Designing EV Harness Using Autocad Electrical

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DESIGNING EV HARNESS USING AUTOCAD ELECTRICAL

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***Abstract*: - AS our earth 's environment is getting polluted day by day thanks to all the pollutions and waste released into the atmosphere, together with it we are running out of resources from our fossil fuels. So as to extend the fuel efficiency and reduce emissions in air, the utilization of conventional ICE must be reduced and therefore the implementation of electrical vehicles had to be promoted. EV has many components which will be explained below. Although, so as for these components to function properly, we got to style the EV harness which connects all the components of the EV making it into one body. Wiring harness forms the nervous system of the electrical system in any vehicle electrical system design. However, thanks to lack of clarity at the start of the project, designing of wire harness is given the last priority. The aim of this project is to style an electrical vehicle harness consistent with the necessity of the most components of the EV and also to optimize cost, serviceability and assembly point of view, using AutoCAD electrical.**

Keywords: Electric vehicle, EV harness, electrical architecture, optimize cost, AutoCAD electrical.

INTRODUCTION:

Nowadays it's been seen that the non-renewable energy sources are getting extinct day by day. Thanks to this, the price of fuels, for running the vehicles has been increasing tremendously. So as to beat the costs of fuels, the utilization of electrical vehicle has been taken under consideration. Not to mention the pollution caused by all these ICE engines emitting harmful gases like, CO2 and CO, etc. which ends up in ozone depletion. Also, non-renewable energy banks are limited and that they need centuries to recharge. The most Important point is, we cannot recharge them as per our needs. Therefore, an alternate source of energy was required and here is how electrical vehicle comes into play.

The development of EVs without ICE engines are accelerating, and also, as the batteries and charging technologies evolve, the percentage of EVs in electrified vehicle sales increase along with them. An electrical drivetrain of an HEV or EV, mainly consists of a high-voltage battery and motor. They're connected by high-voltage wiring harnesses to perform power transfer. This paper mainly discusses about, how to design electrical harness based on the requirements.
The electric vehicles are mainly categorized into two types:

a) All electric vehicles (AEVs), which runs only on electric motor.

b) Plug-in hybrid electric vehicles (PHEVs), which runs both on ICE engines as well as using a motor.

All electric vehicles can again be further classified into:

1. Battery electric vehicles (BEVs) where the source of energy is only from battery.

2. Fuel cell electric vehicles (FCEVs), here the energy is provided from the fuel cell to run the motor.

We could only say the EVs are running on clean energy, if current for charging the vehicles are obtained from the renewable energy sources like solar, wind, hydroelectric etc. The most popular and efficient renewable energy resource, used for charging the battery, is obtained from solar energy.

PROPOSED METHOD:

The first step for building an electrical vehicle and its electrical harness, is to understand the purpose of the vehicle and to identify the components required along with its power ratings and connections.

Selection of main components of electric vehicle:

HUB MOTOR Brushless DC motors (BLDC) is a main-focus area for several motor manufacturers as these motors are better choice in many applications, especially when it comes to motor technology. With the invention of sensor less technology along with digital control, these motors have become more effective when it comes to total system cost, size and reliability.

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A brushless DC motor (also known as BLDC) is basically a permanent magnetic synchronous motor which runs on DC electricity.
There are some similarities between BLDC motors and brushed motors such as high efficiency, high speed, and minimal heating. The main advantage of using bldc hub motor is that their drivetrain is more simplified and they do eliminate differential losses. These motors are installed onto the wheel and depending on the purpose and design it can be onto the front wheel or rear wheel. Even handling and stability of the vehicle, is also increased by using this structural units. The motor selected for this application was 250 W motor 48 V with its peak power at 500 W. This motor is mounted to the rear wheel.

MOTOR CONTROLLER: Motor controller is one of the main important components of the EV system. It basically manages the current and voltage applied to the motor, in order for it to work efficiently. As brushless DC motor doesn't have brushes and commutator, it requires a controller which can help it to commutate. Power from the batteries is supplied to the motor controller which in turn is supplied to motor. The throttle will be linked to the variable resistors which regulates speed of the vehicle by providing signals to the motor controller. The motor and the controller will be procured from the same company as it will be easy for us to tune the controller along with the motor according to our needs. The controller which is selected is 48V 250W tuned BLDC controller

BATTERY: Batteries are the most expensive and the most heaviest comparing to all other existing components. Comparing to all other battery technology, the most prevailing battery technology, is the Lithium-ion battery, which is used in almost all the EV systems. When comparing to other batteries, Lithium-ion batteries are, far more superior when taken into consideration, high energy efficiency and power design, which reduces the weight of the EV substantially. Lithium batteries also have other important characteristics such as, a broad temperature range of operation, fast charging capability, low self-discharging rates, a considerable long-life cycle and almost no memory effects. Thanks to all these promising features, which help lithium-ion batteries to be adopted for commercial purposes like cell phones, laptops, computers, video cameras, digital cameras, power tools and most important, for the electrical vehicle. Battery, we have selected 600 Wh as minimum 50 to 65 Km range was required.

