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INTELLIGENT SMART ELECTRIC VEHICLE

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ABSTRACT

This research deals with the design and manufacturing of the smart electric vehicle, which can automatically shift the power transmission from the internal system to the wheels and vice versa by using a gyroscopic sensor and microcontroller in a controlled manner. Nowadays the era of electric vehicles has just started and it will boost up the automobile industry, in such a way that contemporary fossil fuel vehicles are going to become obsolete in next future. The most important thing is that they are environmentally friendly in nature which reduces harmful emissions. The objective of the project is to develop a smart car which automatically shifts its power transmission. For this purpose, we have used the CATIA software (CAD), to design the mechanical components of the system. We used the 12 volt regulated power supply circuit, 12 volt DC motor, 12 volt DC fan, AT328P microcontroller. After that the comparative analysis willbe carried out between the experimental and analysis results and then the result & conclusionwill be drawn.

As we all know how our world is prominently dominated by S.I Engine vehicles (petrol) and C.I. Engine vehicles (diesel) for wide use of transportation across various kinds of terrains. And like we all know on a hilly terrain with increasing altitude and travelling upstream requires AC to be shut off, which will take the load off the engines and production of electrical energy will be hold,and in this case the whole power is to be transmitted for torque to wheels by power-train. Electricvehicles are having rooftop sales in the recent times, and EV's are going to tackle the same difficulty in going upstream over an increased altitude.

This situation is to be dealt with an automotive engineer's perspective; the idea is to shut all the secondary electrical components. For example, air conditioning unit, music system, etc. and transfer the whole power produced by motor to the primary system for torque production. This process should be automated without any manual input with the help of gyroscope sensors, which are to be used to determine the slope and shut all the electrical equipment's for primaryuse only.We will overcome this problem with a helpful solution.

INTRODUCTION:

An electric vehicle also called an EV uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources or may be self-contained with a battery, solar panels oran electric generator to convert fuel to electricity. An electric car is an automobile that is propelled by one or more electric motors using energy stored in rechargeable batteries. The first practical electric cars were produced in the 1880s. Electric cars were popular in the late 19th century and early 20th century, until advances in internal combustion engines, electric starters in particular and mass production of cheaper gasoline vehicles led to a decline in the use of electric drive vehicles. From 2008 a renaissance in electric vehicle manufacturing occurred due toadvances in batteries, illnesses and deaths due to air pollution and the desire to reduce greenhouse gas emissions. Electric vehicles have several benefits over conventional internal combustion engine automobiles, including a significant reduction of local air pollution as they do not directly emit pollutants such as particulates (soot), volatile organic compounds, hydrocarbons, carbon monoxide, ozone, lead, and various oxides of nitrogen. Several national and local governments have established government incentives for plug-in electric vehicles, tax credits, subsidies, and other incentives to promote the introduction and adoption in the mass market of new electric vehicles, often depending on battery size, their electric range and purchase price.

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Gyroscope is a device used for measuring or maintaining orientation and angular velocity. It is a spinning wheel or disc in which the axis of rotation (spin axis) is free to assume any orientation by it. When rotating, the orientation of this axis is unaffected by tilting or rotationof the mounting, according to the conservation of angular momentum. Gyroscopes based on other operating principles also exist, such as the microchip-packaged MEMS gyroscopes found in electronic devices, solid-state ring lasers, fiber optic gyroscopes, and the extremely sensitive quantum gyroscope. Applications of gyroscopes include inertial navigation systems, such as in the Hubble Telescope, or inside the steel hull of a submerged submarine. Due to their precision, gyroscopes are also used in gyro theodolites to maintain direction in tunnel mining. Gyroscopes can be used to construct gyrocompasses, which complement or replace magnetic compasses (in ships, aircraft and spacecraft, vehicles in general), to assist in stability (bicycles, motorcycles, and ships) or be used as part of an inertial guidance system. MEMS gyroscopes are popular in some consumer electronics, such as smart phones.

A microcontroller (MCU for microcontroller unit) is a small computer on a single metal-oxide-semiconductor (MOS) integrated circuit chip. In modern terminology, it is similar to, but less sophisticated than, a system on a chip (SoC); a SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems.

