

Hazards Associated with EVS - A Review

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Abstract- This paper aims to spot the various hazards and important safety concern areas in EVs as this is one of the new and innovative concepts in the world as well as automobile industries. This review paper contains various possible risks arising from the use of EVs and the work which had been done to overcome all those risks occurring during the regular use of an EV.

Keywords- Electric Vehicle (EV); green transportation tool; hazards; safety

I. INTRODUCTION

In the 21st century, researchers and scientists all over the world are concerned about the use of EVs as it had grown as an improved green transportation tool. Due to the various problems caused by the gasoline engine on the environment and public health, the automobile industry is now switching toward electrically powered vehicles. At this time when the fuel prices are catching their sky high and the running cost of the conventional vehicles is rising abruptly as well as it is the need of today to protect the environment, the eco-friendly alternatives of transport are very few. So, to overcome all these problems, an EV is the best option as it can run with fewer expenses in a limited range. A simple EV is powered by electricity which is stored with the help of a battery. It has a relatively low maintenance cost as well as can conveniently charge at home. EVs are environmentally friendly and play an important role in the automobile industry as they are the most promising sustainable source which differs from the conventional vehicles in reducing the various gases emissions thus controlling the furious condition of global warming. It also helps in controlling the use of various energy resources which are on the way to depletion or extinction. As the future demands to take care of all the natural resources, EV is the best option to use which helps in the development of an extra power source when there is a scarcity of renewable energy sources EVs have so many essential and new features which are important in

upcoming days as the whole world is experiencing the bad impacts caused due to conventional vehicles. EVs are eco-friendly as well as human friendly. While considering human life, EVs can help in improving the various aspects of it by reducing pollution and supporting health-related factors [1].

Electric vehicles are much better than conventional vehicles using internal combustion engines. Due to the rapidly increasing prices of petrol and diesel, it is essential to find the relevant alternative technology in the automobile sector like an EV. Although the initial investment cost of an EV

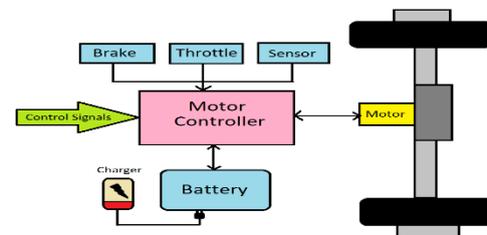


Fig: A common layout of an EV

is more than that of conventional vehicles, in the current situation environment should be given more preference than any other thing. When an EV is compared with the conventional vehicles it is found that an EV is 97% cleaner than the conventional vehicles with a great level of comfort and ease of operation [2].

As an EV has so many benefits while considering the various areas like environment, human life, natural resources, etc. its demand should be increased but it is not a real case. Though an EV plays an important role in the automobile sector, its demand is not that much. As there are some risks or hazards in EVs which should be considered so that it will be possible to overcome the actual problems related to them. EVs can be used for amusement and it is a very useful way to get around but they can also have serious safety hazards. So, it is very much

important that an EV should be designed by considering the various hazards in it. An EV is the future of the automobile industry as it not only reduces the use of fossil fuels but also helps in reducing the impact of ozone-depleting pollutants.

II. EVOLUTION OF EVS

The invention of EVs does not belong to anyone inventor as it evolved through a series of inventions and efforts. The demand for EVs in the market is moreover over the last 100 years and it will continue to increase. The first electric vehicle is invented in the 1800s, the innovators from various countries began their research on the concept of a vehicle that was battery-powered and created some small-scale electric cars. These EVs were different from the vehicles working on steam or gasoline. The emission of pollutants which was the major problem was recovered by EVs, and they were easy to drive as well. EVs immediately became popular in urban areas for short trips around the cities. And at the same time, access to electricity became easy so the process of charging EVs also became easy. Later by considering the increased demand for EVs many inventors started finding new ways to improve them [3].

III. HAZARDS ASSOCIATED WITH EVS

EVs are mainly evolved to replace the internal combustion engine vehicles by considering the increasingly severe environmental problems and decrease in the sources of fossil fuels. EV is more energy-efficient and environmentally friendly compared to conventional vehicles. Many inventions are already done to improve the performance of an EV and reduce its hazards. The various commonly seen hazards in EVs are studied well and the research is done to overcome the problems created while using an EV.

The hazards in EV include various electrical, chemical, and thermal hazards, hazards caused due to the damaged components of an EV, etc. The analysis of the risks in EVs is done based on hazard rating. The most common hazards are caused due to the battery, wiring, brakes, etc. These hazards may lead to various accidents like firing and explosion, road accidents, and many more. Due to the risks in EVs, it is essential to give a quick look at all these factors so that the EVs can perform well with all necessary improvements [4].

