Solar Operated Mechanical Segway

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Abstract- *In this project work, two wheeled and one small supporting wheel self-balancing Mechanical Segway vehicle is prepared, which is also known as a personal transporter Segway. The system is able to operate in transporter mode using mechanical concepts. This project focuses on to manufactured Segway without using any type of programming & Sensors or any state feedback to stabilize system on transporter mode. Small wheel is used so that there is no need of gyroscopic sensors for balancing purpose. The aim of this project work is to build up at a very low cost, highly efficient rate, easy to handle and operational mechanical battery operated segway or transporter. Also the use of non conventional solar energy is used to charge the batteries of segway using a solar panel.*

Keywords- Mechanical segway, solar energy, self balancing,Personal transporter, 3 wheeled segway, human transporter.

I. INTRODUCTION

Generally rural people need to travel longer distances to reach at the destination, the students living in the rural areas need to travel longer distances for taking education. Also in some places like college, office, plant people need to travel in long distance by walking the mini electrical vehicle for single person is solution of this problem. Thus, aim is to produce something which will be useful in such above situation for travelling longer distances, which will be portable, and of low cost.

In this project, "solar operated mechanical segway" vehicle has been built as a part of the course applied control and mechanical and electronics fusion. The goal of this project is that everyone should know about the Segway, how it is manufactured, fabricated and how is the working system of the Segway and another one is the how is to ride and balance of the Segway vehicle. The project is aimed at making a two wheeled and one small wheel balancing electric vehicle and applying some mechanical concepts to it. By using switch, circuit board and electric supply to go forward and go backward direction easily with the help of perfect balancing using this third wheel. The vehicle has electric motors powered by dry batteries. It balances with the help of small wheel there is no used of Microcontroller, gyroscopic sensors and any type of sensors for. The rider accelerates or decelerates by using push up switch go forward and backwards in the direction he or she wishes to travel. Steering is providing by simply self-balance and operated two motors with the help of switches. Non conventional source of energy is used in the form solar energy to charge the batteries using a solar panel kit to convert the solar energy into electric energy.

II. PROJECT OBJECTIVE

As part of the initial stages of the project a number of goals were chosen to measure the project's success. They were divided into essential and extension goals, of which the essential goals are imperative to the project being considered a success. These goals are:

- To develop an accurate mathematical model and control system for MINI VEHICLE.
- To reproduce and analyze the model in software
- To make vehicle portable.
- To kept weight of vehicle as low as possible.
- To cover at least of 10km when fully charged.
- To make design of less cost.

II. PROBLEM STATEMENT

In India, every day we see, some people from village have to travel daily to city side area. For that they have to struggle a lot. Now days, there is lot of problems of environmental pollution people are facing. Global warming is also increasing day by day. To overcome these problems, there is mini electrical vehicles available. But these vehicles are too costly.

To solve such type of problems, there are Automobile engineer who can solve such type of problem quickly as well as easily. First duty of Automobile engineer is to fulfill the requirement of people about automobile vehicle. Being an Automobile engineer our responsibility is to give the output as per requirement of people in the form of vehicle. This vehicle should be easy to operate. Engineer must design this vehicle by considering the person's easy point of view and easy

handling characteristics as well as ride comfort such as hand brake, ease of balancing, low cost, better assembly, easy operation etc.

III. MECHANISM

As the title suggests the mechanism of the segway consists of mechanical system. In this project a chain sprocket mechanism is used. A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. The motor sprocket is coupled with the sprocket which is mounted on the shaft on which wheels are attached. The power gets transferred from motor to wheels through this transmission medium. Thus the mechanism chain and sprocket is used, the power from the motor is transferred to the chain which drives sprocket and hence the power is transferred from the sprocket to the driving shaft. The wheels are fitted to this shaft which is driven by the sprocket and hence the power is transmitted to the final component i.e the wheels which rotate and drive the segway.

