International Journal of Engineering Research and Technology. ISSN 0974-3154 Volume 10, Number 1 (2017)

DESIGN AND DEVELOPMENT OF PERSONAL TRANSPORT VEHICLE E-Ride W 250

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Abstract
The personal transport vehicle works on the principle of battery and electric motor drives. The target area of application is to solve the problems regarding the indoor travelling where the area is huge such as factory shops, college campus, hospitals and many others. In factory shop where the shop floor is large and it becomes difficult for shop supervisors to control the activities along the floor by walking around.
E-ride W250 personal transport vehicle as the name suggests can be used at a time by a single person. This works on power of battery which can be charged with the help of domestic electricity supply or solar energy and motor drives. The motor is connected to the final drive and transmit the motion to the wheels.

Keywords: personal transport vehicle, steering systems, control system, battery, BLDC motor.

Introduction
Transport or transportation is the movement of people, animals and goods from one location to another. Modes of transport include air, rail, road, water, cable, pipeline and space. The field can be divided into infrastructure, vehicles and operations. Transport is important because it enables trade between people, which is essential for the development of civilizations. A mode of transport is a solution that makes use of a particular type of vehicle, infrastructure and operation. The transport of a person or of cargo may involve one mode or several of the modes, with the latter case being called intermodal or multimodal transport. Each mode of transport has its own advantages and disadvantages, and will be chosen for a trip on the basis of cost, capability, and route.

In today's world of industrialization the manufacturing of the product has becomes quick and more economic task. Due to which the manufacturing industry goes on extending the plant size as well as number of employees for better economy. But as the work area increases, due to which maintenance becomes tedious task because more no of employees are needed to be involved in that job.

Following are the difficulties faced by a workshop supervisor.

- It takes very long time for a supervisor to travel from one section to another for daily routine tasks.
- The response time for a supervisor to any difficulty is more for the large area of workstations.
- Supervising different machines and workstations merely by walking result in increase of fatigue on supervisor.
- It is not feasible for supervisor or manager to carry the equipment's which are necessary to resolve the problems related to shop floor like toolkit, laptop etc.
- Supervisor is not able to maintain his physical stamina at the end of the day due to physical exertion caused by visiting various work stations.
- Due to more physical exertion efficiency of getting work done of an employee decrease.
- As the work load increases the assistance is needed by the shop supervisor or manager, which causes the increase in employment.

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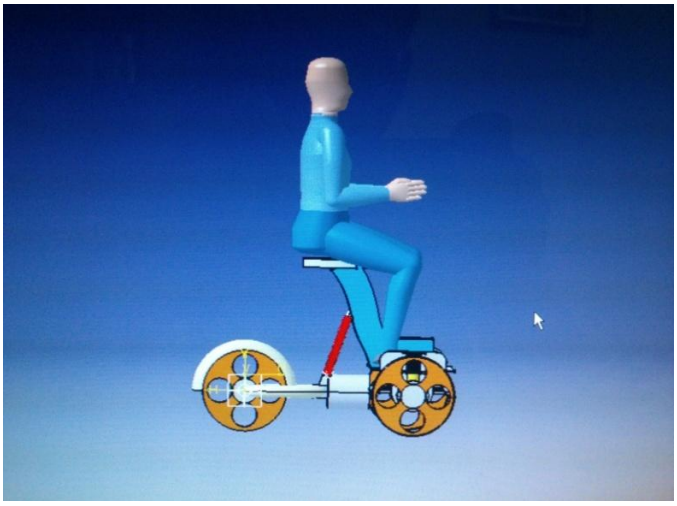

Image 1: Concept Defining in Catia Modeling.

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is connected to the final drive and transmit the motion to the wheels.

Literature Survey

Neil Birtley [1] has been discussed on Review the role of the stylist and aerodynamics. An author given an overview of design stages in body design from concept to final design of product. In this paper he also mentioned the operational procedure creating 2D design on paper on converting those sketches to three dimensional models. He also elaborated the Product planning and Brainstorming techniques.

