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ASSEMBLING AND TESTING OF ELECTRIC CAR

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Abstract - *The focus of this paper is to describe the future of an electric car which has a good range as well as how the electric car can be used instead of IC engine vehicle for normal passenger cars. As the emission norms are getting strict day by day there is a need to develop alternate ways in which the vehicles can be driven without polluting the environment. In this paper a review on electric cars development as well as development in the field of components of electric car such as motor, controller, battery, and chassis development are presented. Alternative solutions such as hydrogen fuel cells are also described as well as a comparison between electric power plants and IC engine vehicle emissions are also discussed along with their effects on the environment. Various features which can be incorporated in the electric car for increasing the range are also discussed in this paper.*

***Key Words*: Electric Car, Motor, Battery, Pollution, Range**

1. INTRODUCTION

Paul et al. [1], as air pollution has became an potential threat to environment and if not controlled can lead to adverse effects of global warming, temperature rise, ozone depletion, etc. which mainly occurs due to emissions of toxic gases from automobiles and electric power plant such as nitrogen oxide, carbon monoxide, sulphur dioxide, carbon dioxide. The author has described different approaches that can help to reduce the air pollution by comparing the amount and percentage of pollutants that are emitting from IC engine cars and electric power plants in case of electric cars. Based on this comparison the author has described that the IC engine gasoline vehicle with controlled emission norms would be more effective than an electric car which uses electricity from coal as a burning fuel in power plants.

David et al. [2], in this paper author states the progress and development of the vehicles in safety parameter. Before the vehicles were fully operated by mechanical and hydraulic powered components. Due to electronic systems the all over driving experience increases. The paper defines the progress made in the development of sensor systems in over all decades. The sensors should be integrated all over the vehicle design for to be effective. Before designing the vehicle appearance, the importance of location of the sensors is to be implemented. There is a broad interest in countries like United States, Japan, Germany, and several European countries for the use of electronic sensor systems which are used for vehicle safety.

Roy et al. [3], as I.C Engines are producing lot of exhaust particulate emissions. Due to this manufactures had to rethink to use alternate fuels for lesser emissions. CNG is the best fuel for I.C Engines due to its potential for low NOx emissions and particulate matters. As diesel engines make more pollution, the substitute for those is CNG complained engines. Changes in compression ratio, Piston design and piston rings are done. The ratio of air-fuel is 27:1 for better complete combustion and low NOx level. Low turbulence piston was manufactured specifically for CNG Engines. Exhaust emissions would be affected by Air-Fuel ratio and ignition timing.

Harding et al. [4], in this article the author have described a 5 passenger prototype car that has been used to build and develop a hybrid electric car. The main purpose of this car was to increase the range of the vehicle by inclusion of an electric motor as well as to reduce the emissions. The car was built to run on the following modes – The first mode was based on electric power only in which the motor alone is capable of propelling the vehicle forward. In the second mode the IC engine power was used to drive the vehicle and in the third mode the vehicle uses both engine powers along with motor power for the purpose of overtaking and to climb hills.

Corbo et al. [5], in recent years the improvement and advancement in fuel for the propulsion system is done for the betterment of environment. The transportation sector has been proposed with electric vehicle for reducing air pollution concern. Due to this various ways were researched to produce the electricity for powering vehicles. Hydrogen fuel cell is one of them, which converts the hydrogen fuel into electric energy thus powering the electric motor. To convert hydrogen fuel into electric energy PEM (Proton Exchange Membrane) fuel cell is used which uses polymeric membrane as electrolyte. PEM is used because it can operate at low pressure and temperature and the life span is also very good if hydrogen is used as a fuel. Thus the availability of hydrogen in environment is abundant but the main concern in this research was the production of hydrogen fuel for vehicles. Two catalytic processes were used to produce hydrogen which is Steam Reforming and Partial oxidation.

