IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 3, June 2023

Design and Development of Solar Trees

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Abstract: *This paper gives an extensive investigation of different sorts of sun-powered tree setups, zeroing in on their plan, producing cycles, and expected applications. Sun-based trees, portrayed by their unmistakable tree-like designs furnished with photovoltaic boards, offer multi-layered benefits going from environmentally friendly power age to imaginative metropolitan plan. This paper investigates a scope of sunlight-based tree plans, including single-trunk, multi-board exhibits, enunciated structures, and secluded frameworks, featuring the special highlights and benefits of every setup. Factors like sunlight-powered charger direction, underlying soundness, stylish allure, and coordination with general conditions are analyzed exhaustively. Moreover, producing processes for sun-oriented trees are talked about, including strategies, for example, accuracy designing, high-level manufacturing techniques, and practical material obtaining. Notwithstanding planning and assembling, this paper investigates the assorted utilizations of sun-powered trees across different areas, including metropolitan foundations, transportation, horticulture, and sustainable power establishments. Unique accentuation is put on the capability of sun-based trees to improve rearview permeability in vehicles, offering a reasonable option to customary frameworks. Creating energy productivity arrangements from daylight to power is a pivotal answer to the world's energy lack and decreasing ozone-depleting substance discharges. The fundamental disadvantage of sunlight-powered chargers is the land prerequisite for the establishment of sunlight-powered chargers. In any case, with sun-based trees, we utilize exceptionally less land to deliver an enormous measure of electrical power.*

Keywords: powered tree, design, sunlight, benefits, energy

I. INTRODUCTION

Sun-based Trees or Sun fueled Photovoltaic Trees are sun-controlled structures that are by all accounts trees. They can be framed from a restricted scope like a bonsai tree to colossal extensions like the size of a breeze turbine. It is a sun-situated masterpiece that is a blend of inventive moreover, mechanical effort. This is a to some degree novel thought that is envisioned attempting to use development interfacing with the assortment and use of sun-fueled energy. In this setting usage of PV advancement for the local need as the sun-based tree is the extraordinary other choice when diverged from customary level or rooftop mounting [1] In sun-fueled trees, PV loads up or cells are coordinated in a Fibonacci series plan as opposed to leaves. The sun-fueled tree creates more power than a standard-level strategy of daylight-based cells. It requires 1% land when stood out from the standard level arrangement [2]. Non-normal energy resources that are being made perpetually in nature and are boundless are called unlimited wellsprings of energy. Various sources are used to make the electric power age like daylight-based energy, Wind energy, Streaming energy, Ocean atomic power, geothermal energy, etc, yet daylight-based energy is the best choice among all of the choices of non-harmless ecosystem power which is being conveyed constantly in nature and is perpetual are called practical wellsprings of energy. Various sources are used to convey electric power age like sun-based energy, Wind energy, geothermal energy, etc, be that as it may, daylight-based energy is the best other choice for economical power resources [3]. The sun-powered tree delivers more energy than a customary level plate game plan of sunlight-powered chargers or modules. Sun-based energy transformation is the change of daylight energy into electrical energy utilizing daylight straight by utilizing photovoltaic or concentrated sun-oriented power. The photovoltaic impact is characterized as the age of electromotive power because of the retention of ionizing radiation energy change gadgets which are utilized to switch daylight over completely to power by the utilization of the sun-based tree produces m traditional level plate plan

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II. LITERATURE REVIEW

The Multi-branch single stem was discovered by Dey and Pesala in 2020. This part is a tree stem and branches emerging at different levels, conveying sun-based modules at different surface places and headings according to the region where these trees are applied. MBSS is portrayed by the plan work that is easy to develop, yet being one of the most un-capable plans in supporting sun-based radiation throughout the daytime considering the heading of the sun facilitated module with different lengths of tree farthest core interests.

Singh et al-2019, Aiden-2011, Hyder et al-2018 The most notable sun-controlled tree nowadays, which gets light with ordinarily high capacity. This model organizes the tree's leaves toward the sun to ensure that the most energy is ingested. One of this tree's key features is that it is derived from nature, as some stood apart from an oak tree. It is seen as a wellspring of energy with an obvious aggregate.

Gangwar et al-2019, Kumar et al-2019, Gangwar et al-2019,Critical et al- 2020.Creative from typical plants is the most undeniable and structures a huge complex umbrella, which assists them with getting light in a wide and surprisingly able way. The limit of these sun-based trees is high and rigidly reflects nature. SPST is one of the trees that consume expansive space for its leaves, is incomprehensibly excessive because of its iron turn of events, and is attempting to convey.

A simple solar tree was discovered by Sheppard in 2013. This kind of light-based tree is maybe of the most ridiculously gigantic sort. It is a sun-controlled module surface plan, clearly, really these modules are presented on steel structures and at a reasonable billion. Engineers have made outstandingly current courses of action that reflect substantial tree plans and inherent endpoints through their innocuous biological features. PV progress has been worked with into its twofold dealings to get light to convey electrical energy while enlightening around the night.

