Fabrication of Small Segment Caroperated By Electirc Power

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Abstract- *The "Small Segment Car" is a game-changing urban transportation concept. With its lightweight and foldable design, this compact vehicle can transform into a portable suitcase, easily carried by hand or rolled on built-in wheels. Powered by an electric motor, it emits zero pollution, making it an eco-friendly option for short trips. Its versatility allows usage in various settings like shopping malls, industrial areas, and college campuses. The "Small Segment Car" combines convenience, sustainability, and affordability, providing an ideal solution for urban commuters who value mobility and environmental responsibility.*

Keywords- Compact; small Segment Car; Foldable Design; Electric; Suitcase.

I. INTRODUCTION

As the population is increasing there is also increasing in demand of the automobiles. Due to the increasing number of automobiles they will require space for driving and also for parking. So we know that there is only limited space available. Due to the increasing number of vehicles on roads, they cause traffic jam and also they acquired a place for parking. As the population is increasing, the demand for vehicle is also increasing.

So, this Small Segment Car (SSC) is a suitcase car which can be folded and can be operated by electricity and is designed for one person which can carry a load up to 80 kg and can approximately cover a distance of 10 km per charge. It can be packed into a suitcase and can be moved by any person. This SSC is a foldable car which can be folded like suitcase, hence it does not require more parking space. The size of the SSC is 48”x24”x9” when opened, so it is approximately five times smaller than normal car. Due to its compactness it can be used in various places like big shopping malls, industries, big campus of college etc. Portable car can be used on footpaths, industries and for covering short distance.

II. LITERATURE SURVEY

“Portable suitcase car” .The thing is to setup a compact vehicle, which is efficient to carry some load and easily get transported or transport it. People are more reliable on motorcycles in India, if the distance is less than a kilometer it is not affordable to everyone thus, the design evolved into a bitsy foldable wallet auto, which can carry peoples and it's powered with the help of electric motor with power source as battery and the battery can be charged with the help of bowl the auto is compact in size and can be carried veritably fluently and is as like a wallet. The slide link of the steering chopstick ensures the foldable medium and allows humans to tote it, which ensure the purpose of lower distance, foldable and compact vehicle.[1]

“Design and fabrication of foldable kart chassis” is the publication of Mr. Akash Chaudhary Raghuvanshi. They understood the drive moving towards the conciseness, and its time is to suppose about machine which can be folded fluently and can be carried far and wide as a luggage. By this creative idea, he made structural analysis on the frame of their kart vehicle and developed a GO KART named as “ASHVA” which was suitable to fold at middle with the help of joint that made connection between its two-lattice front and reverse. Because substantially Karts are used to take the experience of a racing auto, knowing this they manufactured an machine that can be commodity unique. The speed of kart varies on power of machine and how important energy does it need considering the fact lattice and joint of kart were made from mild sword, this joint gave further power and stability to the vehicle. They used mechanical chain to transmit power from the machine to the axle of kart, for a better and smooth experience, rack and pinion system was used. Material selection plays an important part on strength and safety of the product that’s the reason they chose AS- 202pristine sword round tubes as lattice material. Also, they chose the material for shaft so that it can repel all the stresses. They made an effort discussing about the material selection procedure and the joints which can be used in foldable vehicle chassis.[2]

Mazda developed the suitcase car concept, andintroducedbyMazdacompanybytheiremployeeintoaninterde partmentalevent‘Fantasyard’ in 1991. The contest was held up to see which department will come with aninnovative idea for creating moving machine.1990 was successful era for Mazda so tolaunch the wallet auto. A group of 7 masterminds from Manual Transmission Testing andResearch Group worked on this design. They bought the largest Samsonite wallet theycould find and pocket motorbike. The 33.6 cc,1.7 hp two-stroke machine, bars and 4- 6inch- periphery tires from the Pocket Bike were also fitted into the wallet. The hinder buswas placed outside of the case while the frontal wheel was popped out from removable door in the front. The wallet autotook twinkles to assemble and had a maximum speed of 30km/ h. The original prototype was accidentally destroyed after many months of the Fantasyard event, one wallet auto still exists, and it works as good as it worked 24 timesgone.[3]

