SAGAR INSTITUTE OF SCIENCE AND TECHNOLOGY

MAJOR PROJECT-1

COMPACT 3 WHEELER CAR USED TO REDUCE TRAFFIC AND POLLUTION IN A CITY DRIVE .

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SAGAR INSTITUTE OF SCIENCE & TECHNOLOGY, BHOPAL (MP)

DEPARTMENT OF MECHANICAL ENGINEERING
CERTIFICATE

This is to certify that the work embodies in this dissertation entitled ' COMPACT 3 WHEELER CAR USED TO REDUCE TRAFFIC AND POLLUTION IN A CITY DRIVE ' is being submitted by Rahul Kumar (0187ME191065), Dheeraj Verma (0187ME191033), Avinash Kumar (0187ME191021), Ayush Khare (0187ME191022), Shubham Kumar Gupta (0187ME191084)'for partial fulfilment of the requirement for the award of 'Bachelor of Technology in Mechanical Engineering discipline to Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal(M.P.) during the academic year 2019-23 is a record of a bonafide piece of work, undertaken by him/her under the supervision of Dr Sanjay Chhalotre.

Approved and Supervised By
Dr Sanjay Chhalotre

DECLARATION

We ' Rahul Kumar, Dheeraj Verma, Avinash Kumar, Ayush Khare, Shubham Kumar Gupta', students of 'Bachelor of Engineering, session: 2019 - 2023, Sagar Institute of Science & Technology, Gandhi Nagar, Bhopal "COMPACT 3 WHEELER CAR USED TO REDUCE TRAFFIC AND POLLUTION IN A CITY DRIVE " is the outcome of my own bonafide work and is correct to the best of my knowledge and this work has been undertaken taking care of Engineering Ethics. It contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Sagar Institute of Science and Technology,Bhopal

Department Mechanical Engineering

<u>CERTIFICATE OF APPROVAL</u>

The dissertation entitled ***“COMPACT 3 WHEELER CAR USED TO REDUCE TRAFFIC AND POLLUTION IN A CITY DRIVE”.***

being submitted by Rahul Kumar, Dheeraj Verma, Avinash Kumar, Ayush Khare, and Shubham Kumar Gupta, has been examined by us and is hereby approved

for the award of **“Bachelor of Engineering**” in **Mechanical Engineering”** for which it has been submitted. It is understood that by this approval the undersigned does not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the dissertation only for the purpose for which it has been submitted.

Internal Examiner **External Examiner**

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ABSTRACT

Significant with the increasing expense of fossil fuel and its depletion, and the impacts emission gases from petrol

vehicles are having on our atmosphere, an alternative was needed. The design and fabrication of prototype battery electric vehicles are winding up progressively especially three-wheel ones. Three-wheeled battery electric vehicles need the most ideal design conceivable to minimise the extent of energy necessary to power the vehicle. One of the paybacks of an incorporated design is a lighter vehicle, with high efficiency as a design objective focus. The lighter the vehicle, the lesser amount of energy it will necessitate to drive, therefore fewer greenhouse emissions. Three-wheel electric vehicle services are: university campuses, clubs, hospitals, airports, residential compounds, villas, car and goods towing, trailers to haul the trash, remote area transportation etc. This work entails for investigation, design and building of a prototype three-wheeled battery-drive electric vehicle with an entire simple control system. A three-wheeled battery electric vehicle for electric mobility is being developed and tested at Suez Canal University (Egypt) and Sepang International Circuit (Malaysia). The design of the three-wheeled battery electric vehicle must have many favourable characteristics such as low mass and good aerodynamics. The vehicle is designed with one seat to be thrust by a brushed motor attached to the rear wheel and powered by a 48V Lithium-ion battery. The numerical study is performed by MATLAB Simulink 2017 modelling and the results recorded 140km/kWh with the regenerative braking system. The fabricated three-wheel battery electric vehicle's total weight is 55kg. It's tested on different tracks, many attempts, with the best result of 100km/kWh. The vehicle's maximum speed is 60km/h and the maximum efficiency is 70% at 25km/h

INTRODUCTION

- The electric vehicle is a vehicle that runs on electricity alone. Such a vehicle does not contain an internal combustion engine like the other conventional vehicles. Instead, it employs an electric motor to run the wheels. These vehicles are becoming very popular nowadays. They are considered to be a promising solution for the future transportation. The most common example is Tesla.

Why EVs?

1. Electric vehicles save your money

No matter where you plug in across the country, electric vehicles are cheaper to fuel than their gasoline-powered counterparts.

2. Electric vehicles cut your emissions

Even when the electricity used to fuel an EV comes from the dirtiest coal-dominated grid, EVs still produce less global warming pollution than their conventional counterparts.

3. Electric vehicles offer you a better driving experience

An electric engine generates instant torque, which means that electric vehicles zoom off starting lines and provide smooth, responsive acceleration and deceleration. Electric vehicles also have a low centre of gravity, which improves handling, responsiveness, and ride comfort.

4. Electric vehicles cut your oil use

Electric vehicles are an essential part of the UCS plan to cut the nation's oil use in half in twenty years. Using oil causes an array of problems, and transportation remains reliant on oil as the dominant energy source. Electric vehicles offer the potential to disrupt this status quo relationship between transportation and oil and offer a cleaner, better way to fuel transportation for everyone

5. Electric vehicles are convenient

Instead of searching for a gasoline station with the cheapest prices, you can charge at home at a cheaper and much more predictable cost. And plugging in at home takes only a few seconds and lets you wake up with a “full tank” every morning. EVs also have other convenient advantages. Battery electric vehicles are mechanically much simpler than a conventional gasoline cars, so the maintenance requirements are often much simpler and, for this reason, cheaper to maintain. Drivers of electric cars do not have to change their car’s motor oil every 5,000 to 10,000 miles, and they never have to schedule spark plug changes, timing belt replacements, or other engine tune-up items. Depending on your location, EVs have additional benefits, like access to restricted express lanes on highways and bridges, special parking spots, and reduced or free tolls.