Literature Survey:

A detailed review of literature is taken to gather information about various aspects of problem. Focus of relation work done for safety of labors, minimizing accidents and minimizing time consumption

Pedro Marques, Rita Garcia, Luiz Kulay, Fausto Freire [1], Comparative life cycle assessment of lithium-ion batteries for electric vehicles addressing capacity fade we use LCA and capacity fade models to assess environmental impacts of EV batteries. Usage conditions and electricity mix are critical for the EV environmental performance. Lithium-ion batteries are currently used in electric vehicles (EVs) with many advantages; however, batteries contribute significantly to the life cycle environmental impacts of these vehicles. This article presents a comparative life cycle assessment of two types of batteries, lithium manganese oxide and lithiumion phosphate. frequently used in EVs, addressing real-life operational conditions and battery capacity fades.

Shachar Tresser, Izhak Bucher [2], Balancing fast flexible gyroscopic systems at low speed using parametric excitation Amplifies low response due to imbalance with parametric excitation. Isolates the projection of imbalance on high-speed rotational modes. Eliminates the need to balance rotors at high speed. Formulation includes, gyroscopic, nonlinear limiter and parametric amplification. Presented is a method to identify the projection of imbalance forces on high speed related modes of vibration, using data measured rotating at low rotating speeds. The method employs two actuators and several sensors to generate information not available otherwise in rotating structures.

Jing-Shan Zhao, Wentao Liu, Yun Zhang, Zhi-Jing Feng, Jun Ye, Qing-Bo Niu [3], Effects of gyroscopic moment on the damage of a tapered roller bearing, Gyroscopic moment is expressed by parameters of a tapered roller bearing. Boundary condition inducing side damage for tapered roller bearings is obtained. Design criterion to avoid ill-effect of gyroscopic moment is specified. This paper investigates the effect of gyroscopic moment on the induction of damage of a tapered roller bearing. High speed and high load are the typical characteristics of nowadays express trains which rely heavily on the tapered roller bearings. However, the phenomena of damage, especially for the side damage, of rollers and ring raceways in tapered roller bearings cannot be neglected with the occurrence of super speed trains in China

Enrico Ferrero, Stefano Alessandrini, Alessia Balanzino [4], Impact of the electric vehicles on the air pollution from a highway. A numerical chemical-dispersion model is applied to compute air pollution generated by traffic. A measurements campaign is carried out collecting meteorological and chemical variables. Measurement of traffic flows and related pollution emissions make the work original. New fleet scenarios based on electric vehicle introduction are considered. The benefits on air quality and human health due to electric vehicles are evaluated. The results provide useful information to decision makers and public administrators for planning measures to modify the car fleet composition aiming to improve the urban air quality.

Mohammad Reza Solouk, Mohammad Hassan Shojaeefard, Masoud Dahmardeh [5], Parametric topology optimization of a MEMS gyroscope for automotive applications, Parametric topology optimization of an electrostatic gyroscope proposed. Gyro is modeled using a parameterized 3D physical model and a control model. The optimization algorithm is carried out considering automotive application. Automotive MEMS gyroscopes are used for various purposes, such as rollover prevention and dynamic stability. Although, employment of gyroscopes for automotive applications is reported, what is not discussed is the gyro topology design and optimization for these applications. This article reports parametric topology size optimization of a MEMS gyroscope proper for automotive applications.

PROBLEM STATEMENTS

In existing EV's there is a need for automatic power transmission from secondary electrical components to electric motor in high altitude regions. The problem occurs during climbing is affects the performance of the vehicle as well as the battery efficiency of the vehicle. In recent years the EV is developed and the running kilometers provide by the company is not achievable in practical basis because lots of issues and all electronic component need electricity to work, and this electricity is taken from the battery of the vehicle. But when vehicle is climbing hills, required more torque, so need to use more power for the motor. So, to avoid this problem we develop the system which automatically switches off all electronic components which is not required to drive the vehicle.

ACTUAL PROBLEM IN VEHICLE

The air conditioner in a car draws power from the engine, mainly to run the air compressor. An AC system employs a refrigerant flowing through a compressor, condenser, expander and an evaporator. Air blows over the evaporator, where it is cooled and flown into the passenger cabin. So the AC system does use some of the fuel burnt in the engine. But that usage amount is very small in most modern cars. However in older cars, especially the ones with low engine power, continuously using the air-conditioner could reduce the mileage almost up to 20%.This mileage drop is even more prevalent when such cars go uphill with the AC turned ON. This is simply because, more load is put on the engine to move the vehicle against gravity.