“Dynamic properties of a Go-kart chassis structure anditspredictionimprovementusingmodelupdatingapproach”,N .A.Husain, M.M. Rahman and I. Zaman. The purpose of this study is to perform model updating of ago-kart chassis structure in order to reduce the percentage of error between the experimental modal analysis (EMA) and finite element analysis (FEA). Modal properties(natural frequency, mode shapes, and damping ratio) of the go-kart chassis structure were determined using both EMA and FEA. Correlation of the modal parameters gathered in FEA and EMA was carried out before optimizing the data from finite element. By adjusting the selective parameters, incongruities between those two analyses are generally reduced. The sensitivity of selected parameters is also obtained. The significant reduction in percentage of error before and after model updating procedure was carried out in this study clearly shows that model updating technique is a reliable method in reducing the discrepancies between EMA and FEA. Therefore, in cases of high discrepancies between analytical and actual test data, model updating can be considered as an option in order to obtain better correlation between those two sets of data.[4]

III. METHODOLOGY

This small segment car is mainly designed for the purpose of reducing the space of the vehicle. It is used for travelling small distance like approx. 10 to 15 kilometer and can be used in large scale factories like HAL, BEL ect..

For manufacturing this SSC there are certain methods to be followed. Thinking about this project, there were certain problems which araised like how can this car be helpful for the public, making this project should not a loss of money. It has to be helpful for the public not only in one way but also in a good and many was So, thinking about it we thought it can be used in large industries, school or college campus. One more important thing is it can be very much helpful to handicapped who don’t have legs because the height of the vehicle is very less.

The main thing we have to check about this vehicle is the dimension and the placement of the components of the vehicle inside because the vehicle should be folded in such a way that the it should close like a suitcase. So, the wheels, batteries, controller, motor all should be in proper place so that they don’t collide with each other.

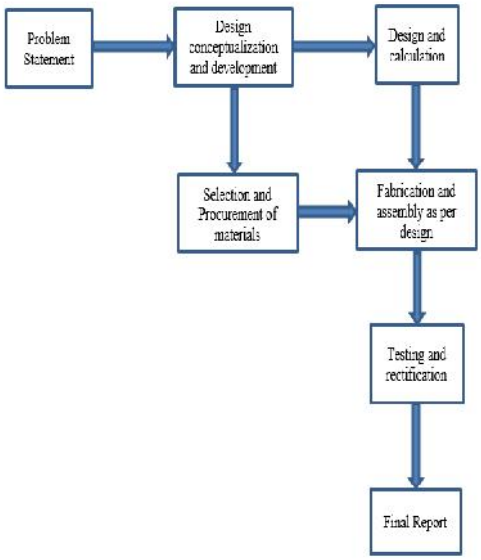


Figure 1: Flow Diagram

Modelling of the car is done in AutoCad and Solid Edge. It was correctly tested whether the components are placed in the right place or not by making a 3D model.

Then the calculations for the vehicle is done as per the size of the vehicle and according to the calculation the motor capacity is 200W, the battery was calculated as 8.33 Ah and according to the load calculation, reaction force and load at front and back is 648.756 and 527.96 respectively.

Materials like battery, motor are collect as per the calculations. MS sheet was taken according to the size of the vehicle and it was fabricated. The model was tested and little modifications were done. Then the model was completed with a very good design and a good purpose.

