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Review on EV: Scope, Challenges and Role of Engineers

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Abstract*: Nowadays we are looking for economic development that is conducted without depletion of natural resources. Taking this into account the main motive of today's automotive industry is to reduce the use of contemporary automobiles and introduce renewable energy into the transportation sector. Vehicles running on natural gases are widely used in India in the public transport sector and taxis. The next revolution is expected in Electric Vehicles. Governments promote the use of EVs in private and public sector transportation by providing subsidies and other facilities. The scope of EVs in the Indian automobile market is increasing day by day. But along with that EV manufacturers and users are facing some challenges like battery charging time, temperature aspects, and higher manufacturing costs. This paper includes a review of the challenges and possible solutions. The role of engineers in the EV industry put forward so many opportunities to aspiring engineers. the role of different engineering streams is reviewed in this paper.

Keywords*: Electric Vehicles(EV), Battery Management System(BMS).

I. INTRODUCTION

Electric transportation offers ideal opportunities for the broader introduction of renewable to the transport sector. Along with that, these types of innovations and implementations help technical professionals like engineers to choose their dream roles and dream career. Before discussing the opportunities, we need to talk about the popularity of electric transportation methods like Battery Electric Vehicles (BEVs). The electric automobile market in India is growing over the last few decades and the authorities are expecting more than 30% of vehicles to be electric or hybrid by 2030. According to the Ministry of Skill Development and Entrepreneurship (MSDE), the electric automobile industry is going to create a huge number of jobs in the next 10 years in India. NITI Ayog and the Government of India are looking forward to the EV industry supporting the country's economic growth. To encourage this growth the central and state government have launched schemes and incentives and some regulations and standards are also in place.

II. SCOPE OF ELCTRIC VEHICLES

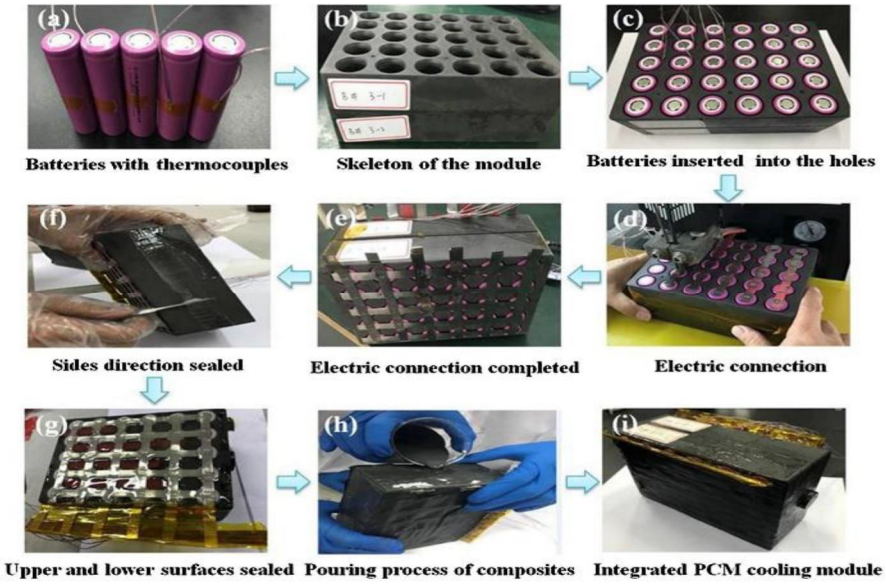
Sustainable development is an organizing principle for meeting human development goals while also sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend [1]. The Electric Vehicle industry in India is growing so fast. India is the 4th largest vehicle market in the world. The large-scale adoption of Battery Electric vehicles and Hybrid Electric vehicles could bring significant changes to our society. This change will be visible in transportation technology. However, this will enable our nation's economy away from imported petroleum. When we look at the mobility challenges faced by the rapidly growing population in Indian cities, the air pollution caused by vehicular tail pipe emission is a primary concern. The second big problem, for which looks almost impossible to solve, is the traffic congestion that slow down the traffic and cause loss of productivity. The overall effect of Electric Vehicles is that it provides people with an alternate, cost-effective solution for transportation. Along with this, we can save fossil fuels from running out prematurely and save our environment. The technology foundation for sustainable mobility is laid by electric vehicle (EV) technology that offers intrinsically high energy conversion efficiencies and zero vehicular tailpipe emission. The introduction of connected technologies in an EV makes it smart and creates unique value for customers. The moderate progress in the electrification of the automotive industry includes the hybrid vehicle, which acts as an alternative to conventional vehicles because of their performance and emission characteristics. Hybrid vehicles are designed with the combined advantages of IC engines and electric vehicle systems to overcome the shortfall of emissions, fossil fuel depletion, and range anxiety. Moreover, hybrid vehicles can be configured to obtain various objectives, such as better fuel efficiency, fewer emissions, reducing the wastage of energy, energy recovery while braking, size reduction in engines, etc. Clean energy and sustainable mobility are key drivers shaping our future. Disruptive technologies such as IoT, AI, ML, Advanced materials Additive manufacturing, Renewables and Energy storages are exponentially growing in their performance and their cost is falling very significantly [1]. Solar charging stations for electric vehicles have emerged as one of the best ways to reduce worlds dependence on fossil fuels for powering various modes of transport. This is due to the fact that electric vehicles are generally powered by electricity produced by fossil fuels, which is a massive cause of concern. As electric vehicles are getting more and more popular,