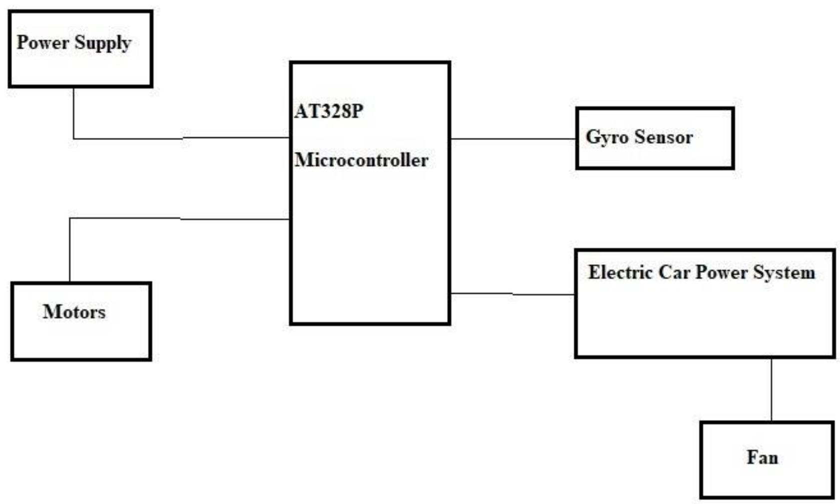
OBJECTIVES:

- When the vehicle starts climbing, the compressor/AC should stops working.
- This extra energy should be supplied to the rear drive for climbing purpose.
- To achieve the high endurance for steep slopes.

METHODOLOGY TO BE FOLLOWED:

WORKING METHODOLOGY:

The required objective of our system is that when the vehicle is started to travel on the inclined roads, the complete power supply must be supplied to the tires of the car by automatically turning off the fan (cooling system designed for the traveler). The frequency and amplitude of on and off of the fan depends on the inclination angle of the road. Hence when the slope is very steep controlling is done in such a way that the maximum power is to be supplied tothe wheels. Similarly, when slope is very gentle accordingly minimum extra power is supplied tothe rear wheels.



We have done our setup in such a way that, the frame of the vehicle has the gyroscopic sensor. When vehicle starts taking inclined path it sends signal to the microcontroller. The microcontroller is programmed in such a way that it will automatically cuts off the power supplied to the fan, and all the power supply is concentrated at the wheels. There is also an arrangement made where the driver can turn off the above designed system so that power can be transferred to both fan and wheels.

ANALYSIS

ANSYS Workbench 21.0 platform to perform modal analysis of thrust coupling. ANSYS Workbench 21.0, as the most advanced CAE software, provides users with simulation modules including: structure, fluid, electromagnetic, heat transfer, and other fields. It is the industry's most advanced engineering simulation technology integration platform, with intuitive and friendly interface, convenient pre-processing and post-processing functions, and its extensive solution functions.

