DESIGN AND MODIFICATION OF THREE WHEELED SOLAR POWERED ELECTRIC VEHICLE FOR PHYSICALLY HANDICAPPED PEOPLES AS TAXI DRIVER

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Abstract:

Transportation and job opportunity condition on regarding the physically disabled peoples in the world have been yet slightly poor attention to it. This paper mainly focuses on designing and modifying the suitable and comfortable light electric vehicle by identifying the existing gaps to facilitating job opportunity to those groups of society like taxi driver. The driver can drive this vehicle by holding two persons. The product concept generated, evaluated, and selected based on those needs. Embodiment design, detail design, technological process development and bill of material were done for the selected product concept. Therefore, **design and modification of** three wheeled solar powered electric vehicle for physically handicapped peoples as taxi driver'' is better solution for to fulfill the socio-economic problems of the target groups of the society.

1 Introduction

Due to The ecological decay the fuel burning is alarming and justifies the design of eco-friendly system. As well as, the deteriorating reserves of fossil fuels forcing the engineers and scientists to develop renewable energy sources. Ethiopia is outlay large amount of foreign currency to import crude oil even though we have abundant resource of solar energy. If solar power utilized for local conveyance, a large amount of currency can be saved and we can also ensure pollution free environment and contribute to nation's economy by creating job. This thesis is focused on creating eco-friendly pollution free vehicle for any adult peoples either handicapped or not which can be easily driven. So, it is better if we provide three wheeled solar powered vehicles with hand drive recharging mechanism. This vehicle is can be operated by electric motor which is

powered by rechargeable battery. The battery also can be charge by either solar system or directly plugging to the ac-current. When the battery is not available due to empty charge we can have another operating mechanism, by using hand or leg drive chain we can drive it at any condition. The vehicle has main components including solar panel, battery, electric motor, chain, pedal and others salient features (rajendra beedu, 2014).

3 Materials and Method

To reach mentioned objectives different technical approaches and methodology were used. First of all, detail working schedule was prepared. Then all literatures which related with the study area were reviewed from various sources such as journal, books, articles and others. After a task of literature study was accomplished the design analysis of the project and result and discussion.

4. Design Analysis

This vehicle is driven by DC electric motor. The power source is the Li-battery which has dual-recharging systems those are the solar charging or PV-cell technology and the hand pedal chargers are mounted i.e. the hand drive chain pedal. Wheel Configuration of the vehicle is like triangular configuration or delta configuration it has one front wheel and two rear wheels. At the rear it has a passenger seat and electric motor which can hold two people and near-middle position the battery, alternator as well as the driver is set. This put most of the weight into rear wheel, so the tricycle becomes more stable.
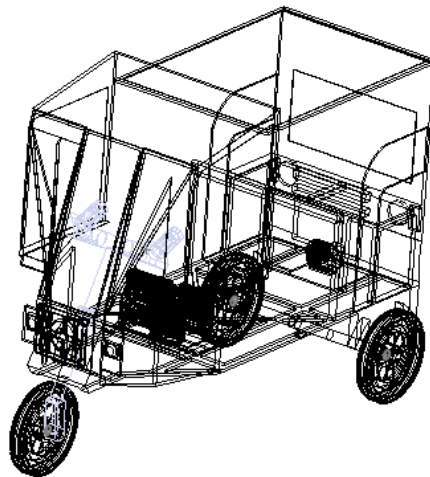

Figure 1: Model of the target vehicle by solidworks

5 Result and Discussions

5.1.1 Propulsion and motor power results with different (θ) for maximum vehicle speed

From all specifications of this vehicle those discussed in the design analysis section of this thesis there are dependent and independent variables which are determined by either by calculation or by assumption. For instance we can classify the variables in to two basic categories

1. Dependent variables and
2. Independent variables

➢ Independent variables; - those are the specifications their magnitude and properties are not constant and their situation can affect the magnitude of the other dependent variables. Those are

- Sunlight
- Road angle gradient
- Wind speed

➢ Dependent variables; - those are the specifications their magnitude and properties are constant but their magnitude can be affected by the independent variables. Those are

- Propulsion energy Motor power (P_m)
- Speed of the vehicle (v)

So from all analysis the magnitude of the power and energy requirement as well as the required electric engine to propel the vehicle is determined based on different given specifications by applying vehicle dynamics concepts i.e. from three wheeled dynamics and drive line vehicle dynamics.

