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AUTOMATIC SOLAR PANEL CLEANING MACHINE FOR POWER STATION WITH IOT

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Abstract: The solar panel works, when sunlight imparts on surface of solar panel. Amount of light that impart on solar panel is directly proportional to the energy generated through it. More the light that imparts more is the power generation. Due to the upwards angle of solar panels, there is lot of collection of dust and bird excreta. This reduces the amount of light that impact on the panel and reduces the panel output hence efficiency gets decreased. The solar panel manufacturers and installers claimed about the projected energy figures that based on the optimum performance of clean solar panel. Due to increasing the dirt on solar panel that can adversely affect the panel's ability to achieve desired output. This is a big challenge in this area; so it is necessary and important to clean the solar panel in order to protect and get more power output. So we have designed and developed the automatic machine which will clean the solar panel and improve the panel efficiency & thus reducing the human effort. This low cost solutions very useful in the sector of non conventional energy.

Keywords: Microcontrollers , AutoCAD 2D 3D, solid Works , Limiting Switches .

I. INTRODUCTION

Most of the industrial applications use the solar (PV) panels as an electrical power source instead of relying on the generators or the ordinary sources for electricity. The most important part of these systems is solar panel where the solar energy is converted to electricity. As this is one of the easy ways of generation of electricity, Photovoltaic panel production has increased globally in response to the growing demand for solar energy. This has become a solution for environmental degradation due to fossil fuels. There are many factors that affect PV power efficiency, such as birds excreta, dust and dirt. The main factor that affects a PV panel's efficiency is dust, which can reduce its efficiency by up to 25-30%, depending on the environment. Though the bird dropping and dirt is not making a big issue, it can be seen that the efficiency of solar panel decreases by 15-20%. So cleaning the solar panels in a frequent period is necessary for getting same output for longer time. Cleaning the solar panels is normally done by manual washing which is tedious and also expensive in terms of the labor involved and time. In practice cleaning Today's World is using the Solar Energy for electricity generation widely. This Solar energy is mainly used by different Industries, Power Plants (which work on solar energy to generate electricity) in bulk.

2. OBJECTIVES OF PROJECT

1) To make electrical and mechanical device
2) To make a device which is suitable economical power stations
4) Taking safety as prime consideration: This device is safer in all aspects.
5) To build a device this can clean large space.

3. LITERATURE SURVEY

1)Automatic Solar Panel Cleaning System Abhishek Naik, Nagesh Naik, Edison Vaz, Abdulkareem Anjuman Institute of Technology and Management, Bhatkal Under the guidance of Dr. Padmayya S Naik (Professor, Department of mechanical engineering)

Abstract-

The solar PV modules are generally employed in dusty environments which is the case in tropical countries like India. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun. It reduces the power generation capacity of the module. The power output reduces as much as by 50% if the module is not cleaned for a month. In order to regularly clean the dust, an automatic cleaning system has been designed, which senses the dust on the solar panel and also cleans the module automatically. In terms of daily energy generation, the presented automatic cleaning scheme provides about 30% more energy output when compared to the dust accumulated PV module.

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2) DESIGN AND DEVELOPMENT OF SOLAR PANEL CLEANING SYSTEM

Abstract-

Solar energy is the most abundant source of energy for all the forms of life on the planet Earth. It is also the basic source for all the sources of energy except Nuclear Energy. But the solar technology has not matured to the extent of the conventional sources of energy. It faces lots of challenges such as high cost, erratic and unpredictable in nature, need for storage and low efficiency. This project aims at increasing the efficiency of solar power plants by solving the problem of accumulation of dust on the surface of solar panel which leads to reduction in plant output and overall plant efficiency. It proposes to develop a Solar Panel Cleaning System which could remove the accumulated dust on its surface on a regular basis and maintain the solar power plant output. The system is a robotic system which could move autonomously on the surface of solar panels by using pneumatic suction cups and use dry methods for cleaning such as rotating cylindrical brush and vacuum cleaning system keeping in mind the limited availability of water in areas where such plants are mainly located. This project also aims to reduce the human involvement in the process of solar panel cleaning as it is a very hazardous environment for them in scorching sun