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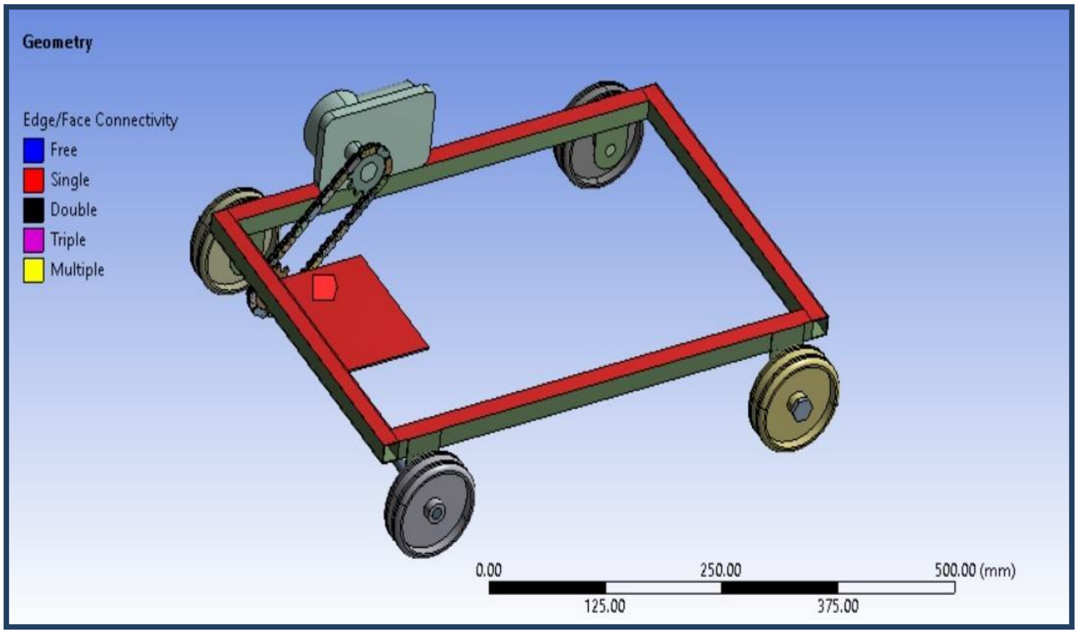
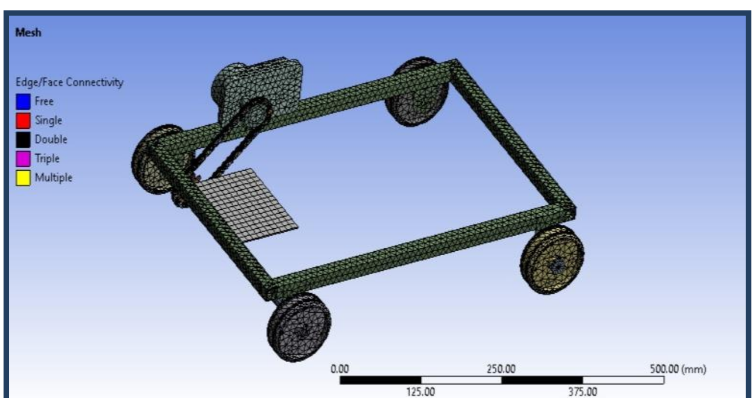
GEOMETRY



MESHING

As the main link of finite element analysis, grid division can best reflect the idea of finite element. The quality of the web site not only affects the efficiency of model analysis, but also directly affects the accuracy of analysis results. Therefore, according to the existing hardware, without affecting the accuracy of the calculation results, the method of dividing the mesh can be appropriately selected to save calculation time.