Types of EVs

1. Battery Electric Vehicle (BEV)

These are the ones which you call a fully electric vehicles. This electric vehicle type does not contain any other source of actuation other than motors and batteries. There is zero emission in these vehicles. The battery is charged through an external source of power such as a DC fast charger or AC charger. On average, the BEVs take around 8 hours to get fully charged using an AC charger. This time can be reduced to 1 hour using a DC fast charger.
These electric vehicles have a range from 250kms to 500kms depending upon the battery capacity and the motor. Some of the 4-wheeler BEVs in India are Tata Nexon EV, Hyundai Kona Electric, Mahindra eKUV100, MG ZS EV and more. 2-wheeler BEVs in India include Ather 450, TVS iQube, Bajaj Chetak Electric and many other startups that are planning to launch by the end of this year.

2. Hybrid Electric Vehicle (HEV)

Hybrid Electric Vehicle | Types of electric vehicles | credits: afdc.energy.gov

These types of electric vehicles are powered by both, fuel as well as electricity. The electricity is generated by the vehicle's own braking system. The heat produced by the brakes is converted into electrical energy. This process of conversion is called Regenerative Braking.
The electric motor is used to start off the HEVs. Then the propulsion is taken care of by the IC engine. This ensures better fuel economy. The operation of the engine as well as the motor is controlled by the ECU. Some HEVs in India are Toyota Prius Hybrid, Honda Civic Hybrid and Toyota Camry Hybrid. Maruti Suzuki recently introduced its hybrid system in a few models too.

3. Plug-in Hybrid Electric Vehicle (PHEV)

These are types of hybrid electric vehicles which can recharge the batteries through regenerative braking or through an external source of power. The HEVs travel about 3-4kms before the engine is switched on, and PHEVs can go up to 65kms before the engine provides the required assistance for the propulsion of the vehicle. PHEV options available in India are Mahindra e-Verito, BMW i8 and the Volvo XC90 T8

EV Charging

1. Level One Charging (120 Volts)

Level 1 charging uses the same 120-volt current found in standard household outlets and can be performed using the power cord and equipment that most EVs come with. Making this type of charging available on your business property is as simple as installing dedicated 120-volt outlets in your company parking lot.

2. Level Two Charging (240 Volts)

Level 2 charging uses 240-volt power to enable faster regeneration of an EV's battery system. Providing this type of charging requires the installation of an EVSE unit and electrical wiring capable of handling higher voltage power. Plug-in America's PlugStar tools offer a listing of Level 2 EVSE currently on the market. Many utilities are offering free level 2 charging equipment and/or incentives with an electric car purchase. Visit our incentives page to learn more.

3. DC Fast Charging (480 Volts)

DC fast charging provides compatible vehicles with an 80% charge in 30-60 minutes by converting high voltage AC power to DC power for direct storage in EV batteries. Automakers currently use the same Society of Automotive Engineers (SAE) J-1772 plug for level 1 and 2 charging, with the exception of Tesla which has an adapter. For DC fast charging there are three plug types used by different automakers: the CHAdeMO, SAE Combined Charging System (Combo/CCS), and Tesla Supercharger. Nissan and Mitsubishi vehicles use CHAdeMO while current and upcoming vehicles from US and European manufacturers have SAE CCS ports. Tesla's Supercharger equipment is only compatible with Tesla vehicles, although they offer an adapter which allows Tesla owners to use CHAdeMO equipment.

Our electric car fact sheet includes a table with information on DC fast charging plug types by model. Most DC fast charging equipment manufacturers now offer equipment with both the CHAdeMO and SAE CCS port connectors to increase compatibility.

LITERATURE REVIEW AND PROBLEM IDENTIFICATION

Literature Review

[1] Zhu Yue

Study on divergence approximation formula for pressure calculation in particle method The moving particle semi-implicit method is a mesh-less particle method for incompressible fluid and has proven useful in a wide variety of engineering applications of free-surface flows. Despite its wide applicability, the moving particle simplicity method has the defects of spurious unphysical pressure oscillation Three various divergence approximation formulas, including basic divergence approximation formula, difference divergence approximation formula, and symmetric divergence approximation formula are proposed in this paper. The proposed three divergence approximation formulas are then) applied for the discretization of the source term in the pressure Poisson equation. Two numerical tests, including hydrostatic pressure problem and dam-breaking problem, are carried out to assess the performance of different formulas in enhancing and stabilizing the pressure calculation. The results demonstrate that the pressure calculated by the basic divergence approximation formula and difference diverge approximation formula fluctuates severely. However, the application of the symmetric divergence approximation formula can result in a more accurate and stabilized pressure.

[2] Anand R. et al.; Transitioning to electric vehicles is a cost-effective climate mitigation strategy in China. The marginal carbon abatement cost for electric vehicles is estimated to become negative. The total 2030 mitigation potential is estimated to be at least 2 million tons of CO2 per year. If the Chinese grid is less coal intensive in 2030 then electric vehicles will mitigate more. Further improvement in energy efficiency will make electric vehicles more. cost competitive.