Robert et al. [6], in this paper the author has described a four door, 5 passenger electric car. This car was developed in January 1967 to provide economical, pollution free

transportation to urban and suburban residents where the residents were suffering from harmful effects of air pollution due to hazardous gases which were emitted by conventional IC engine operated vehicles. The battery used for powering the motor was a Tri-polar, lead-cobalt battery. The main advantage of this battery was that the harmful gases which are produced in the cells are greatly eliminated. The conventional lead acid batteries while charging process emits stibine gas, the hydride of antimony SbH3, which is a very harmful gas. To resolve the problem of overcharge of battery along with oxidation of positive grids speeds up the transfer of antimony from positive to negative plate. The sulphuric acid electrolyte of tri-polar battery consists of a solution of cobaltus sulphate which acts as a protection coat on the positive grid. Due to this the production of the toxic gas (Stibine gas) during charging of battery is eliminated. This battery also has an advantage of lower required charging voltage which helps in fast charging.

Richard et al. [7], the future of electric sports car has been described along with their design consideration. The design presented is based on conversion of an electric car into a hybrid sports car. This paper describes new design concept along with the location consideration of different components of the vehicle such as motor, battery, controller, and alternator with a twin cylinder engine which can be used as an option for increasing the range or run the vehicle if battery voltage falls below specified limit.

Hartman et al. [8], the author has described various speed controllers along with their operation as well as various connections of batteries in series and parallel. The author has also elaborated how these connections would help in transferring nearly 100% power from battery to the motor continuously while the motor is in operation. It also includes how the freewheeling diode is used for eliminating the arcing. The contactors designed also had a longer life for smooth torque transfer.

Junghsen et al. [9], the objective of this paper was Low-emission vehicles and Zero-emission vehicles has been a long term battle of both public and private sectors. There were several major reasons. First, the highway transportation is heavily depends on the petroleum which may result in serious economic impact in case of oil supply storage. Second, nearly 50% of petroleum is supplied by countries outside United States, which contributes to a large portion of trade shortage. Third, the emissions from IC Engines corrupt the environment and ecology. The emissions from combustion severely pollute the environment which is not only harmful to human health but also affects ecological chains.

Rishavy et al. [10], this paper describes the General Motors electric car program which resulted in two battery powered passenger cars, Electrovair I and II. These cars were built to evaluate new motor and control concepts. The program proved that modern high performance electric cars are technically practical. However, a good electric power source is needed and present costs are too high to make electric vehicles economically practical.

Anandhan et al. [11], the power train of a series hybrid electric car was designed to meet the specified requirements hybrid electric four wheeler car. Gasoline fuel energy density is much higher than the electro chemical battery system. The 28 Kg of gasoline produce 330 KWh energy but the same weight battery produces only 1.1 KWh. The only plug-in EV suffers from high cost and limited range of drive. The hybrid EV technology combines the advantages of IC engine and plug-in EV's, thus a practical solution to meet the requirements of performance and low emission.

Silveira et al. [12], an electric car is a vehicle which uses one or more electric motors for its propulsion. The authors researched to construct small automotive cars of high efficiency. The main aim was to develop and apply new technologies that allow increasing the efficiency of electric cars and to study the behavior of the efficiency of the car and the freedom of the battery, as a function of the kind of the electric motor. A brushed DC motor, connected to a 12 V, 6 Ah battery, was engaged to drive the car. Measurements showed that the electric power required by the brushed DC motor was equal to 80 W, with an efficiency of 53%, when operating at minimal conditions. Other brushed DC motors were tested and they result show small efficiency, too. The efficiency of conventional DC machines was affected by the drops in the brushes and by the sliding contact between brushes and the commutator. With the purpose of increasing the efficiency of the car, because of this reason the brushed DC motor was replaced by a BLDC motor driven and controlled by an electronic circuit.

George et al. [13], the adoption of battery-operated cars by the turn of the century could be a less costly control of automotive air pollution than the prohibition of most of the emissions from the IC engine. But another 30 or 40 years must pass before electric cars could out number combustion engine ones on our roads, due to the research, development and manufacturing problems ahead. Permitting only safe batteries in future electric cars reduces their performance and top speed capabilities to ordinary levels. On the other hand, acceptance of the fused-salt electrochemical energy stores would allow performances and speeds comparable to those of modern intermediate-size domestic models. Future electric cars range is unrelated to frequency of home-charging if fast battery exchange schemes were to be available at service stations.

