Conversion of an I.C. engine powertrain to Electric powertrain of an All- Terrain Vehicle

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Abstract - In electrical vehicles, batteries are the first supply of power. The battery we tend to use in electric vehicles aren't that economical and needs charging when few miles. Thus, here is that the idea of latest battery management system. This study presents a comprehensive summary of this comparatively revolutionary and gratifying resolution for battery difficulties in electrical vehicles, additionally as associate in-depth investigation of it. During this new battery management system, The Battery Management System of this Vehicle is essential in determinative the overall operate of ATV. This Report tries to spotlight the objectives of this replacement and application of BMS on ATV. An ATV is fun to drive, versatile, safe, sturdy and superior cross-country vehicle. This vehicle should be capable of negotiating the foremost extreme tract confidently and ease. These objectives were met by dividing the vehicle into its major element subsystems. And one amongst its major subsystems is that the Battery Management System. The Battery Management System's application on ATV focuses towards explaining the procedure and methodology used for powering the cross-country vehicle. This can be a try and apply the Battery Management System and is additionally value effective at identical time. Each single system has been centered upon to enhance the performance of every element. The vehicle will navigate through most tract that ultimately is that the objective behind the creating of any all-terrain vehicles. The task of application of BMS began by conducting intensive analysis of every main element of the vehicle. There was no would like to design bound areas like the frame, as we tend to were victimization the prevailing ATV engineered for competition and so build the remainder to suit thus, every element was designed to be significant, and thereby putting in the Battery management system on vehicle as an entire trying to optimize every element whereas perpetually considering however different parts would be affected. This forced North American nation to assume outside the box, analysis a lot of totally, and redesigning the ability train mounting on the manner so as to possess a flourishing installation. The most purpose of the project is obtaining accustomed the dynamic technologies.

Key Words: All Terrain Vehicle, Battery management system, Subsystem, Terrain.

1. INTRODUCTION

Nowadays with the rising technologies, EV's utilize less energy to travel a certain distance. The value per mile for Fuel is considerably cheaper. As we are converting the All-Terrain Vehicle that was antecedently powered by associate IC Engine to the electrical Vehicle. For this, a 'Battery Management System' is required. The slogan behind creating these major shifts from associate 'IC Engine to an electrical Vehicle is to beat the breakdown associated problems caused thanks to an IC Engine within the All-Terrain Vehicle. Transport sector dependent totally on oil and fuel that their costs area unit unstable and their reserves area unit severely depleted. Moreover, the utilization of those styles of energy pollutes the atmosphere and causes the emission of greenhouse. Abundant analysis has been inquisitive about the economic potency of the mixing of electrical vehicles. They gift a summary of the impact of the increasing penetration of the electron volt into vehicle market. Focusing of the electricity system and therefore the emergence of auto to grid technologies, batteries and electron volt recharge infrastructure conclude the requirement for standardization to facilitate safe transition with economically economical and environmentally permanent . And estimate prices of plug-in electrical vehicles and their work shows the benefits of sensible electrical vehicles compared to the dumb electrical vehicles that that seem most in temporal arrangement of charging and discharging of EVs. To improve vehicle performance numerous researches, manage the optimization of energy management for the new generation of auto Battery is one in every of the energy storage management systems in HEV or electron volt. The battery offer power once vehicle accelerating and absorb power once vehicle braking. So, the jar vary and accelerate performance depend upon the battery. According to previous analysis eighteen of the suspended particulates, 27% of the volatile organic compounds, 28% of Pb, thirty second of chemical element oxides, and sixty two of the CO of air-borne pollution in America area unit created by vehicles with combustion engines. Additionally, twenty fifth of energy-related carbon dioxide (the principal cause for the greenhouse effect) of all the carbon dioxide within the atmosphere area unit discharged from ancient Vehicles. As associate increasing range of individual use public and private transportation, the amount of pollution will increase each single day. Consequently, electrical vehicles have become additional and additional common. An electrical vehicle typically contains the subsequent major components: an electrical motor, a motor controller, a traction battery, battery management system, a plug-in charger that can be operated on an individual basis from the vehicle, a wiring system, a regenerative braking system, a vehicle body and a frame. The battery management system is one of the foremost necessary elements, particularly once mistreatment lithium-ion batteries.