[**3] Hultman and Jack, (2003)**; the design of electromagnetic devices with soft magnet composite (SMC) materials can offer several advantages over conventional laminated materials. It can facilitate the implementation of new structures with fewer parts, and reduced size and weight.

[**4] Su-Hau et al. (2004);** focused on the highly efficient energy usage of battery energy and proposed an integrated management system for electric motors. This integrated management system includes the power-saving controller, energy management subsystem and some hardware protection strategies. The energy management system acts as a supervisor

to all the management of all the events about the battery energy, including the residual capacity estimation and regenerative braking operation.

[5]Bartlomiej et al (2003); provided the evaluation of driving power and energy requirements for automotive vehicles. A survey of the most promising applications of electric and hybrid vehicles in cities with commercial line solutions was given Evaluation of vehicle's energy when is referred to urban driving cycles, reflects an important diversification of the average and maximal power requirements.

[6] Rajeswari et al (2006); studied the capacity of the energy storage system i,e. the battery in a hybrid vehicle. Various tests on the discharge characteristics, including the study of Ohmic resistances under various cases, was carried out for a separate battery as well as a battery used in a hybrid vehicle and the former was found to have greater impedance while cycling The relevance would be the battery selection and analysis, charging modes and technologies

[7] Divya and Jacob, (2009); discussed the present status of battery energy storage technology and methods of assessing their economic viability and impact on power system operation. Further, a discussion on the role of battery storage systems of electric hybrid vehicles in power system storage technologies had been made. As far as battery technology is concerned, in future, there will be a significant development in reducing the battery cost and improving their reliability. The future of large-scale batteries extensively designed for use in the electricity grid is also quite promising. Finally, they suggest a likely future outlook for battery technologies and electric hybrid vehicles in the context of power system application.

[8] Electric Power Controller for Steering Wheel Management in Electric Cars Vicente Milanes

Electric Power Controller for Steering Wheel Management in Electric Cars Vicente Milanes, driverless driving is one of the most interesting topics in the field of intelligent transportation systems. Among these topics, the automation of the actuators involved in the management of a car, and out of them the control of the steering wheel constitute one of the most complexes. In this paper, automatic power steering architecture to manage the steering wheel via Ethernet controller is developed. An onboard PC is connected to the controller to permit handling by computer-generated signals. An electric car has been equipped with the system designed and tests to prove the behaviour of the system in actual situations in the private driving circuit at the IAI facilities are included.

[**9]Design of the Auto Electric Power Steering System Controller (2012**);

The automobile electric steering system is a servo control system. This paper introduces the basic components of the electric power steering system and put forward the reasonable. design solutions of the soft hardware and the correction methods of the controller, given the main technology index of the controller. According to the performance requirements of the car's steering system, make the relevant control strategy of the electric power steering system and through the design of related software and hardware to realize this control strategy and it can control each link of the automobile steering process. To verify the feasibility of the control strategy, comparison experiments are carried out on a vehicle equipped with the developed EPS and the imported EPS, respectively. The results indicate that the developed EPS has a similar performance to the imported one. The developed EPS not only works smoothly but also has proper steering performance, thus can be equipped on passenger cars.

[10] Study on slamming pressure calculation formula of plunging breaking wave on sloping sea dike; Plunging breaker slamming pressures on vertical or sloping sea dikes are one of the most severe and dangerous loads that sea dike structures can suffer. Many studies have investigated the impact forces caused by breaking waves for maritime structures including sea dikes and most predictions of the breaker forces are based on empirical or semi-empirical formulae calibrated from laboratory experiments. However, the wave-breaking mechanism is complex and more research efforts are still needed to improve the accuracy in predicting breaker forces. This study proposes a semi-empirical formula, which is based on impulse-momentum relation, to calculate the slamming pressure due to plunging wave breaking on a sloping sea dike. Compared with some measured slamming pressure data in two pieces of literature, the calculation results by the new formula show reasonable agreements. Also, by analyzing the probability distribution function of wave heights, the proposed formula can be converted into a probabilistic expression form for convenience only.

[11]Analysis of Drum Brake System for Improvement of Braking Performance Siti Nor Nadirah Haba, Muhammad Najib Abdul Hamid, Shahril Nizam Mohamed Solid, Mohd Nurhidayat Zahelem and Mohd Suyerdi Omar); The braking performance has become a very important factor for automotive manufacturers and passengers because of the safety requirements. In general, brake squeal occurrences can be reduced by decreasing the friction coefficient; however, the braking performances also decrease. The objectives of this study are to obtain the dynamics properties (natural frequency) of brake shoes and to propose a new modification design of the brake shoe to improve the performance of the drum brake and stability of squeal. A finite element model of the automotive components has been developed in the analysis to determine the dynamic properties of brake torq measurement and instability of the system. The data of the finite element model is validated by performing an experimental modal analysis. The result showed that the value of natural frequency, brake torque and contact analysis increased when using the new design of brake shoe.

Problem Identification

All previous studies were conducted either on the development of PEV and EVS, Or on future analysis of the implementation of electric vehicles in the country, but there is no study on the development of the economical electric conversion kit for many older vehicles that would be rendered useless if any law is passed banning all pre-2000 year old vehicles.

Currently in India there more than 40 lakh LMVs that are more than 15 year old running in the streets of the country, if they are suddenly hanned when a law is passed, then all these vehicles would be classified as scrap and waste. All these vehicles would be transferred to junk yards leading to a generation of toxic waste from batteries, electrical components, chassis, frame, seats etc.