IV. IMPLEMENTATION

2D and 3D Design Implementation

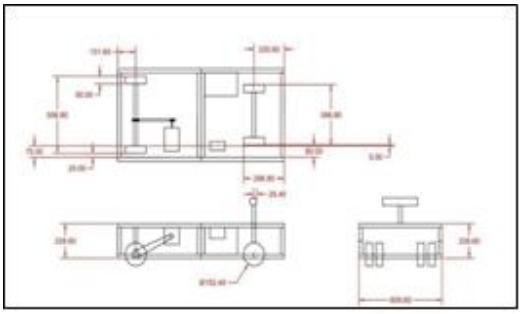
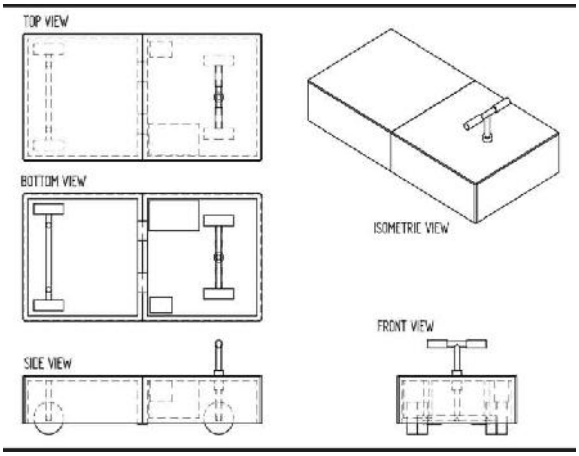


Figure 2:2D Design in AUTOCAD



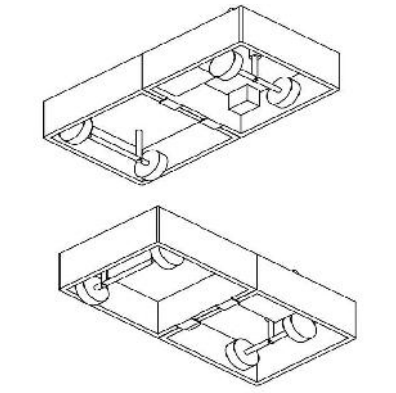


Figure 3:3D Design in Solid Edge

Calculations Done

Power calculation:

Mass of the vehicle = 120kg Maximum velocity = 10 kmph (Assuming gravity = 10 m/s^2)

Weight of the vehicle = 1200 N (Assuming uniform distribution of weight) Weight on each wheel = 300 N

Now this will act along the centre of gravity of the wheel and considering the wheel as cylinder with radius(r)=0.0762 m, length(l)=0.0508 cm.
Moment of inertia along the diameter = 1/4*mr^2 + 1/12*ml^2 Using parallel axis theorem
Moment of inertia along the diameter at wheel surface I = ¼*mr^2 + 1/12*ml^2 + mr^2
I = 9.343 kg.m^2
Initial angular velocity (&1) = 0 rad/sec

Angular velocity (&2) = V/r = 10*5/ (18*0.3) = 9.259 rad/sec
Suppose it takes 5 sec to reach 10 kmph
There for, Angular Acceleration(alpha) = change in angular velocity/change in time
i.e, alpha = 9.259/5 = 1.8518 rad/sec
Torque = I*alpha = 9.243*1.8518 = 17.301 Nm
Speed of revolution(N) = 60*I/ (2*3.142) = 89.207 rpm

Power = 2*3.142*N*Torque/60 = 2*3.142*89.207 *17.301 /60 = 1063.79 W
So we are using 200 W motor for our project

Battery calculation:

According to our motor specs, rated voltage = 24V Power = 200 W
There for, Watt = Amps*Volts
Amps = Watt/Volts = 200/24 = 8.33 Ah That is Rated amps = 8.33 Ah

Load calculation:

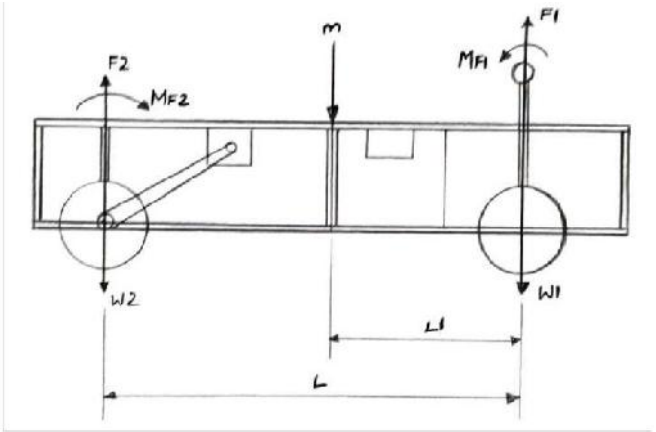


Figure 4: Load Distribution Diagram

Data:

L1 = 389 mm. L = 867 mm.
m = 120 kg.