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III. CHALLENGES IN EV

One of the main challenges faced by the EV Market is its minimum availability of charging stations. The customers are still in a fear that what if we got stuck in somewhere, where we cant find a charging station in 10kmts visibility. This is handled by the government and automobile manufacturers by providing funds and a smooth procedure for planting charging stations in rural areas. Even nowadays researchers are encouraging the construction of solar-based charging stations. Awareness programs are provided by manufacturers to place solar grids in buildings by which they can conserve energy and also use this for charging their Electric Vehicles.

The new era has a significant growth in the usage of automobiles, and this will obviously increase the requirement of fuels to run them. And this will affect the atmosphere and climate as this will increase the pollution level. This motivated the automobile engineers to come up with the idea of hybrid vehicles, which will reduce the pollution level and encourage sustainable development that will take care of the main concerns of consumers like the lack of charging points and the charging time. Hybrid vehicles have the characteristics of both conventional internal combustion engines that use fuel as a source of energy and also electric motors that move the car[3]. Hybrid vehicles are capable of working on fuel and also electrical energy that is stored in the batteries of the vehicle. The design of hybrid vehicles has transformed the automobile industry. Hybrid vehicles are being standardized to achieve the same standards to that as non-hybrid vehicles to have a good fuel efficiency. The government authorities are ready to provide separate infrastructures and even separate rules for the smooth functioning of Electric Vehicles. Like providing relevant space and funding facilities for planting a charging station, and along with that changing the road rules which will encourage the citizens to move to EVs.



The long charging time is the main issue in the development of the EV market. Battery swapping is an alternative that involves exchanging discharged batteries for charged ones and provides flexibility to charge them separately. This de-links charging and battery usage and keeps the vehicle in operational mode with negligible downtime. The main reason for the performance of the battery swapping model is the flexibility of all energy demands for transport. Depending on power, size, and quality, prices for a replacement car battery range may vary. A compatible EV with a battery architecture designed for the BSS is needed in order to participate in battery swapping. In addition, prior to arriving at the BSS, the EV must schedule the battery swap ahead of time to confirm that a battery pack will be available for swap [4]. Other major challenges for an electric vehicle are the availability of raw material, recyclability, serviceability, safety, high initial cost, and infrastructure readiness. Core element used in vehicle batteries i.e. Li-ion is rarely found in India, for which there is a huge dependency on other nations like China and Congo. Also, the Li-ion element is toxic in nature so it is again challenging to recycle it or even dump it. Since the market is gradually adopting electric mobility solutions, the maintenance and service ecosystem is being established by all relevant stakeholders[5].