Thus there is a need to introduce a new conversion system that can prevent the generation of such large amount of waste and also a very high amount of inconvenience caused to millions of drivers and as a whole the transportation system, affecting daily activities of the general public

Also if the normal man wants to switch towards greener energy, he has to buy new and costlier vehicles which start from 6.68 lakh rupees if he is opting for mild electric vehicle, and pay more than 15.5 lakh rupees if he is going for the strong electric vehicle. Thus he has to shell a hefty sum of rupees and also he has to discard his current vehicle .

Therefore we can introduce a new, economical electric conversion kit that can help the driver to avoid scrapping of his vehicle to the junkyard and also helping him to motivate his change towards greener energy by converting is vehicle into an electric powered vehicle at at minimum cost of 66,600 rupees.

Also E-rickshaws that have been introduced have a problem of high voltage draw when running under higher load capacities or at steeper gradients. The user has to press the throttle harder thereby drawing high voltage. This problem arises due to the lack of a proper gearbox that can co-ordinate different gears according to the torque and seed requirements.

As shown in this review, consumer EV adoption has been studied uung several theoretical frameworks. Based on the published literature, we find five main themes in consumer EV adoption behavior Although treated separately here, these themes co-exist and are integrated into each other in many studies. For example in some studies (Moons and De Pelsmacker. 2012 Schuitema et al., 2013), consumer EV adoption behavior has been explained as a mix of planned, emotional and symbolic behavior. These types of studies, where several theoretical perspectives are used in furthering the understanding of EV adoption, are promising since they provide a deeper understanding In addition to the themes, we argue that the literature on consumer EV adoption has some methodological limitations, which call for future research and alternative methodological approaches. Many studies take the form of surveys, with participants who have had no direct experience of EVs on which to base their responses. In this way, they are psychologically distant from EVs, and this limits the validity of inferences about adoption drawn from their responses. Among those studies where participants have been given direct experience of using EVs, many have sample biases, of which the most common to use samples of potential early adopters or people already especially motivated to consider EVs Soch samples cannot be considered representative of the majority of consumers, and it is treacherous to generalize to the majority from findings based on their responses Studies using representative samples and not only focusing on intention to adopt but actual ("unforced") adoption, are necessary to understand how attitudes influence EV adoption and how these relations change over time. As the market for EVs is developing it becomes much more feasible and important to focus on the actual adoption behavior concerning EVs and not only on intentions. In addition, the gap between the intention and actual behavior is important to understand in the EV context. For closing the well-known attitude-behavior gap (Stern, 2000), examining interventions such as imagined group discussions can provide further understanding of consumer EV adoption behavior intentions Another important limitation of the current research concerns consumer knowledge and skills to calculate and compare the financial benefits and costs of EVs and ICEs (Lane and Potter, 2007) Future research on how to educate consumers on this matter can have implications for policy makers and marketing specialists for communicating the financial benefits and costs of EVS versus ICES. Considering that this ratio is likely to change over time, for example by ICEs continuously becoming more fuel efficient, makes this type of understanding even more important.

PROPOSED METHODOLOGY

Proposed Method

We began by searching for suitable vehicles that were produced before 2000. This is done because many ongoing proposals may in future han 15 to 20-year-old vehicles because they emit a high amount of pollutants or have very low fuel efficiency as compared to modern fuel-efficient vehicles. One such example of a proposal is that of SIAM (Society of Indian Automobile Manufacturers) which has asked the government of India, for a ban on all 15-year-old vehicles across the country in a bid to reduce pollution. If this is accepted by the government of India then all these 15-year-old vehicles, which are numbering over 40 lakh, LMVS (Light Motor Vehicles) would in one shot, be rendered useless and would result in a large amount of waste generated in the form of unused metallic body frame, seats, electrical and electronic components, toxic batteries, tyres and various other automobile components, that will be lying around junkyards.

Thus we have selected a vehicle that is a pre-2000 year production model of Honda Activa that will be converted into an electric vehicle.