STEERING MECHANISM

The steering mechanism is critical in providing the user with a simple, smooth and intuitive way to control the direction that Mini vehicle moves. Steering mechanism of the segway in the project quite similar to that of a bicycle. Steering configurations including turning the whole top handlebar, tilting the platform from side to side by adjusting the rider's weight distribution, and a single handed twist grip were all considered. It was decided that a twist grip would be most appropriate for Mini vehicle.

IV. WORKING

The vehicle in this project runs on the batteries i.e on electrical power. A mechanical mechanism of chain and sprocket is used as the parent for running of the vehicle. The is quite simple as the electrical power from the battery is converted into mechanical power by motors which drive the chain sprocket, the sprocket thus runs the shafts which are attached to the shafts and thus the segway runs as per the accelerator is controlled.

V. SOURCE OF ENERGY (SOLAR PANEL)

Power sector is one of the key sectors contributing significantly to the growth of country's economy. Power sector needs a more useful role to be played in defining, formulating and implementing the research projects with close involvement of all utilities such that the benefit reaches the ultimate consumer. In India there is a huge gap between the energy generation and energy consumption. India has a great potential for solar power and it is estimated so many times of the energy requirement which is about 5000 trillion kWh per year. The solar radiation incident over India is equal to 4–7 kWh per square meter per day with an annual radiation ranging from 1200–2300 kWh per square meter. It has an average of 250–300 clear sunny days and 2300–3200 hours of sun shine per year. India's electricity needs can be met on a total land area of 3000 km2 which is equal to 0.1% of total land in the country [1, 2, 3].

In this project hence we are using renewable source of energy to charge the battery in form of a solar panel. A solarplate of power 10 watts @16.4 volts is used to charge the battery. The sunlight which hits the solar plate is used to charge the battery using a converter panel.

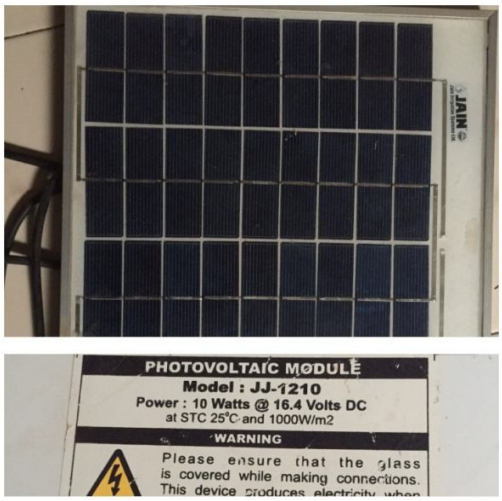
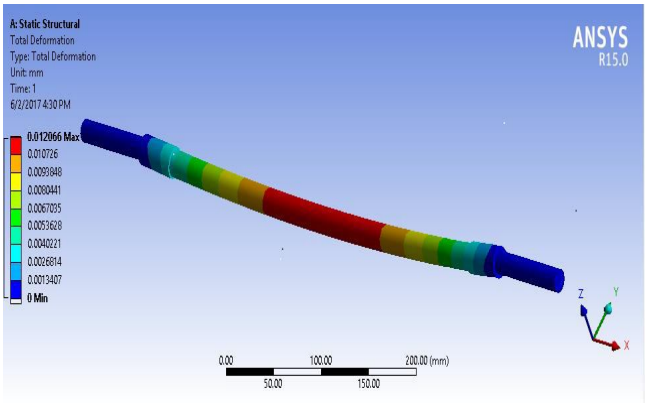


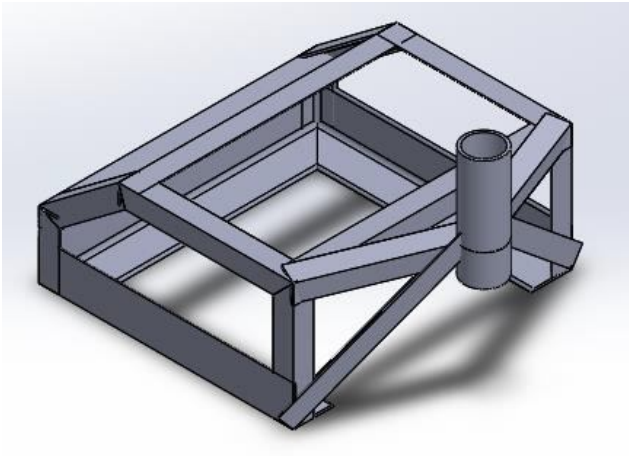
Fig: solar panel

VI. DESIGN AND ANALYSIS

Analysis of shaft:



Design of frame:



VII. MANUFACTURING PROCESS

Designing a new model of self balancing vehicle was a tough job to do. After completing design actual manufacturing was started. For manufacturing the model, one which is cost efficient and which will be easily driven that model was selected. This manufacturing process is done with the help of various component.

VII.1.1. Shaft

Firstly, calculations of design of shaft was done. Then model of axle was manufactured by completing the design in Catia work and analysis in Ansys software.

For this process of shaft manufacturing, Mild Steel(M.S.) material was selected as per design requirement. Then axle of 600 mm length was to be manufactured. Shaft length was divided into 2 parts as 360 mm length of 20 mm diameter whereas 240 mm length of 17 mm diameter. This 240 mm length was at both ends of shaft which was equally distributed on left and right end of shaft. Another shaft of 150 mm length was also manufactured. According to shaft requirement, wheels were selected and brought from market. For proper fitting of wheels and shaft bush were manufactured for two wheels. It has 42 mm outer diameter and 17 mm bore.

VII.1.2. Frame and Bearing

Design and analysis of frame was done in solid works software to check the strength and impact. Frame of required design aspect was prepared with Mild Steel (M.S.) material having 'L' shaped angles. Base angles are of more strength than other frame angles. This angles are of 6 mm thickness and 4 mm thickness.

After completing frame design, required sized bearings were brought from market of P204 series. Block type bearings was selected having 17 mm internal diameter.

VII.1.3 Transmission

Main part of vehicles is transmission system. For transmission of power from motor to axle chain-sprocket mechanism was used. To transmit the power, motor was brought from market as per required specifications and calculations. Another sprocket having 9 teeth was mounted on motor, so to obtained proper reduction ratio.

With the help of design calculation of sprocket, teeth and reduction ratio were obtained. And according to this calculation, sprocket was selected. It has 18 teeth. This sprocket was properly fitted on bush of 35 mm outer side diameter and 1 mm pitch threading. It has bore of 20 mm and a hole for its proper fitting on shaft by using bolt. This sprocket is directly fitted on main wheel axle i.e. shaft and chain is used to transmit power from motor to wheels.

VII.1.4. Steering and handle

Steering of vehicle is similar to the bicycles steering, which is mounted on single steering wheel. Material used for this is hollow rods of Mild Steel(M.S.). Steering of required size was prepared and fitted into frame section. Then handle was manufactured of movable mechanism. Handle is provided with screw and nut arrangement at base for forward and backward mechanism of handle. Another telescopic handle is manufactured having T shape for adjusting as per the height of user. This is manufactured from hollow rod of material Steel and joined to T-shape joint of PVC pipe of 2.5" diameter to a pipe of 2" diameter. An accelerator is fitted on handle bar. This accelerator can be controlled with the help of controller.

VII.1.5. Assembly and Fabrication

After manufacturing all the required components, assembly of all the component was done. Then fabrication of

outer body was done. For manufacturing outer body, wooden material of 6 mm thickness is used and a wooden platform for standing is manufactured having 15 mm thickness. All the body is fabricated using wooden material. While designing and manufacturing of body, its aerodynamic shape and aesthetics were considered.

VIII. CONCLUSION

In the present project model, mini vehicle for single person is complete, this model fulfill the objective on project mention in section.

- Socket-chain mechanism is optimum mechanism for mini vehicle and a formulated design approach was used to create the most efficient and robust configuration of Self-Balancing Vehicle to satisfy all the project goals and one extension goal.
- The static analysis of important component is done on Ansys software and it's within the range.
- •The model has been concurrently with aesthetics, ergonomics to minimize mechanical, electrical and rider integration problems and cost.

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Team Members

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