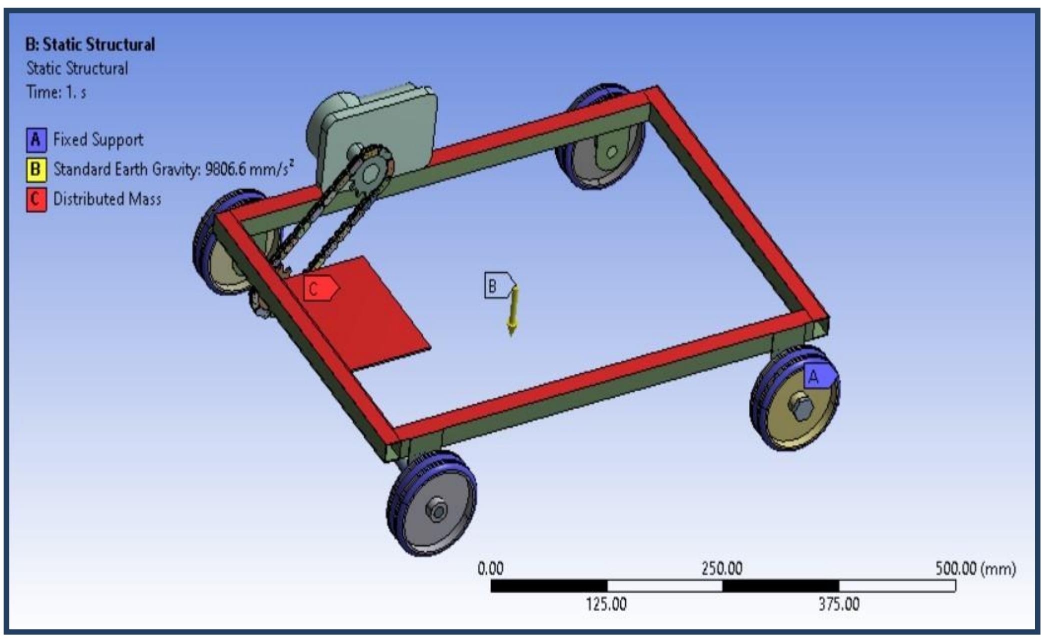
Statistics	
Nodes	76960
Elements	37918

Final mesh model,
it contains 76960 nodes and 37918 elements.

Element Types, when geometries are complex or the range of length scales of the flow is large, a triangular/tetrahedral mesh can be created with far fewer cells than the equivalent mesh consisting of quadrilateral/hexahedral elements. This is because a triangular/tetrahedral mesh allows clustering of cells in selected regions of the flow domain. Structured quadrilateral/hexahedral meshes will generally force cells to be placed in regions where they are not needed. Unstructured quadrilateral/hexahedral meshes offer many of the advantages of triangular/tetrahedral meshes for moderately-complex geometries.

- For simple geometries, use quadrilateral/hexahedral meshes.
- For moderately complex geometries, use unstructured quadrilateral/hexahedral meshes.
- For relatively complex geometries, use triangular/tetrahedral meshes with prism layers.
- For extremely complex geometries, use pure triangular/tetrahedral meshes.

BOUNDRY CONDITION



CALCULATION

1. Required torque to move the frame

The motor rotate with the 5 kg of load at 55 rpm using a 4 inch tyre.Solution:-
1 inch =0.0254 m
4 inch =0.1016 m
Force required lifting the 18 kg loadF = m*a
= 5*9.81
=49.05 N
Torque required to moving operation

Torque = F*d

Torque = 49.05*0.1016Torque= 4.9834 N-m
So, the torque required for moving operation is 4.98348 N-m

2. Torque of the wiper motorSpeed (rpm)= 55 rpm
Power (P) = 120 W

$$\text{Torque} = \frac{60*P}{2*\pi*RPM}$$

$$\text{Torque} = \frac{60*120}{2*\pi*55}$$

$$= \frac{7200}{110\pi}$$

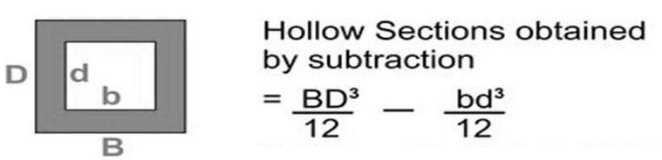
Torque = 20.83 N-m

Torque required to moving the frame < Torque of the wiper

So, selected motor is safe.

3. Frame

Load on frame considered P = 5 kg =49.05Ny = D/2 = 25/2 = 12.5mm
D = 25 mm B = 25 mm t= 2mm thickness



Length of frame is 550 mm Moment of inertia in x directionI = 16345.34 mm^4

$$Mb = \frac{WL}{4} = \frac{49.05*550}{4} = 6744.375 \text{ N-mm}$$

Bending stress of pipe

$$\frac{Mb}{I} = \frac{\sigma b}{y}$$

$$\sigma b = \frac{6744.375*12.5}{16345.34} = 5.15 \text{ N/mm}^2$$

Theoretical bending stress

$$\sigma b(th) = \frac{Syt}{f.s} = \frac{310}{1} = 310 \text{ N/mm}^2$$

$\sigma b < \sigma b(th)$

Hence design is safe.