When the vehicle running forward the speed of the electric engine should overcome all resisting forces but the speed of the vehicle will vary or dependable on the road angle and the wind speed. By taking the maximum speed of the wollo area around Kombolcha town 12km/hr. so the vehicle speed is $6m/s$.

Table . 1 Table result of propulsion power and motor power with different road angle

Road angle gradient(θ)	$F_{resul}[N]$	$P_{propulsion}[kw]$	$P_m [kw]$
0	16.5	98.4	131.2
1	87.95	527.7	703.6

2	159.48	956.9	1275.8
3	230.95	1385.7	1847.6
4	302.36	1814.2	2418.9
5	373.67	2242.6	2933.4

So from this result based on the previous analysis the magnitude of the required propulsion power and the required motor power are simultaneously increases when the road angle gradient increase. [3] discussed a project, Proton Exchange Membrane (PEM) energy unit are progressively being refered to by governments as a conceivable pathway to the decrease of ozone depleting substance outflow. It is one of the forthcoming force hotspots for car applications, prepare machines, stationary cogeneration frameworks, and portable electronic gadgets. Be that as it may, the dryness of the film of a PEM power device diminishes the ionic conductivity, bringing about execution decrease. In this work, a two-dimensional model is utilized to examine the fundamental and collaboration impacts of five outline factors, at three levels in a proton trade layer (PEM) energy unit. Investigation is directed for working possibilities of 0.7 and 0.6V and a scope of current densities. An engine that picks up its energy from a hydrogen tank and a power device Stored in a tank. The substance vitality from the hydrogen will be changed over into electrical vitality by the power device to push the prepare at up to most extreme speed of 80km/hr. Prepare apparatuses like Fans, lighting may likewise keep running on PEM energy unit. This new hydrogen prepare is along these lines ideal for shorter, calmer extends of the system that jolt hasn't yet come to.

5.1.2 Software analysis dimensions and results by solidworks
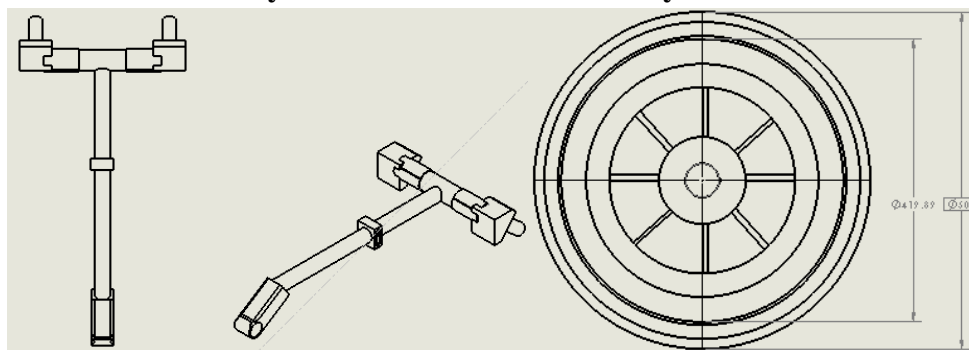
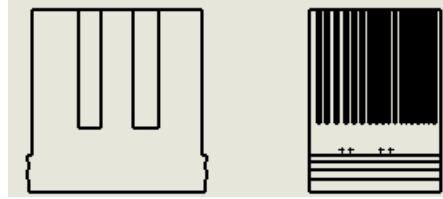