3) AUTOMATIC SOLAR PANEL CLEANING SYSTEM Rutvij P. Kulkarni1 , Mandar A. Kadam2 , Tushar T. Shinde3 , Nitin B. Sonone4 , Prof. Atul D. Atalkar5 1-4 Studets, Dept. of EXTC, Shivajirao S. Jondhle College of Engineering & Technology, Asangaon. 5Assistant Professor, Dept. of EXTC, Shivajirao S. Jondhle College of Engineering & Technology, Asangaon

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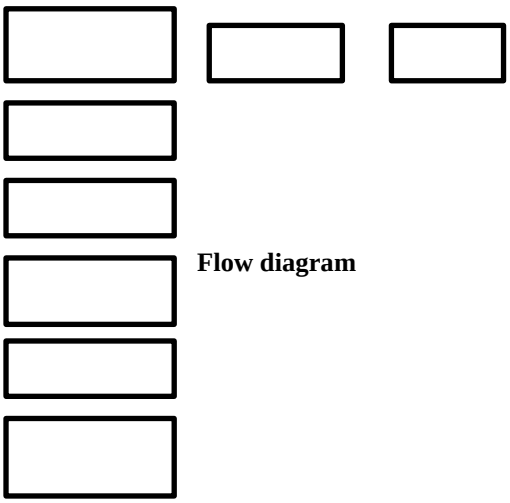
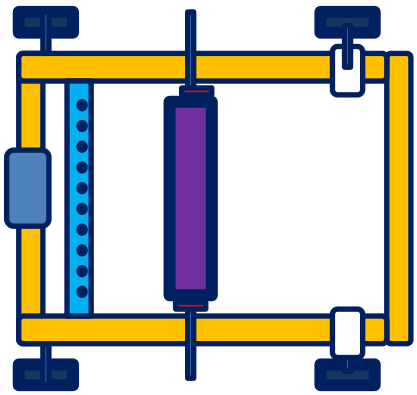
4. METHODOLOGY



Flow diagram



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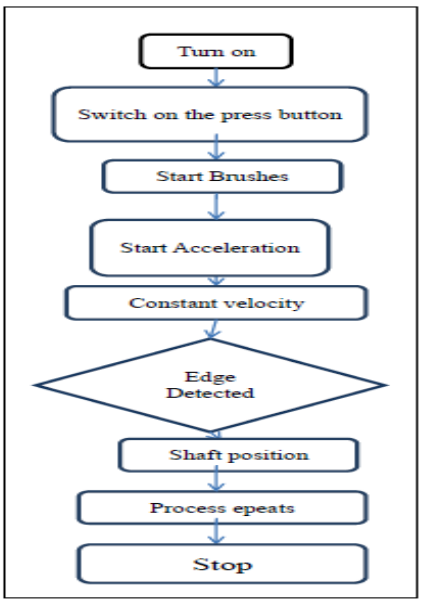

5. Selection Of Materials

The square sections: enhance the reliability of the structure. These are manufactured using graded steel in compliance with set international standards. The square sections are used as support in automotive industry, transmission tower plants, machinery industry, construction industry and many others. These sections are made using high grade steel metal in compliance with international standards. The square section holds superb tensile strength and is rust resistant with ability to offer long working life. The sections are tested on various parameters, which are tensile, bending, flattening and other strengths.

Rectangular Section

The rectangular sections are constructed using finest steel. These are preferred for their robustness. The rectangular sections has precise dimensions and accuracy, which is one of the trademarks of our high grade manufacturing abilities. It is tested on several international standards, where tensile strength, flattening, bending, and drift expansions. It is preferred in several industries, such as furniture industry, construction industry, automotive industry and many more.

STRUCTURAL DESIGN METHODS

Introduction: This chapter describes some of the mathematical technique used by designers of complex structures. Mathematical models and analysis are briefly describe and detail description is given of the finite – element method of structural analysis. Solution techniques are presented for static, dynamic & model analysis problems. As part of the design procedure the designer must be analyses the entire structure and some of its components. To perform this analysis the designer will develop mathematical models of structure that are approximation of the real structure, these models are used to determine the important parameters in the design.The type of structural model the designer uses depends on the information that is needed and the type of analysis the designer can perform.

Three types of structural models are

1. **Rigid Members:** The entire structure or parts of the structure are considered to be rigid, hence no deformation can occur in these members.

2. **Flexible members** : The entire structure or parts of the structure are modeled by members that can deform, but in limited ways. Examples of this members trusses, beams and plates.