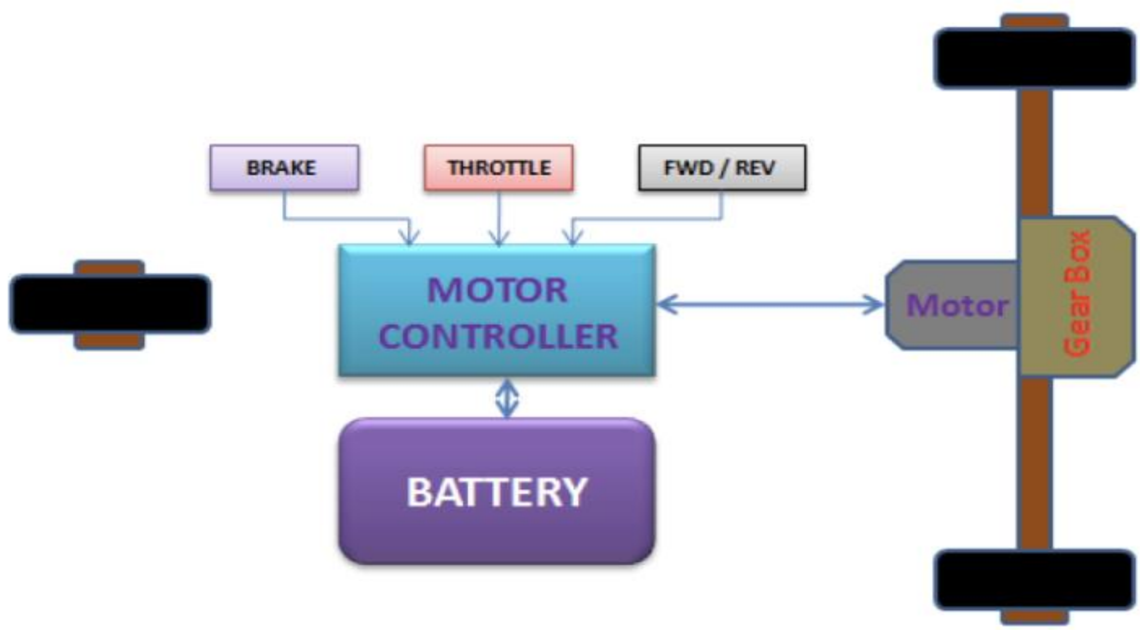
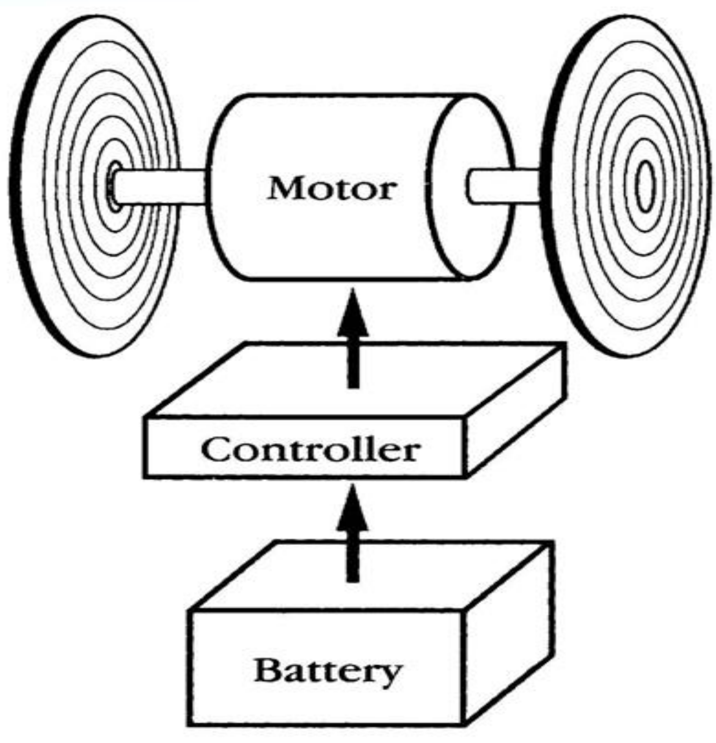


Fig 3.1 Block Diagram of EV kit

WORKING PRINCIPLE

All-electric vehicles (EVS) have an electric motor, battery charging slot and wiring The motor which is contained by an electric vehicle is a BLDC motor (brushes motor) the battery present in the car has the chemical energy stored in it. The ups which are connected to the battery convert the chemical energy to electrical energy and further that electrical energy is converted to mechanical energy with the help of a motor. Let's get the working principle of the motor before explaining the working of a brushless DC motor, it is better to understand the function of a brushed motor. In brush motors, there are permanent magnets on the outside and a spinning armature which contains an electromagnet inside. These electromagnets create a magnetic field in the armature when the power is switched on and help the armature. The brushes change the polarity of the pole to keep the rotation of the armature. The basic working principle for the brushed DC motor and brushless DC motor is are is same i.e. internal shaft position feedback. A Brushless DC motor has only two basic parts: the rotor and the stator. The rotor is the rotating part and has rotor magnets whereas the stator is the stationary part and contains stator windings. In BLDC permanent magnets are attached to the rotor and move the electromagnets to the stator. The high-power transistors are used to activate electromagnets for the shaft turns. The controller performs power distribution by using a solid-state circuit. The gearbox is again connected back to the propeller shaft and the BLDC motor was then coupled to the gearbox and put back together in the vehicle.



MATERIALS USED:

- 1030 AISI IRON RECTANGULAR ROD:-30 FT.
- Differential:-24 inch.
- BLDC Motor:-1.2kw
- Drum brake

Brushless DC motors (BLDC):-*A brushless DC motor (known as BLDC) is a permanent magnet synchronous electric motor* which is driven by direct current (DC) electricity and it accomplishes an electronically controlled commutation system (commutation is the process of producing rotational torque in the motor by changing phase currents through it at appropriate times) instead of a mechanical commutation system. BLDC motors are also referred to as trapezoidal permanent magnet motors.

Unlike conventional brushed type DC motor, wherein the brushes make the mechanical contact with a commutator on the rotor to form an electric path between a DC electric source and rotor armature windings, BLDC motor employs electrical commutation with a permanent magnet rotor and a stator with a sequence of coils. In this motor, a permanent magnet (or field poles) rotates and current carrying conductors are fixed.