Rob Hutchinson et al[2]The main theme of this chapter will be the study of the various inter-relationships between the structure of engineering materials, the methods of component manufacture and their ultimate designed behavior in service. In this chapter author demonstrate the material selection process and its interactivity with design.

Julian Happian Smith.[3] In this book the author describes the modern and basic vehicle designing methods in detail. The text is intended to provide the reader with an introduction to most of the topics that are of concern when a vehicle is being designed from the 'clean sheet of paper' stage. Also author is explained all design consideration for vehicle such as Body Design, Aerodynamics, Chassis design, Suspension and Steering System, and Braking system.

V.M. Karanam. et al [5]In this paper author described in detail about the process of development of a dynamic model of a three wheeled vehicle using ADAMS-CAR. They first describe the rigid body model, and then the modeling of structural flexibilities. The aim of this report is to document procedural details of such modeling, with a view to presenting more research and development oriented investigations in the future. The contents of this report may also be of interest to practicing engineers engaged in multi-body dynamics modeling of wheeled vehicles.

Concept and Design:-.

The design is carried out at following stages

Design

The E-Ride W250 is designed in the sense of maximum utilization and beneficial vehicle to its user. As managers and supervisors are going to play an important role into any industrial organization like manufacturing plants, so that they should utilize their time in such way that they get maximum output in today's competitive world.

The basic design is only for single person at a time. The frame is made up of Steel pipe and designed to sustain against the load of 200 kg weight. The PTV has 3 wheels among which there are two wheels at the front and rear wheel is motored wheeled.

Frame Design

Design Specification of Frame

Design Specification:
Operator weight carrying Capacity: 120 kg
Accessories weight carrying Capacity: 10 kg
Foot-space: 60x40 cm

Catia V5 3D Modeling

Frame Analysis

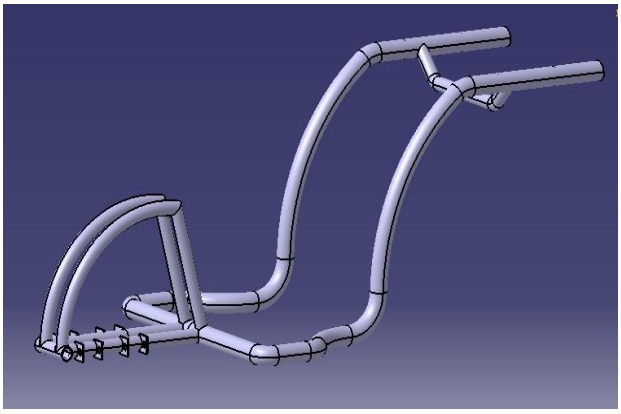

Image 2: Catia 3D Modeling of Frame

Finite Element Analysis

Analysis Report

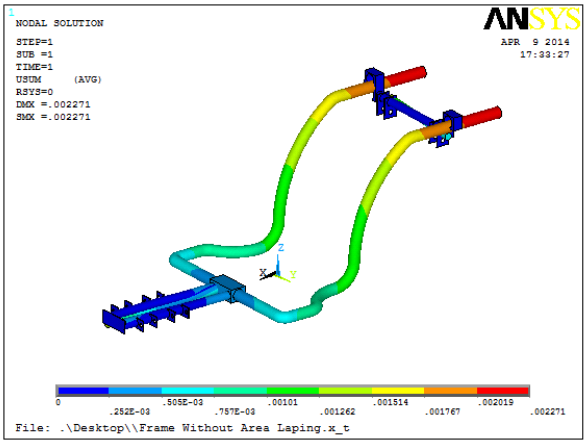

Image 3: Ansys Solution Image

Table 1 Element type and nodes

Entity	Number Defined
SOLID45	840024
Nodes	195723

Table 2 Material Properties

Modulus of elasticity X-Direction	2.00E+05
Major Poisson's ratio Z-Plane	0.3

Table 3 Boundary Conditions

	X	Y	Z	Vector Sum
Maximum	0.002097	0.001179	-0.001341	0.002271

Table 4 Displacement

	X	Y	Z	Vector Sum
Maximum	0.002097	0.001179	-0.001341	0.002271

Table 5 Direct Stresses

	X	Y	Z
Minimum	-1892	-1571	-1116
Maximum	660	108.5	177

Ergonomics

Product Design Ergonomics

The word ergonomics comes from two Greek words:

- ERGO: meaning work
- NOMOS: meaning laws

Ergonomics is a science focused on the study of human fit, and decreased fatigue and discomfort through product design. Ergonomics applied to office furniture design requires that we take into consideration how the products we design fit the people that are using them. At work, at school, or at home, when products fit the user, the result can be more comfort, higher productivity, and less stress. Ergonomics can be an integral part of design, manufacturing, and use. Knowing how the study of anthropometry, posture, repetitive motion, and workspace design affects the user is critical to a better understanding of ergonomics as they relate to end-user needs

Electric Drive System

BLDC 250W Motor

Construction and Operating Principles

Electrical equipment often has at least one motor used to rotate or displace an object from its initial position. There are a variety of motor types available in the market, including induction motors, servomotors, DC motors (brushed and brushless), etc. Depending upon the application requirements, a particular motor can be selected. However, a current trend is that most new designs are moving towards Brushless DC motors, popularly known as BLDC motors.

Steering System and Components

Steering is the collection of components, linkages, etc. which allow a vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches (and also known as 'points' in British English) provide the steering function

Fabrication Process:

Some of the portion of the old frame is used for fabrication to reduce the overall cost and efforts for producing critical shape in frame such as seating bar. The material of frame pipe is Mild Steel. The pipe for fabrication is already cut into required dimension and bends are formed with the help of hand operated hydraulic pipe bending machine. The pipe and the seating bar of old frame are placed on welding platform. The welding of the pipe is carried out with arc welding machine. After welding the entire frame the welded joints are cleaned with hand grinding machine to reduce the unwanted rough surface on frame. While selecting the pipe and frame from old setup we tried to maintain the setup in safe mode from failure point of view by weight and dynamic conditions of PTV.

Technical Specification of E Ride W250

Table 6Technical Specification of E Ride W250

Range per Charge:	25 km
Battery:	48 V 12 Ah
Wheel Size:	
Front	250mm
Rear	350mm
Total Weight:	55kg
Ground Clearance:	140 mm

Common Specification

Table 7Common specification

Battery Charge Time:	4 hours
Storage Capacity:	5 litters
Brakes:	Rear Drum Brake
Motor Output:	less than 250 w
Speed:	25 kmph

Image 4: Frame after Fabrication

Image 5:Frame after Fabrication

Image 6: E Ride W250 with accessories

Results and Discussion

Sr. No	Observation	Result
1.	Max Speed of Vehicle	
	Normal Road	23 km/hr
	Rough Road	15 km/hr
2.	Torque Generated	4.77 N-m
3.	Maximum speed of Motor in RPM	500 rpm
4.	Range of Vehicle one Charge	26 km
5.	Recharge Time	4 hr
6.	Turning Radius	3 m
7.	Ground Clearance	140 mm
8.	Vehicle Dimension	
	Distance between front two wheels	630mm
	Distance between front and rear wheel	950mm
9.	Height of Vehicle	1100mm
10.	Gross Weight of Vehicle	
	Without User	70 kg
	With User	150 kg

Conclusions

- E-Ride W250 is very much economical vehicle as it runs on electricity.
- E-Ride W250 is an effective tool for modern industrialization which will definitely help to improve the productivity and will help the industries to improve their employee performance.
- The features and accessories will improve the monitoring and controlling over the process.
- E-Ride W250 will help the user to improve its performance and work efficiently at the Shop floor.
- The compact design on E-Ride W250 is going to help to improve the parking and utilization.
- E-Ride W250 will reduce the physical stress of user and reduce the health and physical problems of the operator.
- E-Ride W250 has wide range of application.
- The vehicle is easy to drive and can stand still when operator is willing to stop at particular work station
- E-Ride W250 is pollution free vehicle hence it will not harm the work environment and helps to it keep clean.
- E-Ride W250 is a need of today's work efficient industrial sector.

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