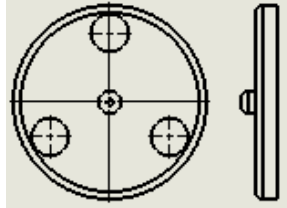Throttle arm   tyre

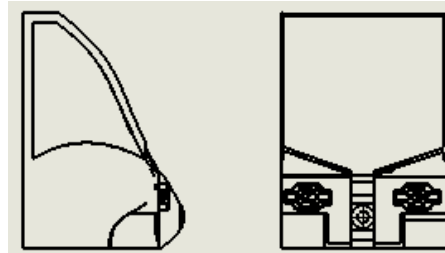Rear axle shaft   battery
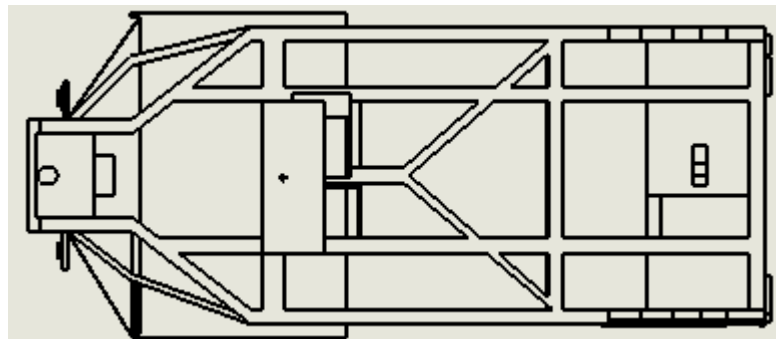
Wheel drum   compartment