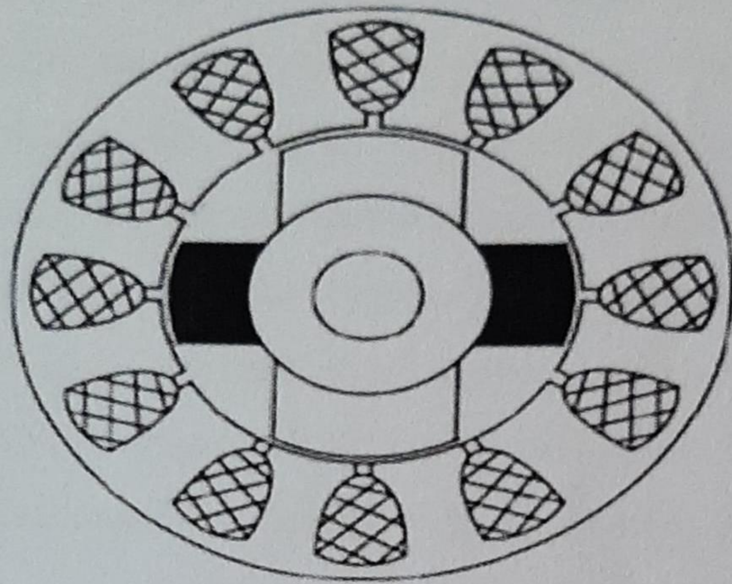
The armature coils are switched electronically by transistors or silicon-controlled rectifiers at the correct rotor position in such a way that the armature field is in space quadrature with the rotor field poles. Hence the force acting on the rotor causes it to rotate. **Hall sensors** or rotary encoders are most commonly used to sense the position of the rotor and are positioned around the stator. The rotor position feedback from the sensor helps to determine when to switch the armature current.

This electronic commutation arrangement eliminates the commutator arrangement and brushes in a DC motor and hence more reliable and less noisy operation is achieved. Due to the absence of brushes BLDC motors are capable to run at high speeds. The efficiency of BLDC motors is typically 85 to 90 per cent, whereas brushed-type DC motors are 75 to 80 per cent efficient. There are wide varieties of BLDC motors available ranging from small power range to fractional horsepower, integral horsepower and large power ranges.

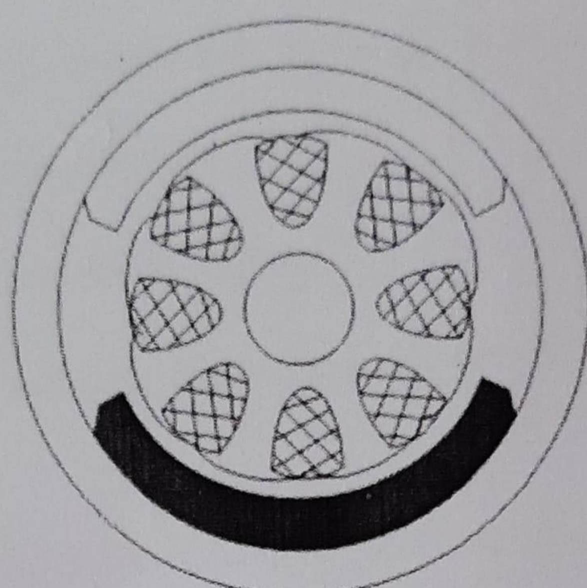
TYPES OF BLDC MOTOR:-Basically, BLDC are of two types, one is the outer rotor motor and the other is inner rotor motor. The basic difference between the two is only in design, their working principles are the same,

INNER ROTOR DESIGN, In an inner rotor design, the rotor is located in the centre of the motor and the stator winding surrounds the rotor. As the rotor/is located in the core, rotor magnets do not insulate heat inside and the heat gets dissipated easily/Due to this reason, the inner rotor designed motor produces a large amount of torque and is validly used.

OUTER ROTOR DESIGN, In outer rotor design, the rotor surrounds the winding which is located in the core of the motor. The magnets in the rotor trap the heat of the motor inside and do not allow it to dissipate from the motor. Such a type of designed motor operates at a lower rated current and has low cogging torque.



Inner Motor



Outer Motor

BRAKING SYSTEM

The braking system is one of the important systems in vehicle Safety. The purpose of the brake system is to prevent or reduce severe injury during/accidents. The function of the brake system is to slow or stop the moving vehicle. Besides, the brake system is also used to maintain the vehicle speed during downhill operation and hold a vehicle stationary on a grade Recently, many countries presented brake system design criteria and operational requirements for brake systems depending on the vehicle types 111. Their regulations of brake systems include slowing the vehicle down in a controllable, stable, predictable, and repeatable manner. regardless of road, load, weather or partial failure. All this may be achieved when the performance of the brake system retains its stability during vehicle brake operation.

DRUM BRAKE SYSTEM

The brake drum is generally made of a special type of cast iron that is heat-conductive and wear-resistant. It rotates with the wheel and axle. When a driver applies the brakes, the lining pushes radially against the inner surface of the drum, and the ensuing friction slows or stops the rotation of the wheel and axle, and thus the vehicle. This friction generates substantial heat. A drum brake is widely used in the automotive industry for more than forty years. Although disc brakes now are found wisely at the front of almost all cars, the drum brake still can be seen at the rear wheel of the cars and light tracks due to the cheap production price and the fact that the maintenance of drum brakes is cheaper due having all in one design that is easier to replace. when repair work is needed. Drum brakes are also self-energizing and can operate as parking brakes while disc brakes require special parking brake mechanisms.