The most occurred hazard in EVs is related to the most important component of it, which is a Lithium-ion battery. Due to the outstanding performance of Lithium-ion battery, it is widely used in EVs, but continuous fires and explosions restrict their applications. The scope of improvement in Lithium-ion is mostly related to cell safety which includes cell chemistry, cooling and balancing, and some current safety standards as well. Due to some limited safety performances in Lithium-ion batteries, their inherent characteristics like high specific capacity and voltage, no memory, little self-discharge, and wide temperature range of operations may hamper [5]. The Lithium-ion battery fails mostly due to the unstable electrochemical system. The various reactions in

a battery are controlled by voltage and temperature. The continuous heat and gas generation leads to the wear and tear of the battery and ignition of combustible materials. The external environment also affects the working of a battery. Several kinds of research are done and the work had been published covering the safety of battery-related topics such as electrolytes, the materials of cathode and anode, advanced batteries, and battery thermal runaway issues as well [6]. Some solutions are also proposed to improve the battery safety in any condition by adjusting the cell's internal chemistry, improving the cooling system of a cell, and cell balancing.

The electrical hazards in EVs are mainly caused due to the damaged wiring as it is too much dangerous and unsafe to touch the EV, when an accident occurs with it, having high voltage integrated components. The voltages of an EV are very high than a normal protective voltage. So, the electrical hazards should be seriously taken into consideration while designing an EV, as safety from the electrical hazard is a must. Various technical measures such as the high voltage interlock mechanism and insulation monitoring of the energy storage system can make an EV safe from unusual hazards. All the high-voltage electrical components are designed in such a way that, the danger caused due to touch can be avoided. All these components are galvanically isolated from the low voltage system and the whole body of the vehicle.

The chemical hazards are the mostly occurred hazards in the case of an EV which caused due to the release of the hydrocarbons and hydrogen fluorides. These substances show their dangerous results when they come in contact with a human through the process of inhalation. The hydrocarbons released from the cell can ignite and can cause a big explosion as well if the system has no relevant venting mechanism. The same is the case with hydrogen fluorides, which are released when a battery fires. It is a very toxic, corrosive, and highly reactive substance that causes bad impacts on human health.

While considering the factor temperature, the thermal hazards in an EV come into the picture. If the cells of a Lithium-ion battery are exposed to a high temperature above their normal operating temperature range which usually does not exceed 60 degrees celsius, some reactions take place in a cell. These reactions are exothermic due to which a large amount of heat is liberated from the cell which results in thermal hazards. If one cell of the battery undergoes thermal runaway, another adjacent cell also gets damaged due to the high temperature of the first cell. This process caused due to the thermal runaway in an EV is difficult to stop as it involves the exothermic reaction during decomposition [4].

The most common and risky hazard in an EV is related to the low noise problem in it. The low noise in an EV has two sides, one is the advantage of it and another is the loss that occurs due to it. The advantage of the low noise is very much important as it is related to the environment, helping in reducing the noise pollution caused due to unwanted noises from the vehicles. But the other side is that because of the low noise in an EV at low

speeds the life taken risk may occur while using an EV on the roads. These risky situations generally occur in urban areas while crossing the roads as it is very difficult for the road users to sense and hear the sound from the EV while walking and they may get injured. In an EV at low speed, the engine does not produce any sound due to which it becomes difficult to detect the vehicle. So, the absence of noise may lead the unavoidable accidents while using the EV [7].

There are some other cases as well in which an EV may become hazardous such as while charging the EV at the garage, at home, or any public charging station, it may get fired which leads to accidents and deaths. While repairing an EV some mistake is done by the worker, the EV may get short-circuited. If while changing the tier of an EV, the jack is misplaced and if it pushes the high voltage battery, a dangerous situation may occur which leads to an accident. There are some chances of fire when an EV is loaded onto the tow truck as it consists of many electrical components [4].

As there are so many situations in which an EV gets damaged and due to which the human life is in danger, there are so many areas related to various hazards in an EV where there is a huge scope for improvement as some work is already done in past few years and some is still going on.

IV. CONCLUSION

Electric vehicles have many benefits and advantages over internal combustion engine vehicles. Nowadays, people are shifting slightly towards electric vehicles due to the advancement in them than conventional vehicles. The industries manufacturing EVs are extremely welcomed in recent years because of their support in saving the environment by reducing the emissions causing global warming and ozone layer depletion.

But according to the research which had been already done on the EVs, it is found that there are some disadvantages as well. Along with the general observations it is found that there is a huge need for work on the various hazards in an EV. The hazards like battery hazard, electrical hazard, thermal hazard, chemical hazard, and low noise hazard, are seen repeatedly in the

case of an EV. Some hazards are spotted and research is conducted to overcome them. Otherwise, the electric vehicle is the best transportation tool considering its various benefits of it.

V. FUTURE SCOPE

EVs are now started becoming popular for general use as it is the future of the automobile sector. In an EV, the battery plays a vital role and many of the discussed hazards mainly revolve around the battery, so if the research is done on it, the EV's future is the most promising. In the future, all the problems or hazards in EVs need to be solved. Each condition needs to be evaluated related to the risks by considering the user. The work is needed to be done in each circumstance which will help in improving the quality of an EV and reducing the unwanted hazards in it. It is the need of future that more efforts should be done to make the EVs excellent so that they can easily stand with the current scenario. If all these needs are fulfilled properly, then EVs can be the most efficient and best option of transportation.

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