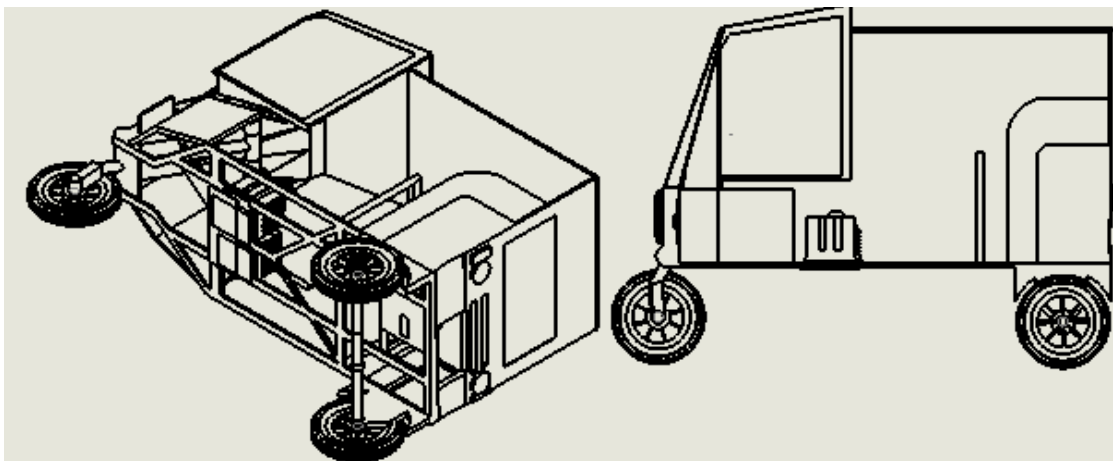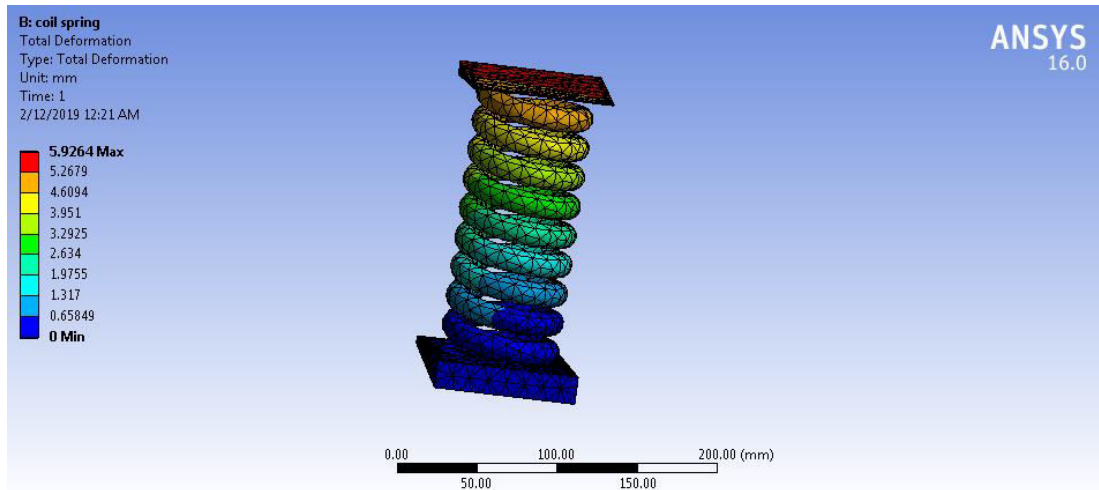
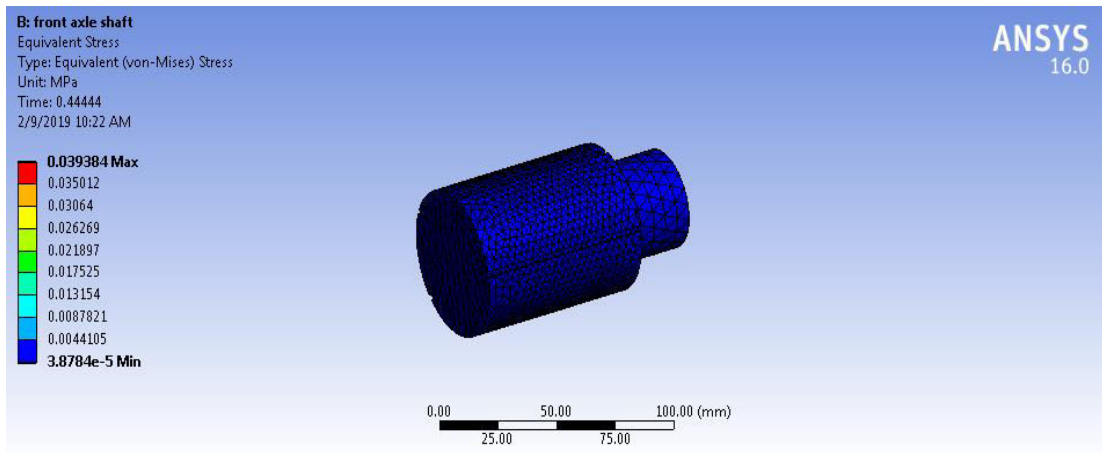Front and rear compression spring   frame
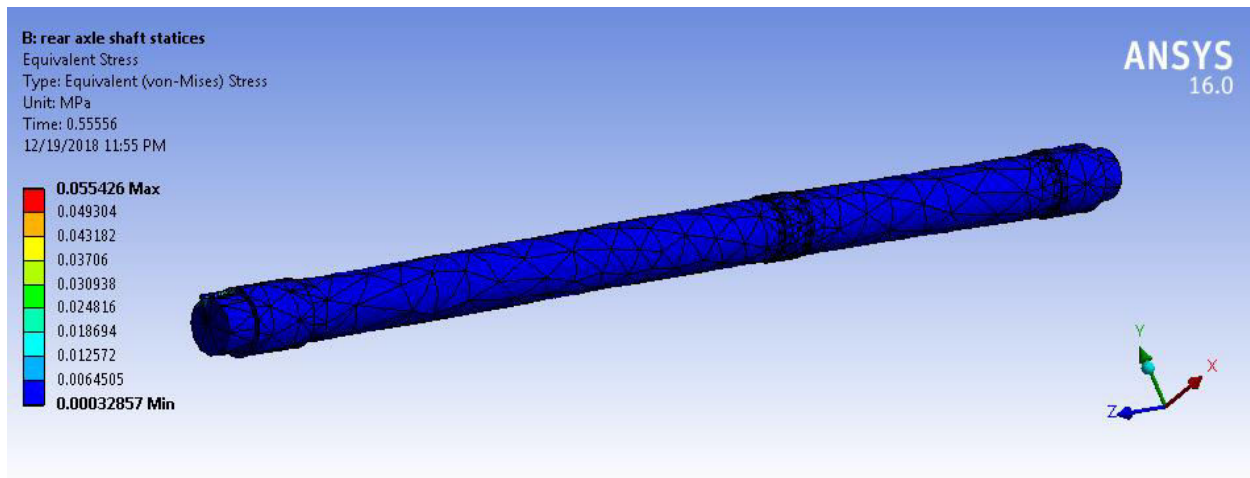
Figure 1: Assembled vehicle by solidworks