DC TO DC CONVERTER: This is also a main component of electrical vehicle although it is not a part of the main electrical drive train. Unlike ICE vehicle, auxiliary power for electrical vehicles is drawn from the battery even at motion, although they cannot use the power directly from the battery as battery has its voltage and current very high. Here the dc-to-dc converter comes into play. It reduces the voltage and current to the required value for the auxiliary systems. The DC-DC converts voltage from 48 to 12 V.

ELECTRICAL VEHICLE HARNESS: Electrical vehicle harness is like nervous system of a human body. It basically connects all the components together, supplying them with required amount of current and voltage. The harness which connects throttle to controller is called throttle harness, and the harness which connects battery to controller and other systems is called power-bus harness. The high-voltage current which gets converted to lower voltage by DC-DC for auxiliaries is called auxiliary harness.

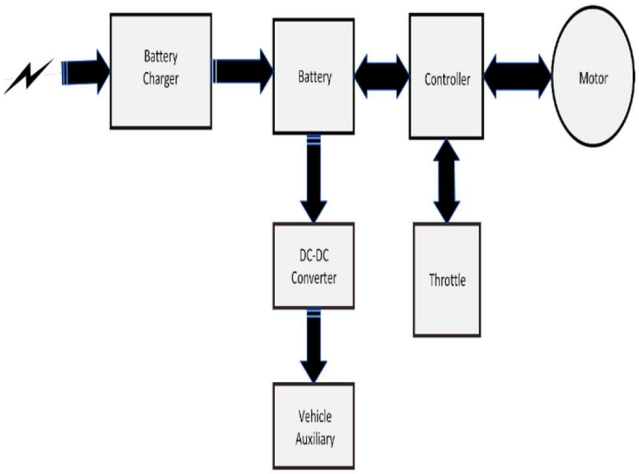

Figure 1: The block diagram helps us to understand how the components are connected with the help of wiring harness.

Once the components are selected, next step will be conduct studies and to identify the requirements for building a high-quality EV harness. What will be voltage at which each component is functioning. What type of connectors required by the components? Are water proof connectors required or not? Placing the connectors according to positioning of the components. The amount of heat shielding required for protecting the harness from the devices which may heat up during operations. There will be always a standard at which all the components will be manufactured, and IPC/WHMA-A-620 is the standard at which the EV harness is manufactured. And finally, what is the quality of the wires used? Mainly FLR wires are used in automobile industry because of its high resistance to heat and will not corrode when in contact with petrol or other harmful substances.

METHODOLOGY:
First step in order to design electrical harness is to prepare the complete electrical feature list containing all the components along with their ratings/capacity, their specifications, the types of wires required and the types of connectors used for mating with them. We should also make sure each component is supplied with current, voltage and earthing points as required, thereby not defecting the components by supplying more than required, along with complete circuit protection. Once the list is completed, by taking into consideration the installation or positioning of the components the harness can be designed using electrical design software. While designing the harness we should always keep the cost into consideration and compile the electrical circuit diagram for the vehicle. Once the harness is completed, it has to be routed inside the vehicle, therefore harness routing clips and supports are very important, for making the routing, neat and tidy.

SOFTWARE REQUIREMENT: The software at which the electrical harness is designed in this paper is called Electrical CAD 2021. This software is really easy to learn and it helps us to understand how the connections are made inside the

software

HARDWARE REQUIREMENT: Since the paper explains about how to develop and design electrical harness, all the components which are explained under proposed method is required. Along with that all the connectors used for designing the harness for E-bike are 110 series two pole,110 series three pole, 110 series six pole, 110 series four pole, 250 series two pole 250 series three pole, Anderson connector, JST connector and bullet connector.

RESULT: Using the electrical CAD, the EV harness for E-bike was designed successfully.

