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DESIGN AND SIMULATION OF LOW SPEED ELECTRIC BIKE

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ABSTRACT:
The main objective of this paper is to present the development of an 'electric bike' with an innovative approach. It also deals about the design aspect of electric bikes. Design and simulation of low speed electric bike for optimization of power covers all the study related to the electric bikes. EVs give better economy with respect to conventional vehicle, good performance and reduces pollution . In order to increase electric mileage of Electric Vehicles (EVs), the power train design needs to be improved. Frame is backbone of , bike it should support and hold the whole load hence it should withstand all the static load. It consist of static simulation for sudden impact for all elements of frame. It could be concluded that the design of electric bike was so fabricated that it could withstand impact.
Key words: Design, Simulation, analysis, bike model etc.

1. INTRODUCTION:

High cost of petrol and diesel in India makes transportation more expensive, we need a negotiable solution in India. transportation is very important hence people started finding new of Energy for running vehicle. EVs are perfect solution to this problem. As electric vehicle are driven by electric motor instead of traditional IC engine. Now a days there is great demand for electric vehicles due to its advantages related to pollution and use of energy. The Battery in EV works as power house provides power to motor. This Battery can be charged by means of solar panel or wall charging. Battery control operation and speed of EV. To improve production, efficiency and variety of electric bike, Fuel cell and petrol electric hybrid are introduce. The usage of electric bike has turned out to be a solution for reducing pollution to a larger extent. To increase sale of Electric bike it need to be improved in quality. Hence in present study Electric bike are design to withstand impact load.

2. METHODOLOGY:

Selection of proper methodology is important for any research work. Experimental approach along with numerical approach should be consider to a quire verified results. In this proposed work stress calculation are done and results are verified using ANSYS Software. We have taken actual measurement of motorcycle frame and considered standard values of measurement. Literature survey was done initially to find the scope for work and objective is determined. The prototype of a pulsar 180 bike chassis is tested for impact load and deflection is calculated. A 3D model of pulsar 180 bike chassis under test is simulated using Solid works Software method and deflection is calculated. The results are obtain. The methodology describe a flowchart based on how the design and simulation of the frame was done, based on the requirement of the customer. The collection of data consists of several factors such as availability, machinability, cost, reliability, feasibility and ergonomics. The total length, height and weight were also taken into considerations.

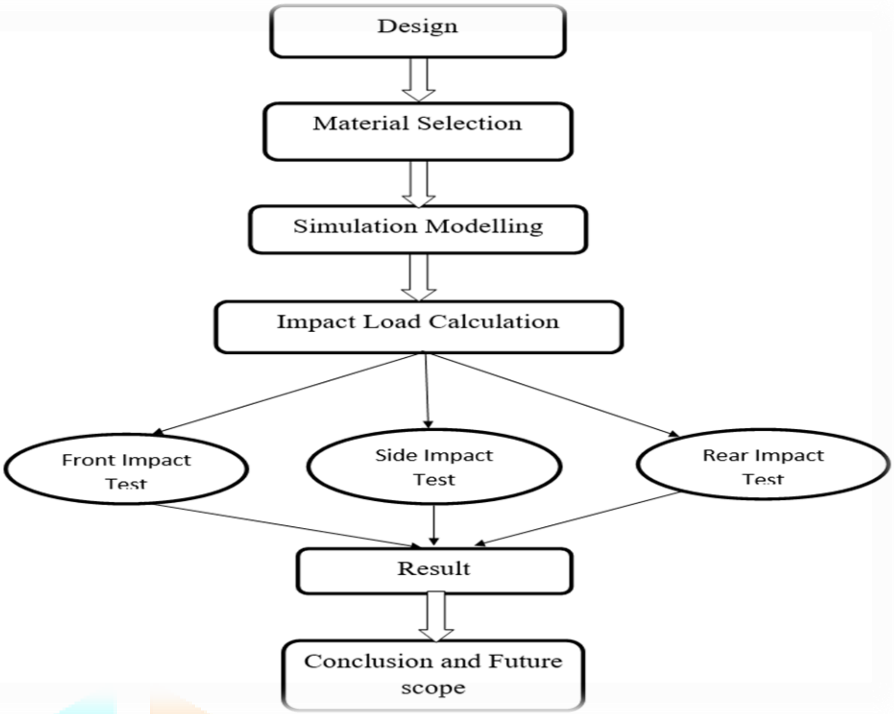

fig.1: flow chart showing methodology used

2.1 Design

The SOLIDWORKS CAD software is a mechanical design automation software that lets designer sketch, experiment with feature and dimension , and produce models and detailed drawing. We can create fully associate 3-D solid models with or without while utilizing automatic or user defined relations to capture design intent. Parameters are values which determine the shape or geometry of the model or assembly. Parameters can be either numeric parameters, such as line lengths or circle diameters, or geometric parameters, such as tangent, parallel, concentric, horizontal or vertical, etc. Numeric parameters can be associated with each other through the use of relations, which allow them to capture design intent. A Solid Works model consists of parts, assemblies, and drawings. Typically, we begin with a sketch, create a base feature, and then add more features to the model. We are free to refine our design by adding, changing, or reordering features.