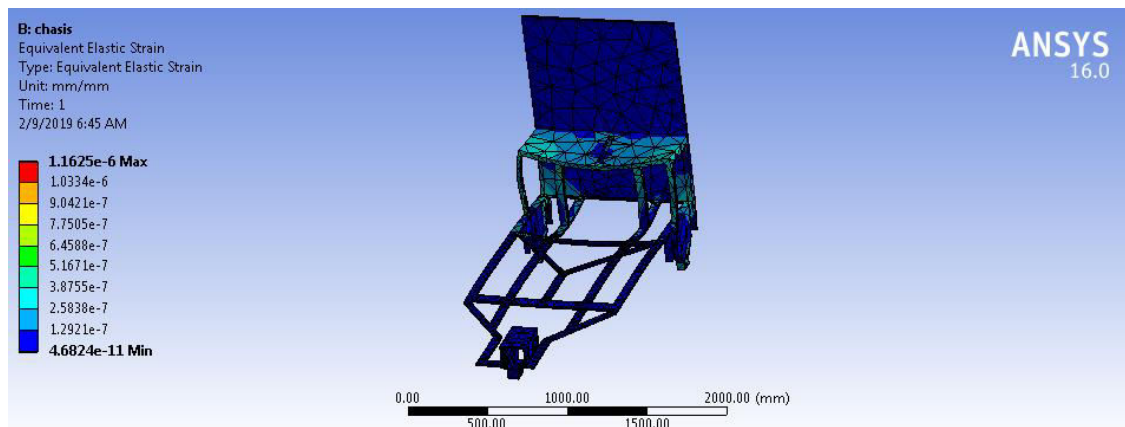## 5.1.3 Software analysis results by ansys

Compression spring

Front axle shaft

Rear axle shaft

Chassis

5.1.4 Building a prototype model of the vehicle

In this section the development of the prototype procedure s and to test the functionality of this vehicle, small sized working model was proposed to be developed. And after the design analysis was done, detail specification of the model was chosen based on the availability of materials.

5.1.4.1 Steps followed during development of a model

1. The kids bicycle with 12 inch wheel diameter was selected. I purchased it from market

2. The following specification of working model was selected and decided.

3. Then ongoing manufacturing the prototype

Specification of Model

Length = 1.3m	Battery = 12V
Height = 1.5m	Steering = bicycle steering system
Width = 1m	Sheet metals =1
Mass = 35kg	Tubolaries = different sizes
Motor = large fan motor	

Progress building prototype in workshop

➡ Frame construction

➡ Assembled with wheel

➡ Assembling of steering ,motor,battery and solar panel with body and frame

Figure 2: Final prototype model of the vehicle [work shop]

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