Where W1 is load at front wheel, W2 is load at back wheel, F1 is reaction force at front, F2 is reaction force at back, MF1 is moment at reaction force F1, MF2 is the moment at reaction force F2.

The first equilibrium conditions for the (vector) sum of the external forces on the rigid object must be equal to zero.

∑F = 0
F1 + F2 – Fm = 0

According to Newton second law of motion, the linear acceleration of rigid body is caused by a net force acting on it,

∑F = mg.

Where g = acceleration due to gravity is 9.806 m/s^2. Fm = 120*9.806 = 1176.72 N
F1 + F2 = Fm = 1176.72 N F2 = 1176.72 – F1

Second Condition of equilibrium:
The sum of all external moments of forces (torque) from external force is zero.

So, the condition that all the moments of forces acting on the body is zero, thereby we get

∑M = 0
∑M from center of gravity = 0 MF1 + MF2 + Mm = 0
MF1 = F1 * L1 MF2 = F2 * (L - L1)
Mm = m * 0 = 0
F1 * L1 = F2 * (L - L1) F2 = 1176.72 – F1
F1 * L1 = (1176.72 – F1) * (L - L1)
F1 * 389 = (1176.72 – F1) * (867 – 389)
F1 * 389 = (1176.72 – F1) * 478 F1 * 389/478 = (1176.72 – F1) 0.8138 * F1 = 1176.72 – F1
F1 (1 + 0.8138) = 1176.72
F1 * 1.8138 = 1176.72
F1 = 648.756 N.
There for,
F2 = 1176.72 – 648.756
F2 = 527.96 N.
i.e.,
W1 = F1 = 648.756 N. W2 = F2 = 527.96 N.

Material Implementation In The Project

1. DC motor :A geared DC motor is a type of electric motor that incorporates a gearbox or gearhead to increase the motor's torque and reduce its rotational speed. This type of motor is commonly used in applications that require high torque at low speeds, such as in industrial machinery, robotics, and automotive systems. The gearbox is typically mounted onto the motor shaft and contains a set of gears that mesh with the motor's output shaft. As the motor spins, the gears inside the gearbox transfer power and reduce the motor's speed while increasing the torque output.

Figure 5:DC Motor

2. Speed controller: A speed controller is an electronic device that regulates the speed of an electric motor. It works by adjusting the voltage or current supplied to the motor to control its speed. Speed controllers are essential components in many electric motor systems, allowing for precise and efficient control of motor speed and performance.

Figure 6: Speed Controller

3. MS sheet and MS rod: MS sheet is a flat, thin sheet of mild steel that can be cut, bent, and formed into various shapes for use in construction, manufacturing, and fabrication. MS sheets come in a range of thicknesses and sizes to meet specific project requirements. On the other hand, MS rod is a long, cylindrical bar of mild steel that is typically used for structural support, construction, and manufacturing purposes. MS rods are available in a range of diameters and lengths and can be cut and welded to fit specific project requirements. Overall, MS sheet and MS rod are versatile materials that offer excellent strength, durability, and affordability, making them popular choices for a wide range of applications.

Figure 7: MS Sheets

4. Battery: A rechargeable dry battery is a type of rechargeable battery that does not contain liquid electrolytes. Instead, it uses a solid or gel-like electrolyte to conduct ions between the battery's electrodes. Rechargeable dry batteries are commonly used in portable electronic devices such as digital cameras, remote controls, and handheld gaming devices. They are also used in larger applications such as electric vehicles and renewable energy storage systems. Dry batteries have several advantages over traditional liquid electrolyte batteries, including longer lifespan, higher energy density, and improved safety. Additionally, they do not require maintenance, are less prone to leakage, and can be recharged many times before needing to be replaced. The most common types of rechargeable dry batteries are lithium-ion and lithium polymer, which are widely used in consumer electronics and electric vehicles.

