of motor:

Maximum passenger mass:

Mass of vehicle:

Mass of batteries:

Total mass:

Electric:

Motor: BLDC

Voltage rating of motor: 48V

The power rating of motor: 1800W

Desired Range: 100 Km

Desired top speed: 35 Km/H

Calculations

I. Required AH

I. Current being drawn by the motor is calculated below

V * AH /1000 = Motor Capacity(in KW)

Here voltage of the motor is 48V

Motor capacity = 1.8KW

So by equating these values 1800/48 = 37.5

We get AH is 37.5

Ii. Acceleration current

While accelerating motor draws more current and in deceleration draws less. So in this condition, some current loss will be there and we take that loss as acceleration current. Here we take it as 5% (you can use a 5 -10% range if your vehicle runs in heavy traffic/ or the speed of the vehicle varies continuously)

So by considering acceleration current, the effective current drawn by the motor is:

37.5 * 1.05 = 39.375 rounded up to 40 A

II. Power

Then we know Power = V*I. Power required at 35 km/h speed is 48*40 = 1920 Watt.

After finding Power, Here we are designing a battery pack for the 100 km range, and for that, we need to consider a **Travel factor**.

Travel factor = Total range(travel)/ total speed.

Our total range is 100 KM and the Total speed is 35 km/h.

So here Travel factor will be 100/35 = 2.85

This travel factor is to travel 100 km at 35 km/h speed constantly.

So Power required for it will be:

Power = Power* Travel factor

i.e: 1920 * 2.85 = 5472 Watts.

So the Total power required will be 5.5 kW.

III. Battery Capacity

Then we need to consider the Efficiency of the battery pack.

Li-ion

Li-ion Batteries usually have around 85% - 93% charging and discharging efficiency. Considering the worst case, let us take the efficiency of the Li-ion battery pack as 85%.

So, Charge/ Discharge efficiency of the battery = 85%

Total Power = 5.5 Kw

So Battery Pack Capacity required = 5.5/0.85 = 6.47 kWh.

Finally, we need to consider the Efficiency of BLDC Motor and usually, it is around 85 - 90%. Here we consider the worst-case efficiency taking 85%.

So the Total Battery capacity required is 6.47/0.85 = 7.61 kWh.

Comparison of different batteries

Batteries to be compared: Lead Acid, Li-ion, Li-Po