The arrival of Electric Vehicles smoothens the energy conservation ideas, but along with that, it comes up with a fear of short circuits and fire. Thermal runaway results in a rapid increase of battery cell temperature and pressure, this also results in the release of flammable gas. These flammable gases result in the initiation of flame ignited by the battery's high temperature, which eventually

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leads to a fire. Avoiding charging the EV battery immediately after the EV stops running will reduce the risk of fire, as the li-ion cells contained in the battery remain hot for some time. Give time for the battery to cool down and then put it on charge. . In order to prevent accidents related to the charging safety of electric vehicles and ensure proper safety of passengers and people, the charging safety and charging safety protection methods of electric vehicles have become the research priorities for scholars.[6] Battery Management System is the control center/brain of a battery pack. The BMS is a set of electronics that enable it to monitor and manage the battery‟s performance. It ensures that the battery operates within its safety margins. The Battery Management System is necessary for the safety of the battery and people using it, for overall performance management, and to prolong battery life. BMS continuously manages and communicates cell voltage, cell current, cell charge balancing, battery soc, and temperature in an understandable format to the user.[7]

IV. ROLE OF ENGINEERS IN ELECTRIC VEHICLES

As per the report by the Principal Scientific Advisor, the Indian Government has announced an outlay of Rs. 10,000 Crore for phase 2 Fame 2 scheme to boost electric mobility. As governments around the world unveil plans to end the sale of petrol and diesel vehicles, it won't take a long time until electric vehicles will take over both public and private transportation.



Everyone is looking for something new, something unique, and some add-ons to their regular life. The upcoming technologies like the Internet of Things, Artificial Intelligence, and advancement in manufacturing technologies opens a lot of opportunities for engineers to explore career options in the research and development of Battery Electric Vehicles.

The major challenges faced by BEVs are the battery charging time, battery size, performance, and life of batteries. The variable torque requirement and need for improvement in battery performance are like an opened door to the world of research and development for engineers.

An important aspect of a Battery Electric Vehicle is its electric design. An electric engineer can enhance the present design of Electric Vehicle by implementing improvements in Electrical Vehicles. The opportunities to implement the system with better design from the point of view of the environment and economic aspect can be considered the responsibility and opportunity of a design engineer. The user experience and customer satisfaction are always the priority when it comes to automobile design.

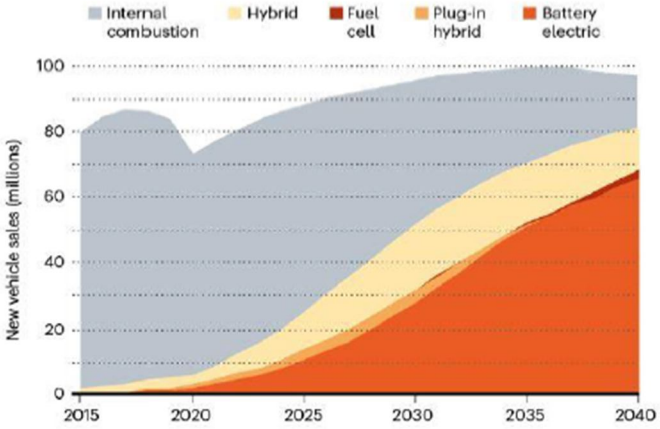
A skilled workforce is a must for the better performance of electric vehicle manufacturing. The skill associated with manufacturing process design, battery design, and motor design and operations.

The Battery Electric Vehicles demand Electric and Electronics maintenance. So, the development of electric & electronics maintenance. So, the development of electric and electronics maintenance workshops will be the need of time in upcoming years. The wide world of electric maintenance of automobiles is open to engineers to explore and start with their enterprises.

Many industries like TATA, OLA, etc. are coming forward and proposing to install charging stations in metro cities to urban areas. One can think of start-up opportunities in these areas as charging stations and this will be the next alternative to petrol and diesel pumps.

In 2014 Government of India Launched the MAKE IN INDIA campaign to encourage companies to manufacture their products in India. By Taking inspiration from this many industries has established itself as a leading manufacturer of industrial battery chargers and control panels. The main objectives are, to increase the manufacturing sector‟s growth rate to 12-14% per annum, create more opportunities and ensure that the manufacturing sector‟s contribution to GDP is increased to 25% by 2025.Thus many startups are coming forward with the same objectives and making electric transportation grow at a fast pace. Both vehicle manufacturing and implementation of the new charging station and charging methods are also included in this growth. While looking into the components of a DC charging station, components like microcontroller and semiconductors, connectors, and magnetic core

materials need to be imported for the implementation of a DC Charging station. But most of the other components like enclosures, PCBs, and all passive PCB level passive components are locally sourced and manufactured. Due to the attractive pricing for chargers in India, there are export opportunities in South East Asia, Africa & Middle East. Ease of access to the regional testing labs results in faster development and certification. And as the Government gives preference to these types of Local Manufacturers by giving Government tenders, the entrepreneurs are considering this as a profitable market.

