Electrically Driven Vehicle with Automatic and Manual Charging

S.D.Kumar, Raja Bala Yoga Naveen, T.Rahul, B.Surrendran, P. ShanmukhaAravind

Abstract: ***The use of conventional system for transportation has already had a source effect on the environment. This has called for the urgent shift to an alternative technology-Electric vehicles. This change has a lot of effect on the consumers as well as the environment. In order to encourage this change, we propose a method for electric vehicles fitted with various charging techniques .The engine and gearbox assembly is replaced with a motor and a axle setup and the power transmission takes place with the help of a chain drive, dynamo is fitted to scavenge the energy and supply back to the battery setup. A manual rotating mechanism is also provided for rotating the dynamo.***

Key words: Charging, Conversion, Electrical vehicle, Dynamo.

I. INTRODUCTION

There are multiple problems caused due to the emission of pollutants into the environment, ranging from decreasing air quality,disruption of flora and fauna, and several other hazards. It is found that automobiles alones contribute to half of the carbon-di-oxide produced, quarter of the nitrous oxide and hydrocarbons present in the environment this has compelled the government to take drastic measures in the field of automobile emission regulations .several changes have made in the existing rules and regulations including the modification of engines. It is expected that by the year 2020, a complete ban of 2 strokes engines and a partial ban of 4 stroke

Engines to come into effect, a survey recently conducted in a metropolitan city of India concluded that about 40% of

II. LITERATURE REVIEW

1.Joeri Van Mierlo in his papers stated about the evolution of electrical vehicles from its origin,needs of transformation into electrical vehicles, the impact these vehicles have on the economy and the different effects and outcomes of the same.

Auto rickshaws are powered by 2 stroke engines. Auto rickshaws are one of the most used transportation systems in the country and the fact that these vehicles will be forced to be scraped due to the government regulations,though mechanically stable is inevitable, this made us come up with the idea of converting these auto rickshaws into electrically driven ones powered by batteries and motor. We propose the solution of replacing the IC engines which powers auto rickshaws with a electrically driven system, the use of brush less DC motor and controller setup is considered lead acid batteries are used due their ease of availability and being available at a nominal price but we suggest the use of lithium ion, solid state batteries in the future due to their high number of running cycles and efficiency. The conversion is carried out by removing the engine and gear box setup and placing a suitable motor mount as a substitute, the motors output is received by a chain sprocket and is transferred to the axle with the help of a chain drive additional provisions are required to place the batteries in place, in order to reuse the energy lost a dynamo is mounted at fitted to the axle with the help of a belt drive. A buck booster setup is used to supply the voltage produced by the dynamo safely to the battery. For automatic charging we suggest the use of the switch mode power supply setup (SMPS). In order to make the vehicle more user friendly a manual charging technique is suggested which includes a chain drive coupled the dynamo in one end and the other end can be manually powered.

2.Avmeric Girard has mentioned about the need of conversion into alternative energy sources and the various steps to be followed. He also focused on the power grid and stated the considerable decrease in co2 emission when compared to IC engine equivalents when electrical systems are employed.

3.Waleed Salman had mentioned an innovative way of scavenging the energy and using the same to power smaller electrical devices and circuits for the electrical vehicle. This was carried out with the proposal of a high energy regenerative shock absorber.

4.Larisa Gabsalikhov has identified the problem of providing power systems for urbanised areas which require a large amount fossil fuels for its functioning which in turn possess a serious threat to the environment in multiple ways. She suggests an alternative approach by converting them into electrical busses.

5.K.John Holmes has conducted a study on the different types of electrical vehicles available in the market, the different problems to be overcome in deploying plug in electrical vehicles .He also discusses about the infrastructure required for developing charging stations for electrical vehicles

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6.C M Dinis has conducted a study on three different methods of charging lead acid batteries namely the constant current method, the constant voltage method, the mixed method. He also states the precautions to be taken in order to avoid the possibilities of overcharging and overheating while charging lead acid batteries