WORKING ON DRUM BRAKES

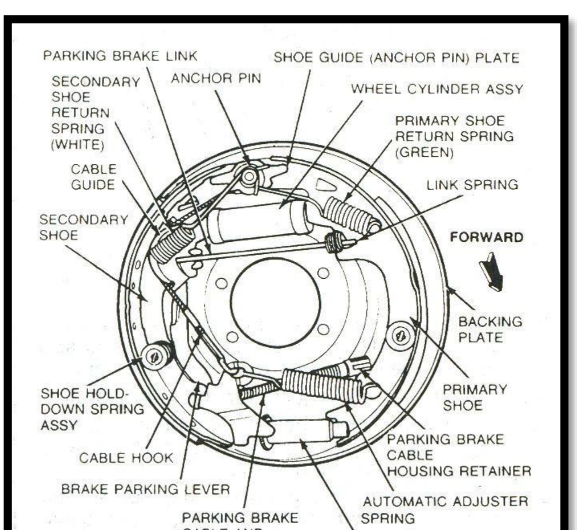
• Drum brakes work on the same principle as disc brakes.

• Shoes press against a rotating surface.

• In this system that surface is called a drum.

•Drum brake also has an adjuster mechanism, an emergency brake mechanism and lots of springs.

• The shoes are pulled away from the drum by the springs when the brakes are released.



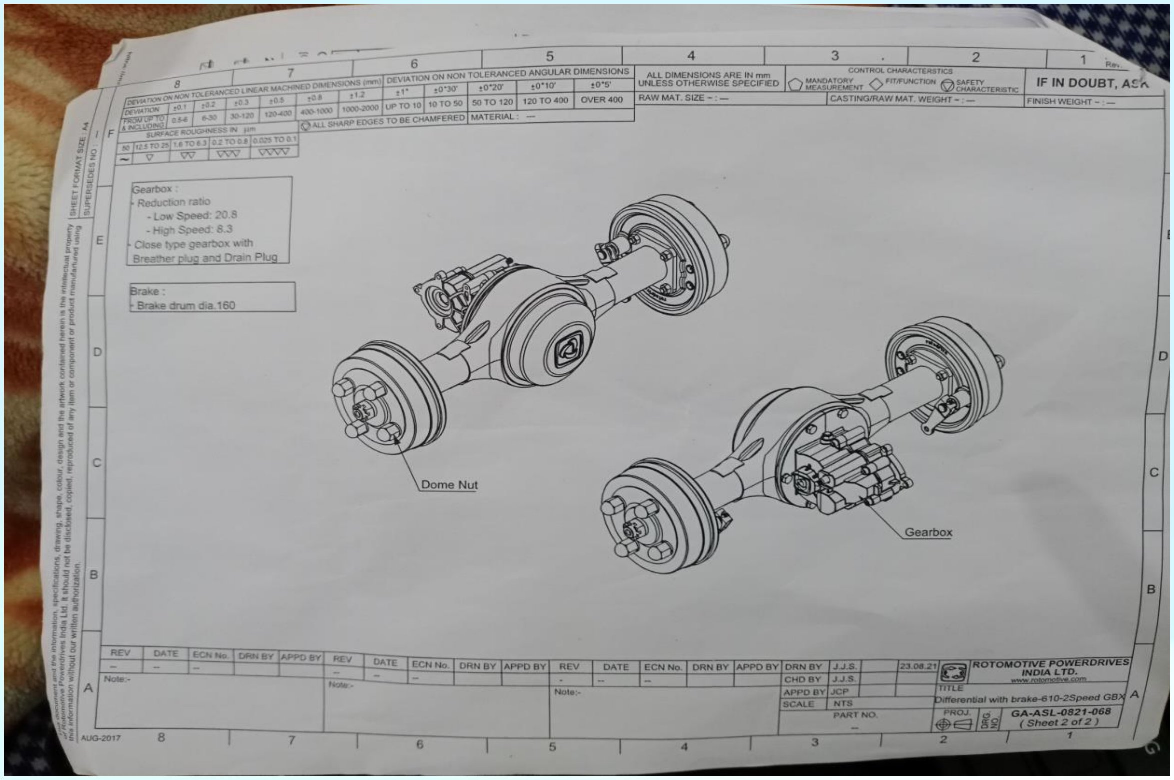
METHODOLOGY

With the ever growing demand for cleaner vehicles and diminishing fossil fuel reserves, there is a wide area of implementation of the cost-effective conversion of conventional old vehicles into new electric vehicles. But the change towards greener vehicles comes with a hefty price tag that de-motivates the consumer. We are developing 3 wheeler 2-seated compact car for city drive. As electric cars are quite costly and cannot be owned by the middle class so we are developing a compact car that will be cheaper than an electric car. As it has compact in design it will be helpful in more traffic areas, and also helps to minimize the time.

