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DESIGN, DEVELOPMENT, ANALYSIS AND TESTING OF PORTABLE SOLAR TRACKING AND MOBILE CHARGING SYSTEM

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Abstract— Electricity currently plays an important role in our everyday lives, but the energy sources for electric power have been depleted, forcing researchers to look for an alternative source of power, which led to the discovery of solar energy. Solar energy is renewable and environmentally benign, and photovoltaic panels can convert it to electricity. These panels can be utilised in a fixed configuration or in a single or dual axis solar tracking system. Their efficiency is limited in a fixed form since the panels are slanted at a specific angle, however in a tracking system, the panel is made to move in a single or dual axis. The Portable Solar Tracking project offers rapid and effective tracking in the smallest feasible size and cost, and the system's portability allows it to be used in mobile charging applications as well. The project will involve the design, development, and analysis of the aforementioned system using Unigraphics for solid modelling and Ansys Workbench for analysis. Test and trial on a scaled prototype for a 5 watt power panel will be used to evaluate the system's performance and efficacy in comparison to the existing system.

Keywords— Solar Energy, Power Electronics, Energy shortage, Renewable Energy, Power Crisis, Solar Charger, Green energy

INTRODUCTION

To get the most out of solar panels, point them in the direction where the sun shines the brightest. However, there are a lot of factors to consider while determining the best course of action. This website is intended to assist you in determining the optimal location for your solar panels in your specific situation.

This advice applies to any solar-powered panel, including photovoltaics, solar hot water, and so on. The panel is either fixed or has a slant that can be altered seasonally, we assume. (Panels that track the sun's movement throughout the day can get 10% to 40% more energy than fixed panels in the winter and summer.

If you live in the northern hemisphere, your solar panels should always face true south.

METHODOLOGY

Proposed work

1. Literature review: Technical papers, white papers, patent documents, etc
2. System design of Automatic tyre inflation as for the component selection, geometry and profile selection, charge system selection, mounting & orientation.
3. Mechanical design of components under given system of forces to determine functional dimensions of the components to be used using various formulae and empirical relations
4. 3-D modelling of set-up using Unigraphics
5. CAE of critical component and meshing using Hypermesh/ Ansys
6. Mechanical design validation using ANSYS
...critical components of the system will be designed and validated
7. Manufacturing, assembly of the device and test-rig for experimental analysis and validation.
8. Testing and trial to derive performance characteristic of equipment under various load conditions.
9. Result discussion and thesis preparation.

DESIGN METHODOLOGY:

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy & efficiency .

Hence a careful design approach has to be adopted . The total design work , has been split up into two parts

- System design
- Mechanical Design.

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man + machine interactions, No. of controls, position of controls, working environment of machine, chances of failure, safety measures to be provided, servicing aids, ease of maintenance, scope of improvement, weight of machine from ground level, total weight of machine and a lot more.

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

- Designed Parts
- Parts to be purchased

For designed parts detailed design is done & distinctions thus obtained are compared to next highest dimensions which is readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage

The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retail shop with given specifications.

SYSTEM DESIGN

In system design we mainly concentrated on the following parameters: -

System Selection Based on Physical Constraints

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room. The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

Arrangement of Various Components

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

Components of System

As already stated, the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired.

Man Machine Interaction

The friendliness of a machine with the operator that is operating is an important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section.

- Design of hand lever
- Energy expenditure in foot & hand operation
- Lighting condition of machine.

Chances of Failure

The losses incurred by owner in case of any failure is an important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

Servicing Facility

The layout of components should be such that easy servicing is possible. Especially those components which

require frequents servicing can be easily disassembled.

Scope of Future Improvement

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

Height of Machine from Ground

For ease and comfort of operator the height of machine should be properly decided so that he may not get tired during operation. The machine should be slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

Weight of Machine

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in transportation & in case of major breakdown, it is difficult to take it to workshop because of more weight.



Fig. 1 Test and Trial on Solar Tracking Portable solar mobile charger with solar tracker

RESULTS AND DISCUSSION

1. The review revealed the significance of solar tracking , various single axis and dual axis tracking systems are studied by the researchers , although it is clear from the review majority of the research is done on the solar tracking systems in the fixe location , few or no reseachers have discussed the solar tracking system that are designed for mobile charging . So also the literature review does not find any research on a single actuator system that can track the sun in more than two axes.
2. The theoretical design of the main shaft and ansys analysis revealed that the part is safe.
3. The theoretical design of the solar panel bkt and ansys analysis revealed that the part is safe.
3. The theoretical design of the pinion and ansys analysis revealed that the part is safe.
4. The theoretical design of the gear pair revealed that the part is safe.
5. The theoretical design of the gear pair and ansys analysis revealed that the part is safe.
6. The voltage increases with angle of tilt maximum voltag e of 12.1 volt is observed at 90 degree angle of tilt of panel
7. The current increases with angle of tilt maximum current of 0.38 amp is observed at 90 degree angle of tilt of panel
8. The power increases with angle of tilt maximum power of 4.598 watt is observed at 90 degree angle of tilt of panel.

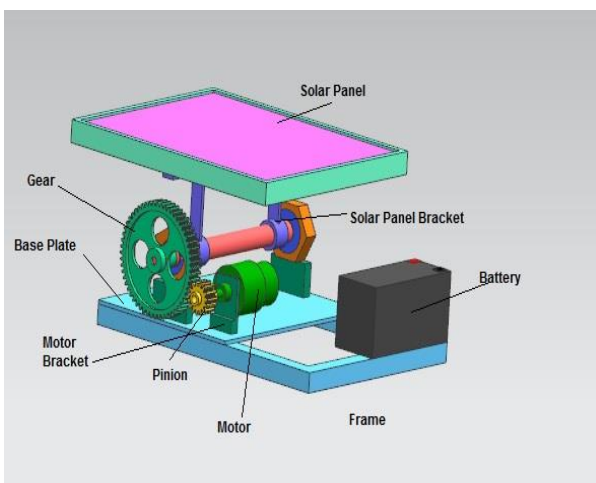


Fig.2 Portable solar mobile charger with solar tracker

Conclusion and Future scope

In conclusion, a portable solar mobile charger has been designed, simulated and constructed to have a compact size at low cost and this device has been evaluated to be efficient, reliable, portable, and an economically viable solution to charging mobile phones in India. As a country having abundance of sunlight, this device brings an alternative to non-renewable energy sources that are highly expensive and not available. This device encourages green technology. A fascinating fact is the incorporation of a heat sink to absorb dissipated heat. This device can be carried around in the pocket and can be used on the go. It is an alternative solution to carbon emissions from generators.

The limitation of this work is the unavailability of Solar Panel on Proteus thereby making it impossible to have an exact software simulation;

The following recommendations have been made for future implementation and improvements:

The device should be incorporated with some LEDs to indicate the exact level of charge in the backup at all points. This can also be achieved using an LCD as a display or indicating component.

A higher power solar panel should be used to increase the efficiency of the device, lowering the charging time. This can be done by fabricating the panels and applying certain photoconductive layers of silicon: doping. The device should be built to accommodate charging from electric grids when desired or when out of sunlight, this is to reduce the task on the panel. This can be achieved by building a power supply mechanism into the device.

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