3. **Continuum** : A continuum model of structure is the most general, since few if any mathematical assumptions about the behavior of the structure need to be made prior to making a continuum model. A continuum member is based on the full three – dimensional equations of continuum models.

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In selecting a model of the structure, the designer also must consider type of analysis to be performed. Four typical analysis that designers perform are :

1. **Static equilibrium** : In this analysis the designer is trying to the determine the overall forces and moments that the design will undergo. The analysis is usually done with a rigid members of model of structure and is the simplest analysis to perform.

2. **Deformation** : This analysis is concerned with how much the structure will move when operating under the design loads. This analysis is usually done with flexible members.

3. **Stress** : In this analysis the designers wants a very detailed picture of where and at what level the stresses are in the design. This analysis usually done with continuum members.

4. **Frequency** : This analysis is concerned with determining the natural frequencies and made shape of a structure. This analysis can be done with either flexible members of a structure. This analysis can be done with either flexible members or continuum members but now the mass of the members is included in the analysis.

The subject of MACHINE DESIGN deals with the art of designing machine of structure. A machine is a combination of resistance bodies with successfully constrained relative motions which is used for transforming other forms of energy into mechanical energy or transmitting and modifying available design is to create new and better machines or structures and improving the existing ones such that it will convert and control motions either with or without transmitting power. It is the practical application of machinery to the design and construction of machine and structure. In order to design simple component satisfactorily, a sound knowledge of applied science is essential. In addition, strength and properties of materials including some metrological are of prime importance. Knowledge of theory of machine and other branch of applied mechanics is also required in order to know the velocity. Acceleration and inertia force of the various links in motion, mechanics of machinery involve the design.

6. SOLAR PANEL

It is a panel of 10 watts consisting of photovaltic solar cells. Per hour solar panel charges 10 watts of power. Since to charge the panel of 25 watts it will consume 150 minutes approximately depending on the sunrays falling on the panel.

Battery
Voltage=V=12volts
Current=I=22 amps

Power of battery
P=V*I
=12*7
P =84 watts

To charge the battery of 84 watts . it takes nearly 8.4 hours approximately to charge the entire battery.

Technical parameters

Nominal Voltage	12V
Nominal Power	50W
Nominal Current	1.0-1.5A
High Speed	75-76 rpm
Low Speed	50 rpm

Wiper assembly features

Length of wiper L	Wiper blade: 550mm Wiper arm: 500mm
Length of wiper R	Wiper blade: 300mm Wiper arm: 670mm
Center distance	284mm / 457.4mm