Verma and Mazumder-2014. One unequivocal course of action covers light hour to get the sun's bars with the best ampleness. It consolidates modules that structure a semi-round vault. It is worked around the sun to cover the sun way from morning to night [9].

Kumar et al-2020. This kind of plan cements a leg, At the most imperative characteristic of the zenith, a light game plan charger is gotten concerning a particular point. Sun-composed modules are dispersed on the branches in much the same way and on the different sides inside unambiguous propensity spotlights to work on the catch of light. It sets three axes to push toward a 3D body and, as required its name. It moreover takes less space for its papers. Its cost is generally lower examining the ergonomic and moderate blueprint inside.

III. MATERIALS AND METHODOLOGY.

MATERIAL:

FRAME:

The frame is the main Supporting Structure of a machine to which all other components are Attached, Comparable to the Skeleton of a machine, and the structure is made of mild steel material.

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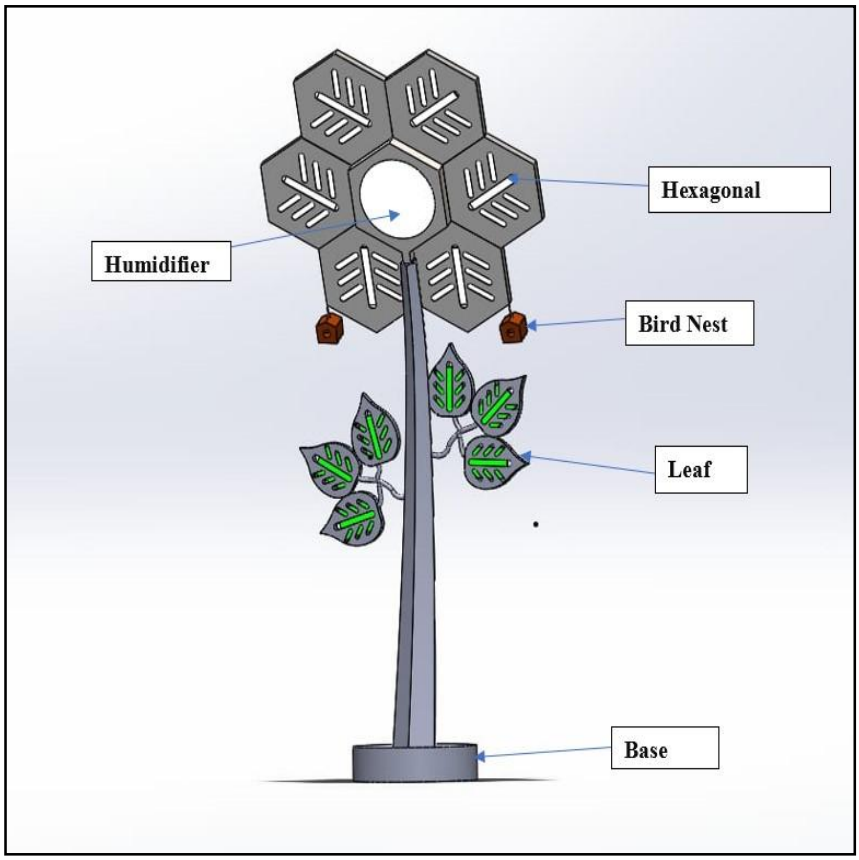

Figure1.1:- The Frame of the solar tree

BATTERY:

Battery is utilized to store the power which is produced by the sun-oriented power tree. The battery-powered batteries are lead dioxide frameworks. The Separators and plates retained the weakened sulfuric corrosive electrolyte and were immobilized. At the point when the battery unintentionally cheats then it produces hydrogen and oxygen, extraordinary one-way valves permit the gases to get away from hence staying away from exorbitant strain developing in any case, the battery is fixed and is, hence, support-free, spill confirmation and usable in any position.

Battery Cell Composition-Lithium Ion
Number Of Cells-6
Terminal-SAE Terminal
Amperage-12 Amps
Country of Origin-India
Voltage-12 Volts

SOLAR PANEL:

A sun-powered charger is a series of interconnected silicon cells joined together to frame a circuit. In more prominent numbers how much power created by these interconnected cells can be expanded also, utilized as a power creation framework. To make sun-powered cells, the unrefined substance silicon dioxide of either quartzite rock or then again squashed quartz is first positioned into an electric curve heater, where carbon is applied to deliver the oxygen. The items are carbon dioxide and liquid silicon. At the point when light energy strikes the sun-powered cell, electrons are thumped free from the molecules in the semiconductor material. If electrical channels are appended to the positive and negative sides, cultivating an electrical circuit, the electrons can be caught as an electric flow that is power.