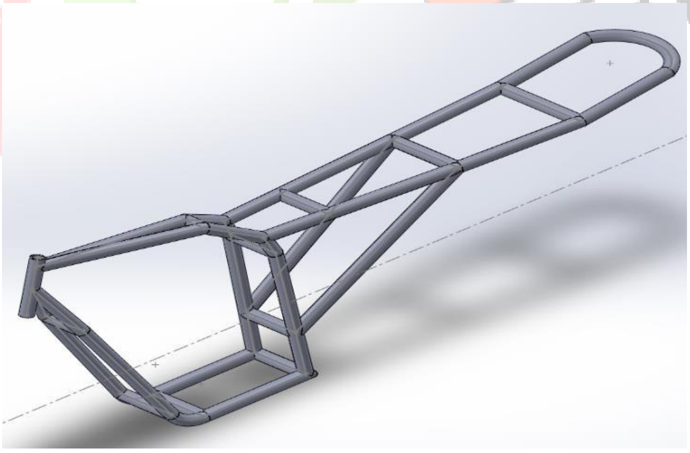

fig.2: bike frame.

fig.3: front view

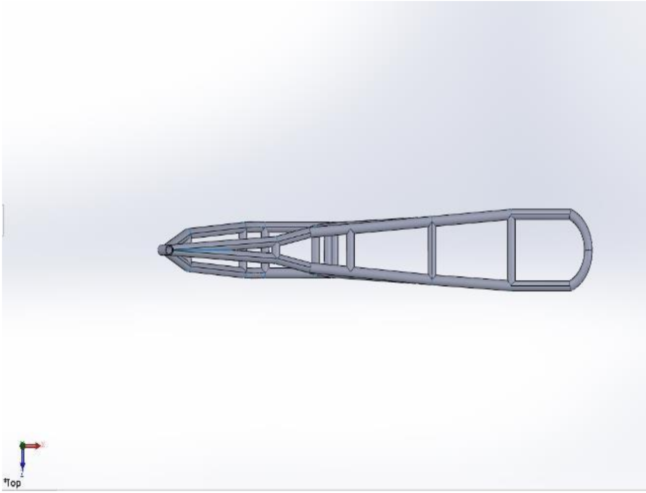

fig.4: top view

fig.5: side view.

2.2 Material selection:

The selection of the material in design depends on various factors such as load, function, climatic condition, lifetime, and overall expenditure. Taking the above factors into consideration, material selection was done in order to design an efficient and economical type of frame. Steel Alloys, Aluminium and its alloys, Titanium, Carbon Fibre were preferred type of materials during selection. Comparatively, AISI 4130 Alloy Steel was used in the present study as it is easily available, cost effective, and has improved mechanical properties.

table no 1: material composition

Element	Content
Iron (Fe)	97.03 – 98.22
Chromium (Cr)	0.80 – 1.10
Manganese (Mn)	0.40 – 0.60
Carbon (C)	0.280- 0.330
Silicon (Si)	0.15 – 0.30
Sulfur (S)	0.040

table no 2: mechanical properties

Properties	Metric
Tensile strength	731 Mpa
Yield strength	460 Mpa
Mass density	7.85g/cm^3
Shear modulus	8000 Mpa
Poisson ratio	0.285
Elastic modulus	205000 Mpa

2.3 Impact Load Calculation

Basic calculation:

- Weight of the vehicle: 215kg (the weight of the bike + driver)
- Top speed: 40km/hr.
- i.e. velocity: 11.11m/s
- impact time: 0.5 sec (an average time of impact)

Then by using the above data it can be written as:

V_f =0 (final velocity of the vehicle after collision)

V_i = 11.11 m/s (initial velocity of vehicle) T = 0.5sec (time of impact taken) a =? (Acceleration to be found) By using the formula:

$V_f = V_I$ + a x T 0 = 11.11 + a x 0.5 a = 22.22 m/s.