ANALYSIS

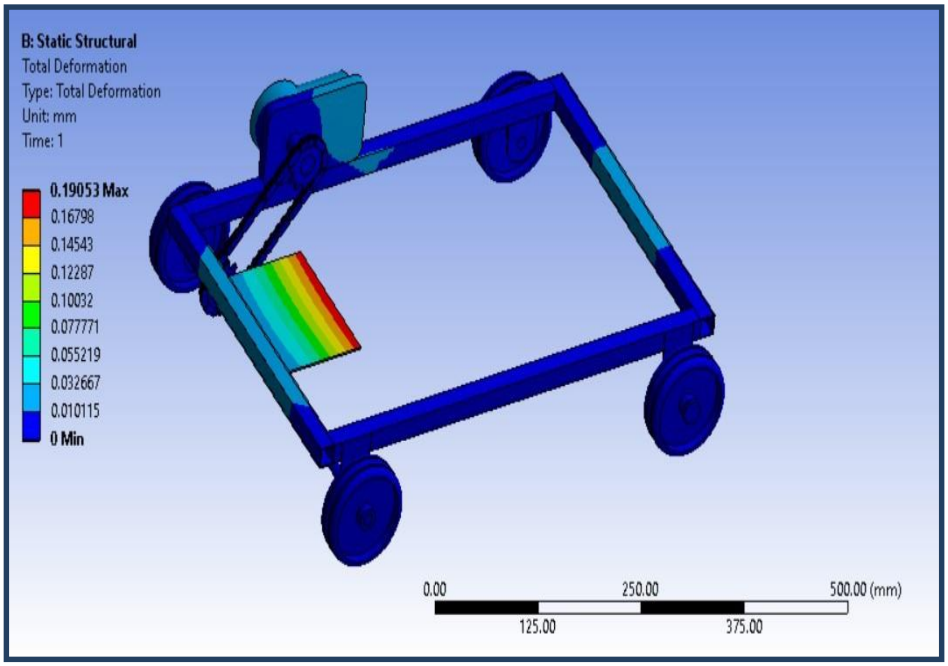
ANSYS Workbench 21.0 platform to perform modal analysis of thrust coupling. ANSYS Workbench 21.0, as the most advanced CAE software, provides users with simulation modules including: structure, fluid, electromagnetic, heat transfer, and other fields. It is the industry's most advanced engineering simulation technology integration platform, with intuitive and friendly interface, convenient pre-processing and post-processing functions, and its extensive solution functions.

CONCLUSION:

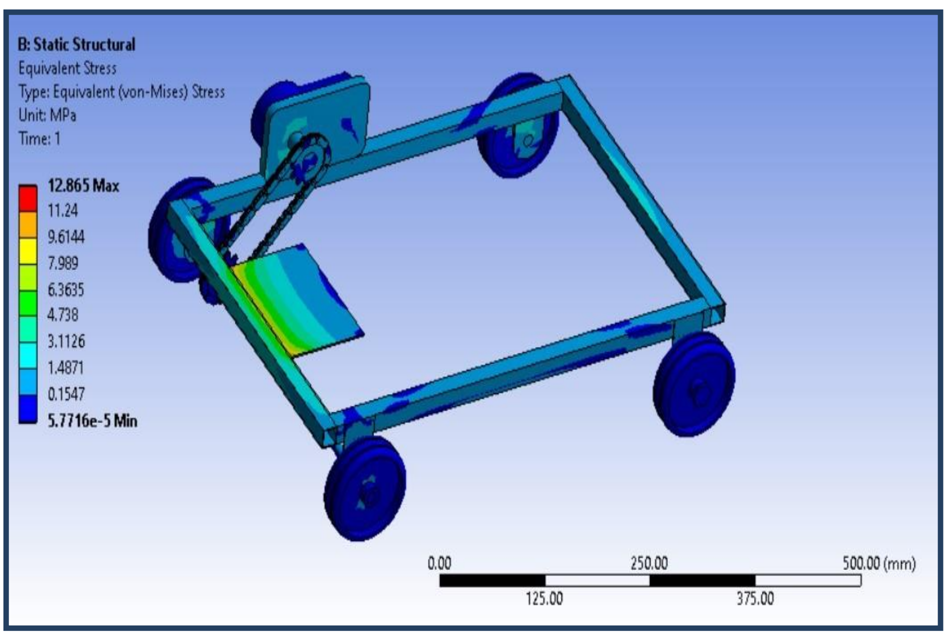
In this project, we successfully completed a work on smart EV vehicles with the help of research papers. Design and 3D modeling of smart EV vehicles is completed using solid works software calculation is done with respect to solid works model. The manufactured model was tested and the working of the mechanism was demonstrated successfully

RESULT

1. TOTAL DEFORMATION



2. EQUIVALENT STRESS



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