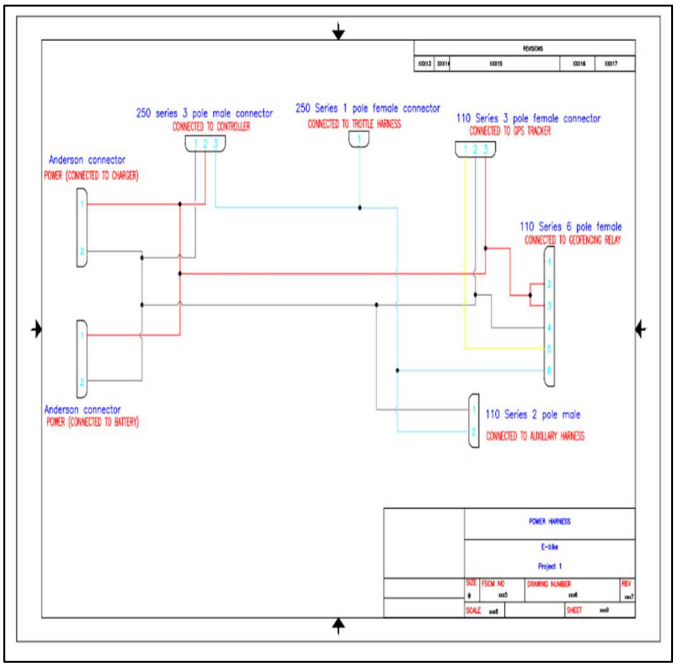

Figure 2: The Power-bus harness using electrical CAD

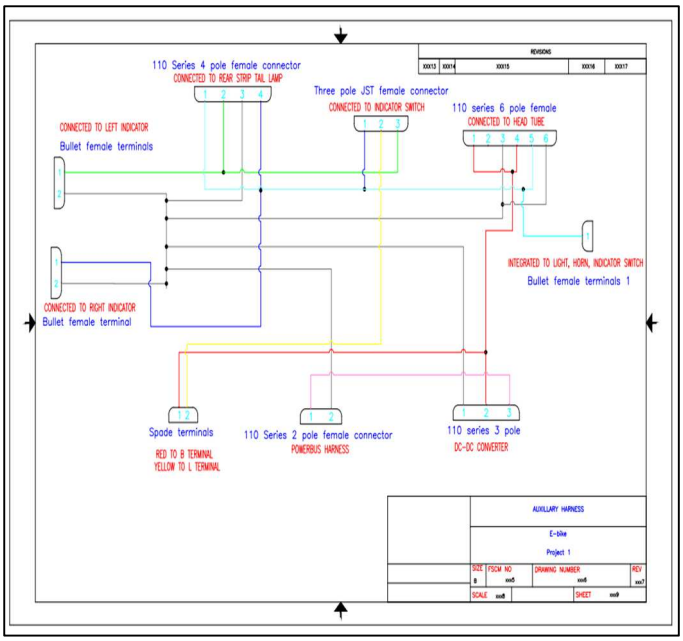

Figure 3: Auxiliary Harness designed using Electrical CAD

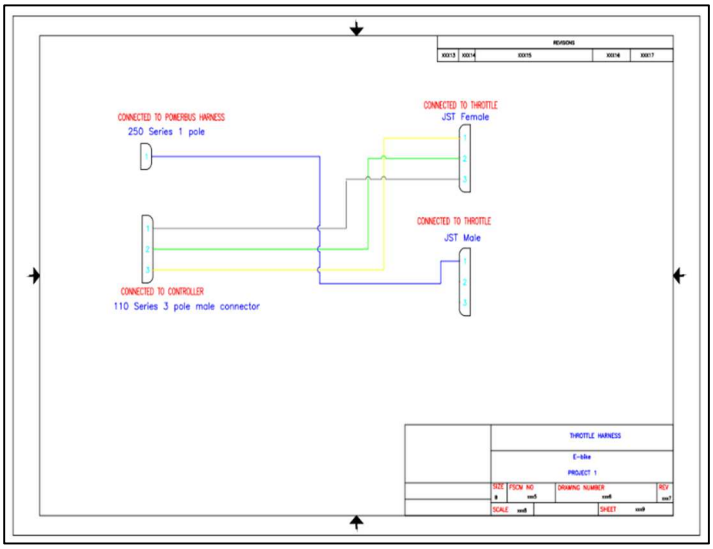

Figure 4: Throttle Harness designed using Electrical CAD

CONCLUSION:

The wire harness will be designed according to design and requirement of the new project, which is the latest E-bike two-wheeler. The wiring harness in any automotive vehicle plays a decisive role in the success or failure of the product. Hence, the design will be having a long-term impact for product meeting the target of quality, cost and timeline. Also, the final design decides many factors as customer service, assembly sequence and reliability of the electrical system. Any issues reported by the customer after the launch of vehicle, can result in CALL BACK of the vehicle. Hence, a critical analysis of all proto vehicle running feedback on the wire harness will be performed by the project team. Any project patent completed using the resources of a company will be owned by the company itself.

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