We know,

Force = mass x acceleration

= 215 x 22.22

Force = 4.7778 N

G-Force = force / (mass of the vehicle x 9.8)

G-Force = 4.777/ 215 x 9.8 G-Force = 2.26 N.

So here we can conclude that a normal **2 G load** is to be applied in order to analyze the chassis in different aspects.

The following calculation are made considering that 2g force act

Impact load = 2 x 9.81 x 215

Impact load = 4218.N.

Impact time = (215 x 11.11)/ 4218.3 Impact time = 0.5sec.

Yield strength: 460MPA.

2.4 Impact Test

The impact test is a method to resolve the toughness of the frame of the material under varying loading circumstances. The main concept is to test the robustness of the materials of the frame. During to impact loads, the material absorbs a certain amount of energy. If the absorbed energy exceeds the nominal limit of the material then breakage takes place. Thus the amount of energy that material could absorb can be determined. Material toughness basically determines the amount of the energy that could be absorbed, if this exceeds then fracture occurs.

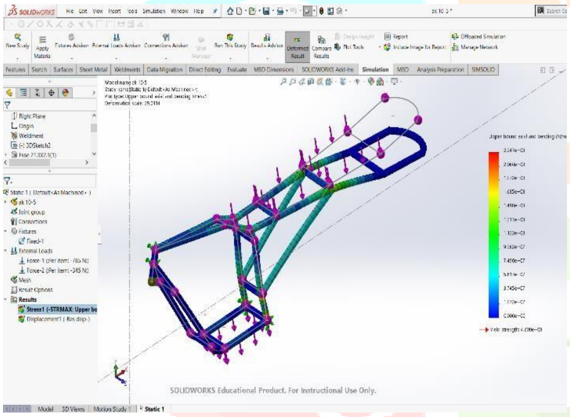

fig.6: stress

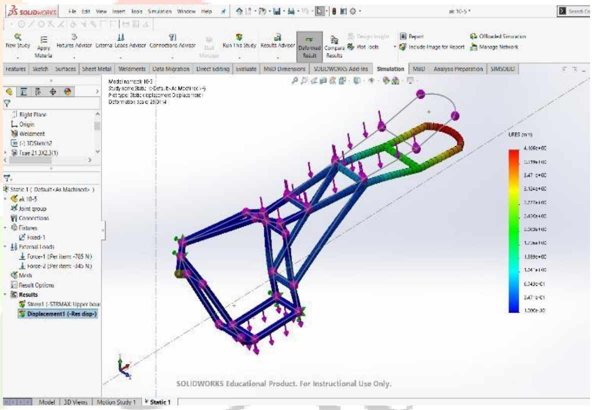

fig.7: deformation.

2.4.1 Front Impact Test

For the front impact, driver and battery load was given at respective points. The rear swing arm mounting joints and rear position kept fixed. Front impact was calculated for an optimum speed of 40kmph. The loads were applied only at front end of the chassis. Time of impact considered is 0.5 seconds. The impact force is 4218.3N.

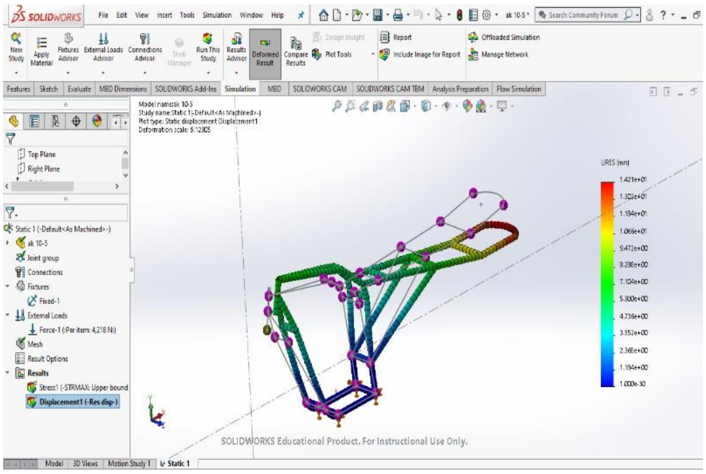

fig.8: front impact deformation.