5. Chain: A chain is a mechanical component that consists of a series of interconnected links that can transmit power or motion between two or more rotating shafts. Chains are commonly made from metal, such as steel or stainless steel, and come in a variety of sizes and styles to fit different applications. Chains are popular due to their high strength, durability, and ability to transmit power and motion over long distances. However, they require regular maintenance, including lubrication and tension adjustment, to ensure optimal performance and prevent wear and tear.

Figure 8: Chain

6. Plummer Block Bearings: Plummer block bearings, also known as pillow block bearings, are a type of mounted bearing that provides support and alignment for rotating shafts. They are commonly used in various industrial applications, such as conveyor systems, machinery, and heavy equipment. Plummer block bearings consist of a housing, typically made of cast iron or steel, and an inner bearing insert. The housing has a flat base with bolt holes for easy mounting and is designed to withstand heavy loads and provide stability.
7.

Figure 9 : Plummer Block Bearings

V. RESULT

Fabricated Model

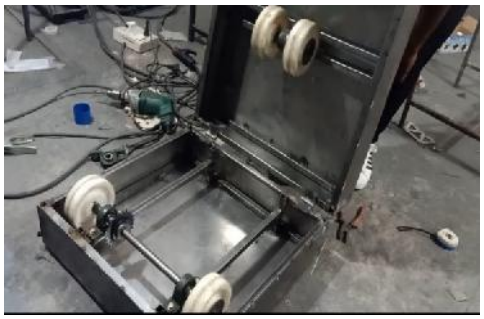


Figure 10: Fabricated Model

The potential results and implications of this project.

1. Power and Performance:

The 250-watt DC motor, combined with a 24-volt battery and 8 amps of current, provides a total power output of 192 watts (24V x 8A = 192W). This power level is relatively modest, which would result in a vehicle with limited acceleration and a moderate top speed of 20 kilometers per hour.

2. Battery Range:

With a battery capacity of 24 volts and 8 amps, the total energy storage of the battery can be calculated as follows: 24V x 8A = 192 watt-hours (Wh). Given the range of 10 kilometers, it indicates an energy consumption of approximately 19.2 watt-hours per kilometer (192Wh ÷ 10km = 19.2Wh/km). This estimate assumes that the energy consumption remains constant throughout the trip, but it could vary depending on factors such as terrain, speed, and load.

3. Towing Capacity:

The specified towing capacity of 80 kilograms suggests that the suitcase car is capable of pulling or carrying additional weight up to that limit. However, it's important to note that towing capacity may impact the vehicle's performance, acceleration, and battery consumption. Higher loads can increase energy consumption and reduce the overall range.

4. Practical Applications:

Given its modest top speed and limited range, the suitcase car could be suitable for short commutes, last-mile transportation, or compact urban environments. Its towing capacity could be useful for carrying small loads or transporting items over short distances.

5. Charging and Recharging:

To recharge the 24-volt, 8-amp battery, you would need a charging system that matches those specifications. The charging time would depend on the battery's state of charge and the charging rate. Typically, lower-powered chargers take longer to recharge the battery fully.

6. Safety Considerations:

As with any vehicle, safety considerations should be a priority. The suitcase car should be equipped with proper braking, steering, and stability systems to ensure safe operation. Additionally, adherence to local regulations and standards regarding vehicle design and safety would be crucial.

Overall, the fabrication of small segment car operated by electric power is designed for relatively short trips and light loads. It would be most suitable for urban areas or as a convenient transportation solution for short distances.

VI. CONCLUSION

Our project "FABRICATION OF SMALL SEGMENT CAR OPERATED BY ELECTRIC POWER" is the perfect application of theory and practical we have studied so far in engineering.

Some of the applications and future scope of our project is as follows,

- Useful for handicapped people.
- It can be used in college campuses
- It can be used in industrial areas to minimize the walking distance.
- Leisure and tourism, as they provide enjoyable and eco-friendly way to move around.
- The vehicles can be manufactured to have greater capacity as well as larger area for heavy duty works.

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