Currently, three kinds of traction batteries area unit available: the lead-acid, nickel-metal hydride and lithium-ion batteries. Lithium-ion batteries have variety of benefits over the opposite 2 kinds of batteries, and that they perform well if they're operated mistreatment an effective battery management system

2. BATTERY MANAGEMENT SYSTEM (BMS)

There square measure differing types of BMSs that square measure accustomed avoid battery failures. The most common kind may be a battery observation system that records the key operational parameters like voltage, current and also the internal temperature of the battery on with the close temperature throughout charging and discharging. The system provides inputs to the protection devices so the observation circuits may generate alarms and even disconnect the battery from the load or charger if any of the parameters exceed the values set by the security zone. The battery is that the solely power supply in pure electric vehicles. Therefore, the BMS during this style of application ought to embrace battery observation and protection systems, a system that keeps the battery able to deliver full power once necessary and a system that may extend the lifetime of the battery. The BMS ought to embrace systems that management the charging regime and people that manage thermal problems. In an exceedingly vehicle, the BMS is a component of a fancy and fast-acting power management system. Additionally, it should interface with alternative on-board systems such as the motor controller, the climate controller, the communications bus, the safety system and also the vehicle controller.

While the definition of a BMS may disagree counting on the applying, the basic task of the BMS may well be outlined within the following manner.

• It ought to make sure that the energy of the battery is optimized to power the merchandise.

• It ought to make sure that the chance of damaging the battery is tokenism.

•It ought to Monitor and management the charging and discharging method of the battery.

3. POWER TRAIN CONSTRUCTION

As the powertrain is an important factor of the electric vehicle, it mainly consists very essential devices which are discussed in subsequent points.

1) The 48v 120AH LI Battery is connected to the motor as well as input to the Dc convertor.
2) Moreover, Dc to Dc convertor is connected to the accessories.
3) The accessories are HV contactor, brake switch, traction system light (TSL), potentiometer, instrument cluster, FNR switch.
4) Now the motor controller is an important system which gives input from the accessories.
5) The motor controller send signal to the motor, according to the output from the accessories.
6) The motor is connected to gearbox (single speed) through positive drive (chain drive) as there is no slip occur.
7) Furthermore, the gearbox is connected to the drive shaft which are subsequently connected to the wheel.

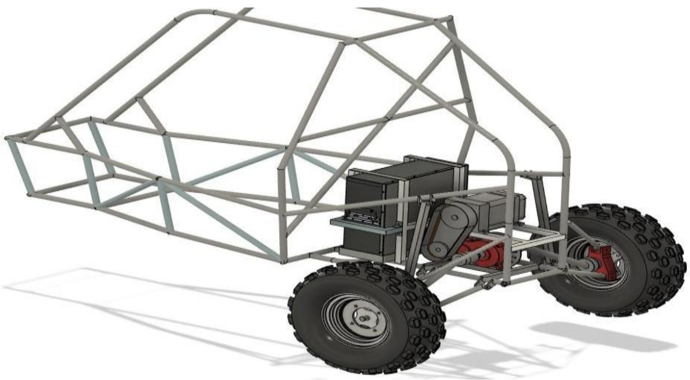

Fig 1: 3D View

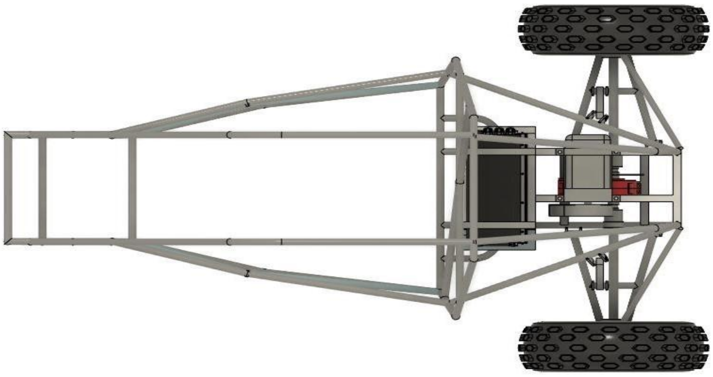

Fig 2: Top View

Fig 3: Rear Section

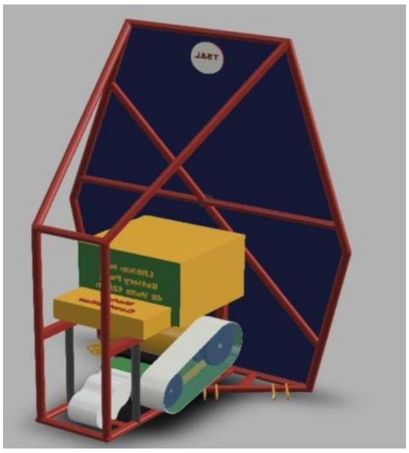

Fig 4: Side View

4. POWER TRAIN WORKING

Power Train working there are four major components of powertrain are:

- The Battery

- Motor
- Motor Controller
- Gearbox.