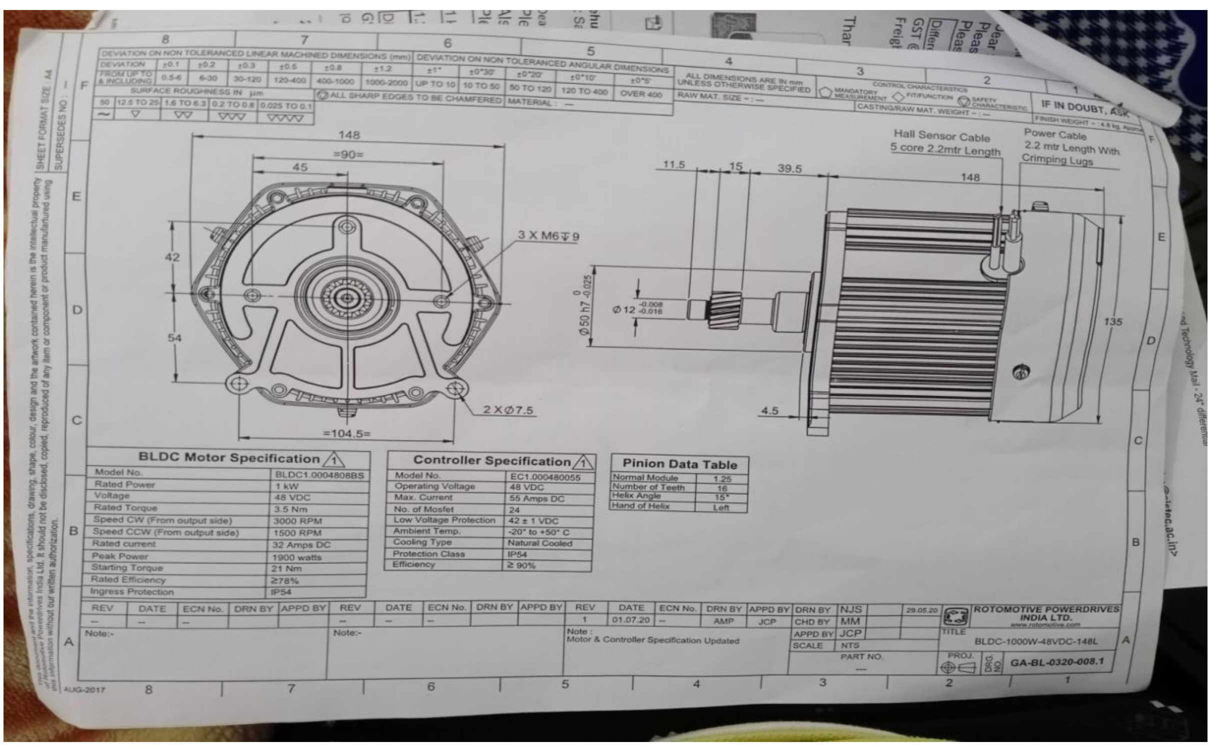
FRAME AND DESIGN:-

METHODOLOGY

DIFFERENTIAL USED:-



MOTOR USED:-



BATTERY USED:-

MODEL	EXIDE
BATTERY TYPE	LEAD ACID
VOLTAGE	12V
BATTERY AH	9AH
NO. OF BATTERY	4
WEIGHT OF ONE	3KG

REFERENCES

1. Study on divergence approximation formula for pressure calculation in particle method Zhu Yuc.Jang Shengyao, Yang Xiangtan and Duane Rigiang
2. Vehicle Engineering Published by Academy Publish org (Publishing Services LLC), 2120Carey Avenue, Cheyenne, WY 82001, USA.
3. Richard Stone & Jeffrey K. Ball. Automotive Engineering Fundamentals, SAE International, 2004, .
4. (Su-Hau et al. 2004) focused on the highly efficient energy usage of the battery energy and proposed an integrated management system for electric motor.
5. Anonymous (1998). "Attractive Alternatives," Daimler Benz High-tech Report 1998, G. (1988). "LH-Jetronic," in Automotive Electric/Electronic Systems, Adler. U. and Bauer.
6. Felger, H, Eds, Robert Bosch, Stuttgart, 1988.
7. Heisler, H. (1995), Advanced Engine Technology, Edward Am old. London, 1995.
8. Herzog, P. (1998), "HSDI Diesel Engine Developments Towards Euro IV." Institution of Mechanical Engineers Seminar Publication, Future Engine and System Technologies, Professional Engineering Publications, London, 1998.
9. Yamaguchi, J. (2000). "Shrinking Electric Cars," in Automotive Engineering. Vol. 108, No. 6, 2000, PP. 10-14.
10. Yamaguchi, K., Moroto, S., Kobayashi, K, Kawamoto, M, and Miyaishi, Y. (1996). "Devel opment of a New Hybrid System-Dual System," SAE Paper No. 96023 1. Society of Auto-motiveEngineers, Warrendale, PA, 1996.
11. M. H. Westbrook, The Electric Car: Development and Future of Battery, Hybrid and Fuel-Cell Cars(Institution of Engineering and Technology, 2001).
12. M. Bernhard and M. Terpening, ""The 21st Century Electric Car," Tesla Motors, 19 Jul 06.
13. Mercer, M., (1998). "Hybrid Car to Arrive in Europe and U.S. in 2000," in Diesel Progress, September October 1998, pp. 60-61.
14. Moons, L. De Pelsmacker, P., 2012. Emotions as determinants of electric car usage intention. J. Mark. Manage. 28 (3-4), 195-237.
15. Stern, P.C., 2000. Toward a coherent theory of environmentally significant behavior 56
16. Lane, B, Potter, S. 2007. The adoption of cleaner vehicles in the UK: exploring the consumer attitude-action gap. J. Cleaner Prod. 15 (11-12), 1085-1092 http://dx.doi.org/10.1016/jjclepro 2006 05.026
17. Dr Naresh Chandra murmur (HOD PRINCIPAL SCIENTIST SURFACE ENGNEERING AND TRIBOLOGY)
18. https://edu authorcafe.com/academies 7825/design-and-analysis-of-three-wheeled-vehicle chassis
19. Electric Power Controller for Steering Wheel Management in Electric Cars Vicente Milan's
20. Differential Steering Control of Four-Wheel Independent-Drive Electric Vehicles Tian
21. Sin Nor Nadirah Baba, Muhammad Najib Abdul Hamid, Shahril Nizam Mohamed Soid.Mohd Nurhidayat Zahelem and Mohd Suyerdi Omar
22. https://en.wikipedia.org/wiki/Drum brake
23. Study on slamming pressure calculation formula of plunging breaking wave on sloping sea dike Xing Yang