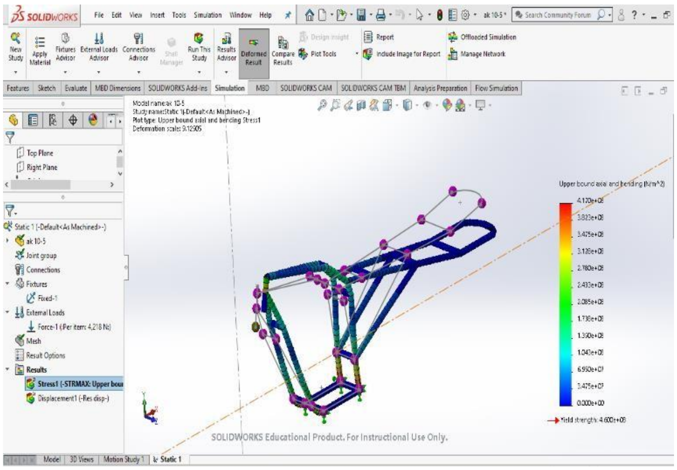

fig.9: front impact stress.

2.4.2 Side Impact Test

The most probable condition of an impact from the side would be with the vehicle already in motion. So, it was assumed that neither the vehicle would be a fixed object. For the side impact the velocity of vehicle is taken 40kmph and time of impact considered is 0.5 seconds. The front and rear joint points kept fixed. Constraining left side of chassis and applying load equivalent to 2g force as calculated to the right side of chassis (Vice versa).

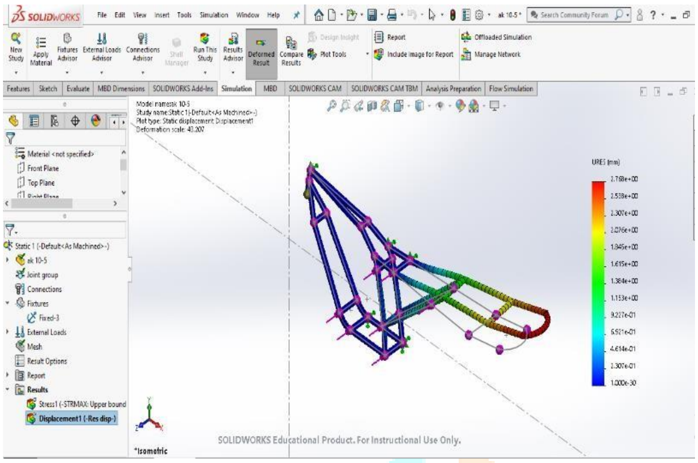

fig.10: side impact deformation.

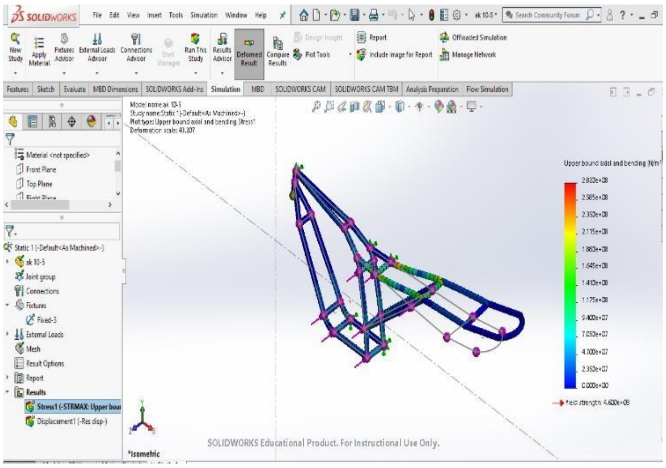

fig.11: side impact stress.

2.4.3 Rear Impact Test

Considering the worst-case collision for rear impact, force is calculated as similar to front impact for speed 40kmph. Load was applied at rear end of the chassis while constraining front end and front steering joint points. Time of impact considered is 0.5 seconds as per industrial standards.

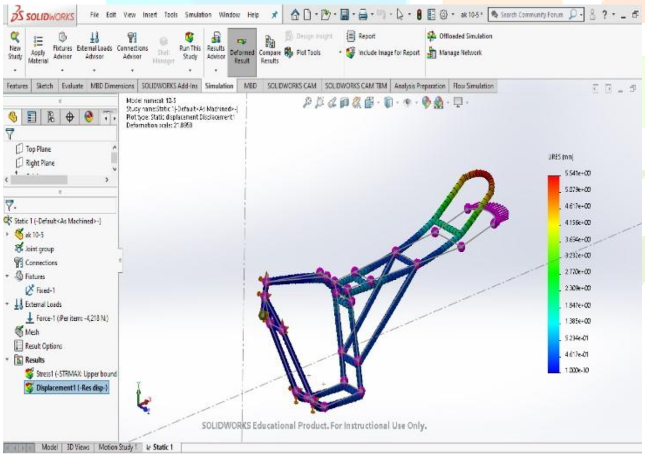

fig.12: rear impact deformation.