1) First, AC 440V current supplied is to the battery for initial charging purpose of battery.
2) The step-down transformer reduce voltage to 48v which is required.
3) Now, the battery is connected to the motor as well as dc to dc converter.
4) Then the dc-to-dc converter is connected with brake switch, FNR switch (for forward, neutral, reverse motion), TSL (for the indication of system is working), acceleration pedal (potentiometer), instrument cluster, HV contactor (use as kill switch).
5) As the output of some accessories is connected to the motor controller.
6) Then the motor controller is connected with the motor and send signal which are received from accessories as per required condition.
7) Now, the motor is connected with the gearbox through positive drive (chain drive) and transmit power.
8) Then lastly gearbox transmitting the power to the wheels through drive shafts

5. BATTERY CALCULATIONS

- 48 v, 110 Ah, Li-ion battery
- i.e., 5.28 kWh

- If we run the motor rated power (i.e., 4.5 kw)

$$\frac{\text{Battery kwh}}{\text{Motor load in kW}} = \frac{5.28}{4.5}$$

- 1.17 X 60
- 70 Minutes.

- Battery Charging time (if we take 24A charger),

- $\frac{110\text{Ah}}{24}$
- 4.58 X 60
- 275 Minutes = 4 Hours 35 Minutes.
- (Usually 10-15% of full rating is recommended to increase battery life)

7. ANALYSIS RESULTS

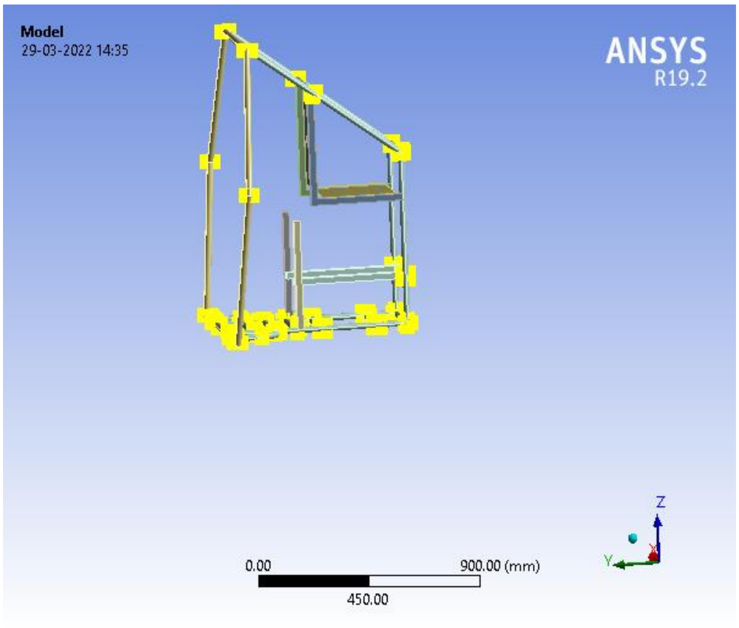

Fig 5: Analytical Result

Object Name	*Total Deformation*	*Equivalent Stress*
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Total Deformation	Equivalent (von-Mises) Stress
By	Time	
Display Time	Last	
Calculate Time History	Yes	
Identifier		
Suppressed	No	
Results		
Minimum	0. mm	0. MPa
Maximum	236.1 mm	27120 MPa
Average	131.88 mm	34.69 MPa
Minimum Occurs On	firewall	
Maximum Occurs On	Base	
Information		
Time	1. s	
Load Step	1	
Substep	1	
Iteration Number	1	
Integration Point Results		

Display Option		Averaged

No

Total Deformation:

Time [s]	Minimum [mm]	Maximum [mm]	Average [mm]
1.	0.	236.1	131.88

7. ADVANTAGES OF BMS

1) Maintains battery in an exceedingly state within which it will fulfill its purposeful style necessities.
2) Protects the protection of the battery-operated device and detects unsafe operative conditions and responds.
3) Protects cells of battery from harm in abuse/failure Cases.
4) Prolongs lifetime of battery (normal operative cases).
5) BMS is to stay track of the state of charge (SOC) of the Battery.
6) Easy in Coulomb enumeration.
7) Easy and simple to predict capability fade and internal Resistance increment.

8. LIMITATIONS OF BMS

1) Advanced in AC imminentness.
2) Additional computationally dearly-won than non-feedback strategies and highly rely on model accuracy.
3) Sensitive to the quantity and quality of coaching knowledge.
4) Open loop sensitive to the voltage sensing element exactitude, Unsuitable for cell with flat curves.

9. CONCUSION

Actual speed - 60 - 80 km/hr (Approx.*)

Battery drainage - 3% for every 10 min in half throttle& 4% for every 10 min in full throttle.

i.e., 100/4 = 25

25*10 = 250 minutes

250 minutes* = 4 Hours 10 minutes (Approx.)

•Considering the nature of the track and some other factors the Battery's Run timemight get affected.

•The run time we got while the Testing was around 4 Hours and 10m minutes* withfully Charged Battery.

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