Symons et al. [14], for a commercially successful electric car, the rechargeable batteries are used as a power source. The requirements for a good battery system are ease of cooling, constant voltage and current characteristics

during the period of power consumption and maintenance. The batteries should be capable of charging at various powers and speed. For 200 miles the energy stored in the battery is 75 kW-h. The costing of the battery management system has to be less. In batteries, zinc and chlorine are used as active elements. The electro chemical reactions in the battery should not side react.

Andreas et al. [15], now a day due to increasing demand in automotive industries, new technologies are introduced in automotive sectors for the beneficial uses. With the help of rapid prototyping the author has described how a model base can be created using executable software, it has many advantage instead of traditional development process. Energy conversion and storage at the University of UIM has developed a series hybrid electric drive train. In this base process the implementation is based on the system model additional code generation in RTW has to be adapted to specific target means of three different code generation targets which consist of few scripts and some system dependent block sets to include the target hardware.

Williams et al. [16], in this article the author has discussed about the energy which was essentially required for both operation and construction of variety of car were calculated and estimated. A fuel cell vehicle offer major energy saving from the forgoing arguments that the electric battery vehicle will requires much energy for its construction as would a gasoline powered equivalent.

Boyune et al. [17], the author had presented a detailed study on electric vehicle technology with different type of battery which had faced so many troubleshoot: high cost, weight, long charging time required, and the danger of electric shock. By using contactless power transfer we can overcome the inductive power transfer pickup of electric vehicle problem. In this paper, by using series capacitor with ferrite cores, multi windings they developed inductive power pickup. And tested at power output of 20kw and efficiency of 86.7% at 20 KHz and 250mm air gap. As the power output enhance with pickup current value of secondary winding. As current value of pickup increase, core loss in secondary winding increases due to magnetic flux. Due core loss it leads to decreased transfer efficiency. High power transfer pickup rated output power of 20kw and the transfer efficiency as high as 87.7%.

Anil et al. [18], in this article the authors had discussed pollution situation in large cities and the need to develop specific city cars to reduce burden on environment. The limiting factors for the commercial vehicle and city vehicle were the power to weight ratio. This occurs due to battery management system. Due to this pricing of the vehicle increases. The general public contribute low level of interest due to high initial cost, limited range and high operating cost.

Dimarogonas et al. [19], in this paper the authors had presented design of electric cars powered by rechargeable batteries these vehicles that could contribute significantly to the reduction pollution in big cities. The vehicle shape was of major importance for the market and it represented the car's philosophy and character. Electric cars are not just concept cars, but they are going to become part of the future cars. Of course, the cost of an electric car can't be compared with the IC engine vehicle.

Agarwal et al. [20], the paper describes the energy required for charging an electric car through the Energy Source which is Electric Power Plants, which generally burns coal for producing electricity. Indirectly for running of vehicle on road the engine was used for producing energy. So the alternative fuel method is great for future.

Jm et al. [21], in this paper a detailed study was presented on the effect of vibration on electrical, electric component and other electric equipment is directly acted as market durability failure of the product. Excessive warranty claim can be avoid with proper design of HEV batteries system and understanding the magnitude and frequency of the vibration input that help to minimise the failure due to vibration and achieve predicted life of battery.

Tang et al. [22], the main aim of this study was to establish rear end camera which could be used as collision warning system for enhancing the safety of the vehicle, by using a mounted rear end monitoring camera. This idea was developed to avoid the accidents which are causing due to inattentive drivers. With the help of image processing, distance, acceleration, velocity of the follower vehicle can be measured. This type of technique is widely in existing vehicle in many cars.

Tinting et al. [23], this paper proposed a smart electric car park model which includes electric power flow in two directions which is known as V2G and G2V. The main focus of this model was to provide a means to the car park owners and EV customers to buy and sell the electricity in terms of active or reactive power with the help of grids. The authors have proposed that this charging and discharging grid system can provide better profits to the car park owners and EV customers economically as compared to the results of the conventional charging method.

2. CONCLUSION

After studying the research papers and collecting the information about the growth in development of electric cars, the progress that the electric vehicle industry has seen in recent years is extremely necessary as an alternative way to reduce the greenhouse gas levels and to provide a means of transportation. The biggest obstacles to the widespread adoption of electric powered transportation are the development of charging stations and the costs of the vehicles as compared to conventional

IC engine vehicles and the another main concern is the production of electricity from the power plants with regulated emissions.

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