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Figure1.2:- solar panel

Output Power	10 Watts
Operating Voltage	12 Volt
Panel Technology	Poly Crystalline
Manufacturer Warranty	5 years of Manufacturing defects
Performance Warranty	25 Years
	A+ Grade, anti-PID Poly Crystalline cells
Additional Features	Cell Conversion efficiency > 16%
	Compliance with IEC standards

SOLAR CHARGER CONTROLLER:

A sun-powered charge regulator is utilized to hold the battery back from cheating by controlling the voltage and current coming from the sun-powered charger to the battery**.**

A charge controller limits the rate at which an electric stream is added to or drawn from electric batteries. It thwarts cheating and may protect against overvoltage, which can lessen battery execution or future, it could moreover thwart thoroughly draining a battery or perform controlled discharges, dependent upon the battery advancement to shield battery span.

Figure 1.3:- solar charger controller

Rated voltage:	12 / 24 V
Rated current:	30 A
Permitted voltage range:	□ ≤ 23 V for 12 V battery - The range of the highest operating voltage of a set of panels connected to one input of the controller □ ≤ 46 V for 24 V battery - The range of the highest operating voltage of a set of

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	panels connected to one input of the controller
Output voltage:	Equal to the voltage at the battery terminals
Battery charging current:	max. 30 A
Load Current:	max. 10 A
Main features:	2 x USB power output: 5 V / 2 A, The device is designed to charge only AGM, gel, and lead-acid batteries, LCD, LEDs indicating the device operation status, Operation modes 24H - the load is powered all the time 1H ... 23H - the load is powered for the selected number of hours after sunset 0H - the load is powered from dusk till dawn
Weight:	0.13 kg
Dimensions:	134 x 70 x 30 mm

Table : Solar charge controller specification

LIGHTS AND WIRE:

We are utilizing two kinds of light varieties one is utilized for the hexagonal design of the tree which utilizations white variety light and the other is for the leaf of the tree which utilizations green variety light. Links of exceptional mechanical strength are important to give stable associations between the modules for use in conditions with high mechanical pressure, dry and wet climate, raised temperature conditions, and high sunlight-based insolation

HUMIDIFIER:

A fog-cooling framework is an innovation that utilizes a fine splash of water to bring down temperatures in the encompassing region. It works by constraining water through tiny spouts to make minuscule drops that form a fog.

Low noise operation.

Small fog particles.

Long operation life

Driving Voltage: DC 3-12V.

Low Impedance Stable Waveform

Figure1.5: cooling system

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DESIGN :

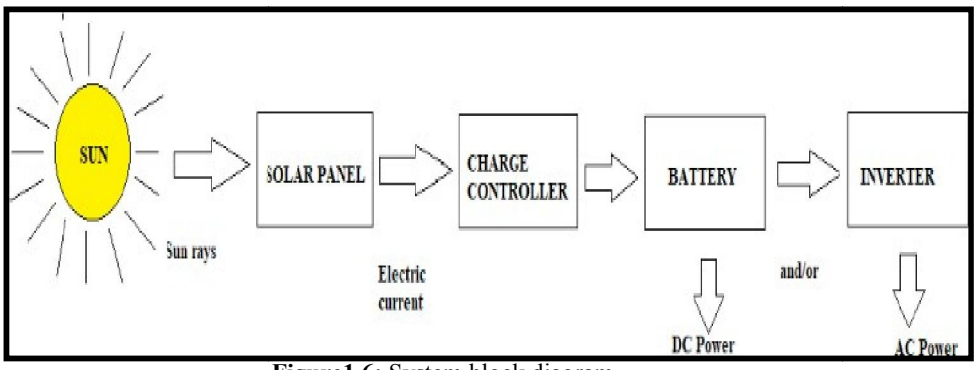

Figure1.6: System block diagram

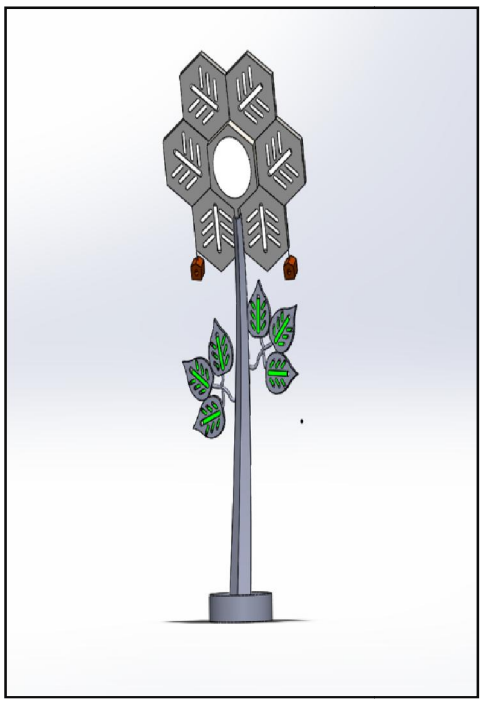

Figure 1.7:- 3D Design of solar tree

Figure 1.8:- Actual diagram of solar tree

In this work, we have presented our thought that the Daylight Tree thought for local zap is a significant push toward declining power bills and dependence on structure power which is touchy nowadays in India. It similarly gives a flawless energy source to lessen a perilous climatic deviation. The energy interest (store) of the little family is considered and taken to conclude the constraint of the proposed system and structure part assesses.