III. DESIGN AND ANALYSIS

The design selected was a three wheeler auto rickshaw Chassis since it is one of the most common modes of transportation in India. The chassis along with its suspension system, wheels were kept intact. For the purpose of breaking new master cylinder was fitted and brake lines were altered as per requirement. A motor mount was designed to hold in place the selected motor. The motor output was received via chain sprocket and transferred with the help of chain drive. An axle was designed to replace the gear box and differential assembly and it accommodated a sprocket, and pulley for the dynamo. A small chain drive arrangement was provided as the hand driven mechanism for rotating the dynamo. A rack setup was provided to accommodate the lead acid batteries that were used to power the motor setup. A booster setup was also included to complete the dynamo circuit and act as a regenerative source for the batteries. Copper wires with polymeric insulating materials were used to connect the different components

The chassis was designed in solid works software and was also analysed using the same. The analysis included Side impact stress deformation, Rear impact displacement, rear impact formation, side impact displacement, front impact analysis displacement, front impact analysis stress deformation for 1500 N.

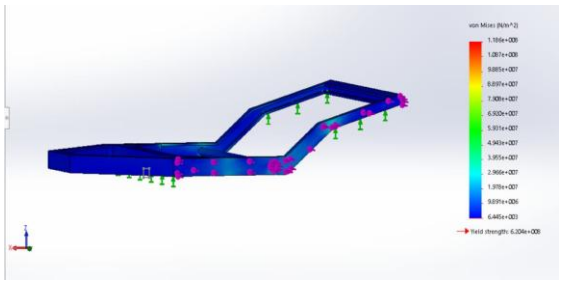

Fig 1 Side impact stress deformation

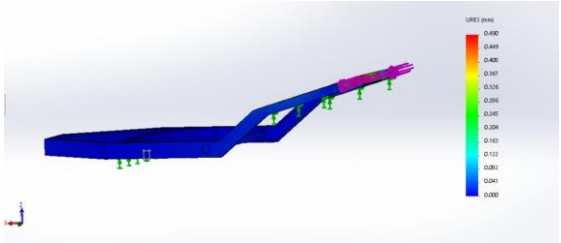

Fig. 2 Rear impact displacement

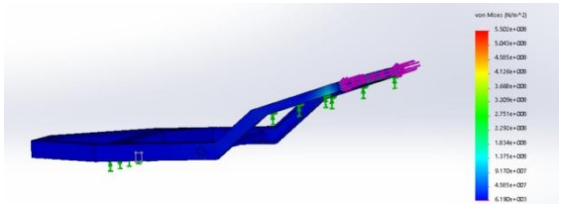

Fig. 3 Rear impact deformation

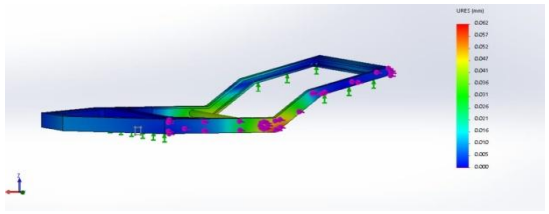

Fig. 4 Side impact displacement

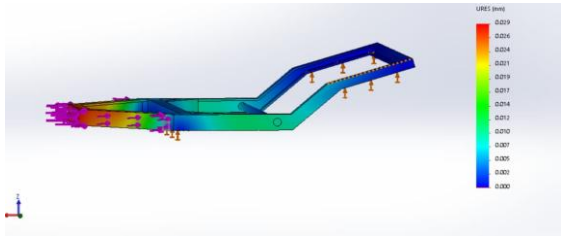

Fig. 5 Front impact analysis displacement

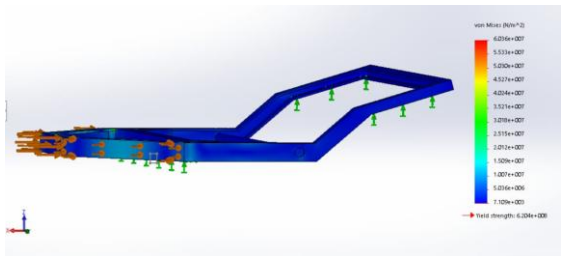

Fig .6Front impact analysis stress deformation

IV.COMPONENTS AND SPECIFICATIONS

DC MOTOR: A battery poered dc motor is requiredto power the system in order to perform this a permanent magnet DC motor was used with the output being transferred to the the axle with the help of a chain drive.. This motor has voltage of 12V and 750W and runs around 1000 rpm. The output current could be found as:

I = Power of Motor/ Voltage of Motor

I= 750 W/ 24V = **31.25A**

The Output speed can be found as:

N = Speed of motor / input voltage of motor:

N = 1000 RPM/ 24V= **42V**

BATTERY: Lead acid batteries were chosen for this purpose due to their availability and low price. Lithium ion and solid state batteries could be used for quicker charging and better performance of the system on the whole

Battery Power is the product of the voltage and the current capacity of the battery and this equals to:

Battery Power = 12V X 42Ah = 504 Watt hr.

For two batteries = 504+504 = 1008 KWhr.

Now using this value we can find the total time to discharge for the battery.DYNAMO: A dynamo is a device that converts energy from one form to another, here we aim at operating a dynamo which converts energy from mechanical to electrical form A dynamo has been used in order to scavenge the energy loss during the operation of the vehicle, a chain drive is used to directly connect the axis rotation to that of the dynamo. Here we use a 12V 22AH battery.

BOOSTER: The buck boost converter XL6009 was chosen for the purpose of amplifying the output voltage from the dynamo to the battery, the input range for the converter is in the ranges 3-30V and its output ranges 5-30V at 1.2 AH

V. CONVERSION AND CALCULATION

5.1 Motor Power (Pw)

Engine power is the maximum possible output the engine can give as an output. The power output given by the engine depends on various factors such as size and design of the engine, the load to be pulled,and the speed at which the engine is running.The motor is made to run from the energy provided by the batteries . The motor power is determined by the velocity and load and current at which the motor runs.. The theoretical value of the power is calculated by using the equation given below,

$$P_W = VI \text{ (Watts)}$$

Here Power (P) in Watts and the velocity V in m/s. Current I in amp. The power of the motor hugely depends on the load pulled by it , as it determines the torque required which varies directly to it.

5.2 Battery Charging

Batteries are source of energy providers for the functioning of the vehicle, thus it should provide a continuous and uninterrupted power supply for required. Batteries can be connected in either series supply or parallel supply based upon the requirement. The sum of the voltage gives the capacity of the battery in series setup, while sum of the current produced by the batteries give the capacity of the battery used in parallel setup, Since a series setup is used here the capacity of the battery is given as,

$$V = v * n$$

Where **V** is the total voltage produced by the battery, v is the voltage capacity of each batter, and n is the number of batteries used.

5.3Charging time

Charging time is basically the time taken by the battery to get completely charged and be ready for use, it is given as,

Charging time of battery = Battery Ah / Charging current

$$\mathbf{T = Ah / A}$$

Where Ah is the ampere hour rating of the battery and A is the current in amperes

Charging current should be 10% of the Ah rating of battery.

VI. CONCLUSION

A solution for today's pollution and emission problems has been suggested in the form. "Electrically driven vehicle with automatic/ manual charging". The idea of conversion of a traditional system into an electrical system can be seen as a very promising solution to tackle the rapidly changing government rules as well as reducing the emission of pollutants considerably in a very economical way. The process of conversion has been done in a very simple manner without making any major changes to the main frame of the auto rickshaw. The use of more powerful brushless DC motor and controller setup powered by better lithium ion batteries can result in longer ranges of travel between chargers and increases efficiency. Hub dynamos can also be used to scavenge maximum amount of energy and supply in back to the battery.

VII. APPLICATION AND FUTURE SCOPE

The conversion of a conventional IC engine driven vehicle into an electric vehicle was successfully carried out with different charging techniques. The system uses a setup to convert AC to DC for charging the batteries and also uses dynamos for current regeneration. This type of vehicle can be used in place of fossil fuel powered vehicles as a substitute, in the future fossil fuels will be extinct and this type of vehicle will be a promising alternative mode of transportation. And also electrically powered vehicles considered to be safe when compared to other modes. Electrically powered vehicles have very less emission rates and contribute very less to pollution we would like to suggest the use of a brushless DC motor with controller setup for achieving higher speeds and also Lithium ion batteries or solid state batteries (in the future) as further improvements.

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