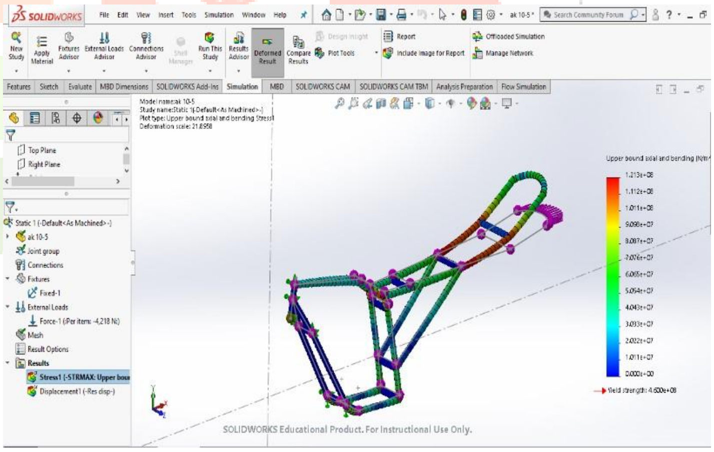

fig.13: rear impact stress.

3. RESULT

Table 3: Result.

ANALYSIS	LOAD	DEFORMATION (mm)	STRESS (MPA)	FOS
Normal Force	2g	4.16	224.7	2.04
Front Impact	2g	1.42	417.0	1.10
Side Impact	2g	2.76	282.0	1.63
Rear Impact	2g	5.54	121.3	3.79

4. CONCLUSION

In conclusion, the overall project goals were taken into account and the best performance of each goal was achieved after research throughout our project. The report consist of design and simulation of low speed electric bike. Using the results which are illustrated in the report the overall design is safe, effective lightweight and reliable for needs. Simulation results also prove to be much safer. The normal force having deformation of 4.16 mm and stress 224.7 Mpa has FOS 2.04, front impact having deformation 1.42 mm and stress 417 Mpa has FOS 1.10, side impact having deformation 2.76 mm and stress 282 Mpa has FOS 1.63 , rear impact having deformation 5.54 mm and stress 121.3 Mpa has FOS 3.79. Thus, we can conclude that chassis can withstand the given loads. As for conclusion this project has successfully fulfilled it's objectives in terms of design as well as analysis.

- Using the results which are illustrated the report, the overall design is safe, effective, lightweight and reliable for the needs.
- Simulations results also prove to be much safer, still various analyses such as fatigue test and buckling can be done for finding our unsafe or non-reliable result.
- Instead of the material AISI 4130 various materials can be used such as carbon fiber and titanium.
- The carbon fiber and titanium alloy restricts the design as it costly but it is compared to be much stronger than the material we have used. So depending upon the requirement the efficient one can be chosen.
- Due to the choosing of AISI 4130, the loading conditions have been restricted, so if any other stronger material has been chosen the loading conditions can be expanded.

REFRENCES

1. S. S. Pawar , Mayur Dumbre , Samar Rajput , Kunal Dalvi , Pranav Deshmukh (2020), Review Of Electric Bike. International Research Journal of Engineering and Technology (IRJET) Volume: 07 Issue: 03 | Mar 2020, www.irjet.net. , e-ISSN: 2395-0056.
2. Chetan Mahadik, Sumit Mahindraka, Prof. Jayashree Deka, “An Improved & Efficient Electric Bicycle system with the power of real –time Information Sharing”. ISSN:2348-6953
3. Mitesh Trivedi, Manish Budhvani, Kuldeep Sapovadiya, Darshan Pansuriya, Chirag Ajudiya, “Design & Development of E- Bike”
4. Haruo Sakamoto, Design and Manufacture of a Hand-made Electric Motorcycle,2004.
5. Rajan kumar, Munna kumar Pradyumn Sah, Mustaim Alam, Prof. Dr. M. Asok Raj Kumar, “Design and Fabrication of Electric Bicycle”
6. Behzad Asaei, Mahdi Habibidoost, Aghil Yousefi- Koma, Hamed Jalaly, “Design, Simulation and Implementation an Electric Hybrid Motorcycle”.
7. Youjun Choi, Yong Eun Kim, Heeseok Moon and Young Wook Son, “Model Based Design and Real- Time Simulation of the Electric Bike using RT-LAB and Simulink”
8. Marian Gogola, the e-bikes more dangerous than traditional bicycles, https://www.researchgate.net/publication/325915812, April 2018.
9. N S Gopi Krishnan and Kiran P Wani, “Design and Development of a Hybrid Electric Two- wheeler.