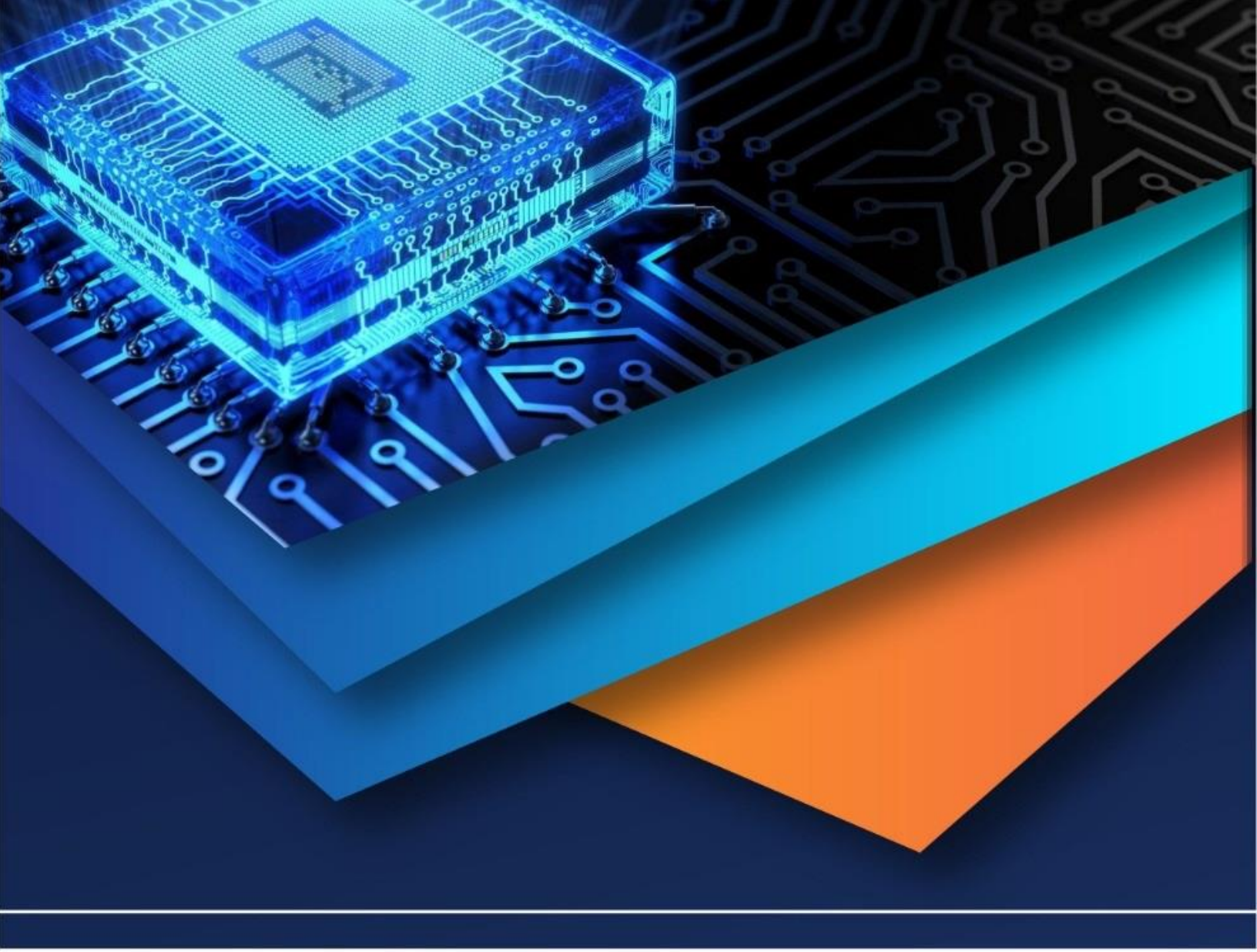


V. INFERENCE

As the popularity of BEVs unveils an uncounted number of opportunities for engineers. They must be prepared to grab the opportunities. Develop and encourage the skills required to fulfill these roles and make your dream come true.

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