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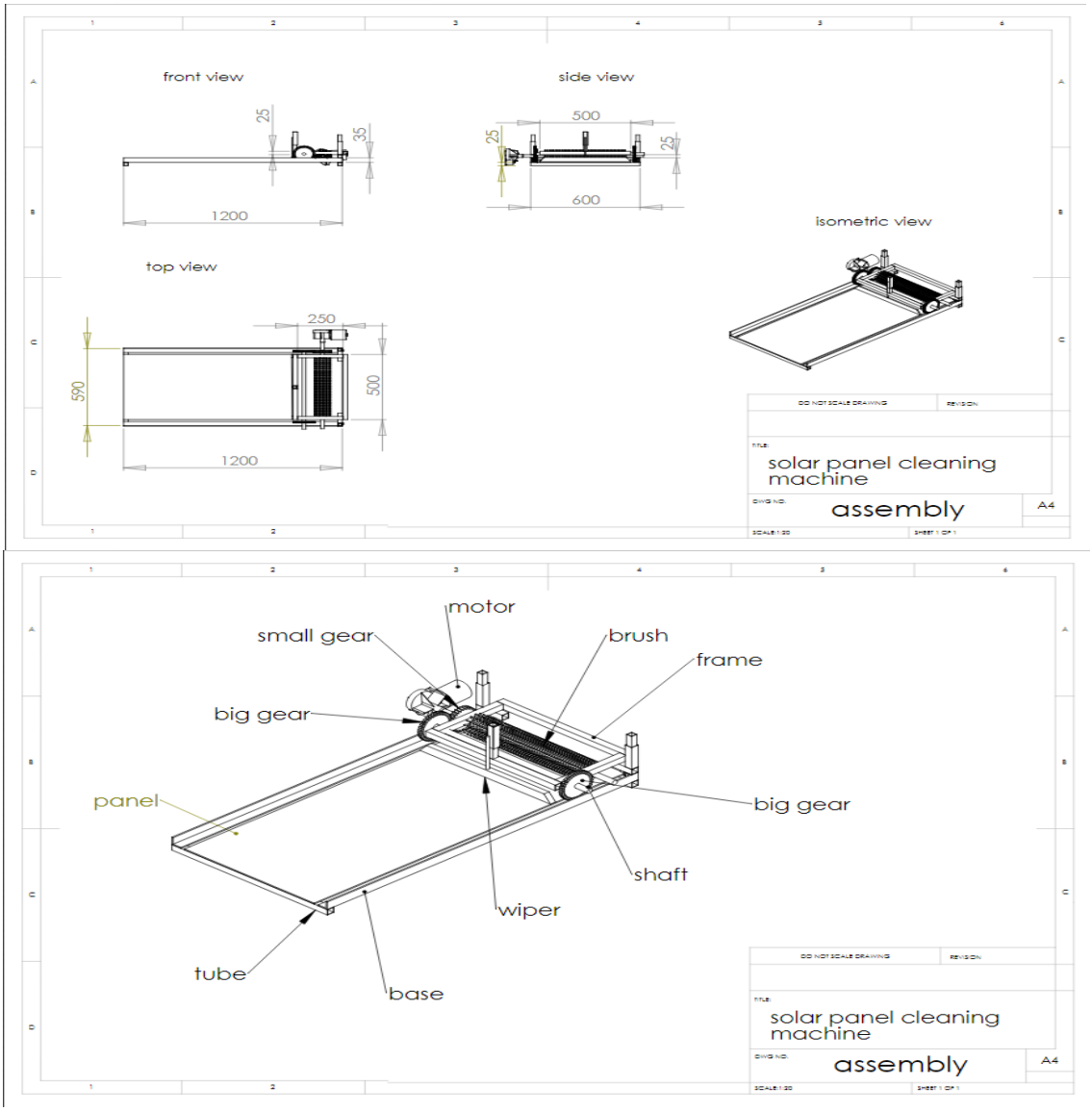
7. DRWINGS



8. ADVANTAGES

1) Manual effort is reduced.
2) Operating time is less.
3) It consumes less cleaning liquid.
4) Power consumption is less.
5) Design is very simple.
6) Easy fabrication.
7) It occupies less floor area.
8) Net weight is less.
9) Maintenance cost less.
10) Easy control of cleaning solution supply.
11) Smoother operation

APPLICATIONS

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1) Solar panel
2) Glass
3) roofs
4) floors

9. FUTURE SCOPE OF THE PROJECT

We feel the project that we have done has a good future scope in any engineering industry. The main constraint of this device is the high initial cost but has low operating costs.

Savings resulting from the use of this device will make it pay for itself with in short period of time The device affords plenty of scope for modifications, further improvements & operational efficiency, which should make it commercially available & attractive. If taken up for commercial production and marketed properly, we are sure it will be accepted in the public very easily

10 .CONCLUSION

We have taken up this project as real challenge, as we were not experience in the field. We started our work on this project facing new hurdles initially.

After the completion of the project work we tried its working in our college and we were pleased to note that it does meet the requirements for what it is meant.

The maneuverability of the device is quite good and the handling is quite simple. For commercial purpose one can improve the efficiency of the device effectively by increasing she features in the device.

10 . REFERENCES

TEXT BOOKS

1) S. B. Halbhavi Department of Electrical & Electronics Engineering Microcontroller Based Automatic Cleaning of Solar Panel Gogte Institute of Technology, Belgaum Karnataka, India.
2) Ashish Saini and Abhishek Nahar .Solar Panel Cleaning System. ijir.2017; 3(5):1222-1226.
3) H. G. Patil - Design Data Hand Book –ShriShashiprakashan, Belgaum,4th Edition 2007
4) K Mahadevan and Balaveera Reddy- Design Data Hand Book- CBS Publication,3rd Edition, 2010
5) R. S. Khurmi & J. K. Gupta - Machine Design- Eurasia publishing house New Delhi,14th Edition, 2008
6) T.R. Banga & S. C.Sharma – Industrial Organization and Engineering Economic (Estimation & Costing) Published by Romesh Chander Khanna, New Delhi 24th Edition 2006
7) Theory of Machine –Rattan S.S Tata - McGraw Hill Publishing Company New Delhi,2nd Edition,2006