IV. EXPEIMENTAL PROCEDURE

The trial interaction includes a technique for getting the upsides of force produced from the sunlight-based tree and the fixed boards as portrayed in Figure 2.2 by utilizing the instruments. Both the sunlight-based tree and the decent boards were stacked to their evaluated limit by checking the worth of yield current utilizing a multimeter. The variety in sunlight-based irradiance on the decent board and the boards of the sunlight-based tree was likewise observed utilizing an irradiance meter. The readings were recorded for April and May investigating the space contemplations the readings of just two days of these months have been introduced in the resulting segments**.** It is trying to store electrical energy

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for all electric power structures. Sun-arranged tree sheets charge batteries during the daytime. At dusk, the sun-fueled tree turns ON its Determined Thus. The inward control can moreover deal with the aggregate of light followed through on how much charge is left in the batteries. A sensor gauges a proportion of light in the air moreover, triggers the sun-controlled lights to turn ON thusly at dusk and OFF at dawn. Worldwide situating structure decreases sun-controlled cell yield instabilities achieved by continual cycle and weather pattern shifts.

V. RESULT AND DISCUSSION

The power output variations from the solar tree and traditional fixed panel are shown in Figures, while the variations in the solar irradiance falling on each panel are presented. It can be clearly noted from the power curves that the power output from the solar tree is higher compared to the traditional fixed panel. Consequently, the total energy production over the given time period is also much higher compared to the traditional fixed panel. A comparison between the output yields of the fixed panel and the solar tree is provided. The power output from the solar tree over a 6-hour duration from 11:00 am to 5:00 pm is 78 watts, and in a week, it generates 534 watts.

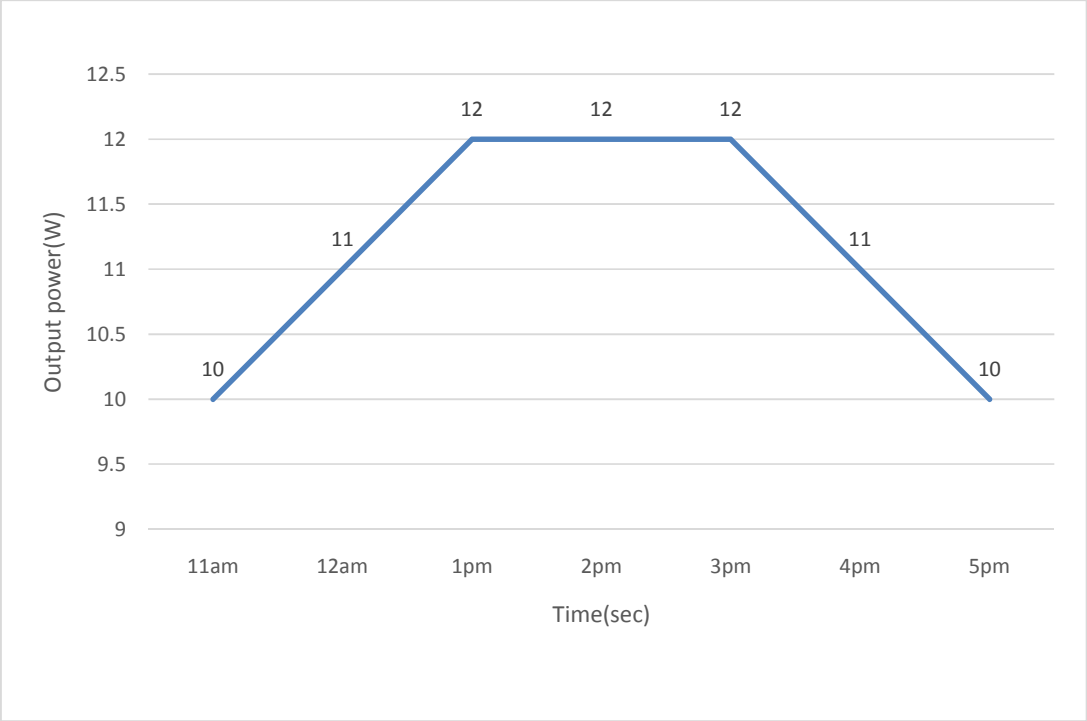

Figure 1.8: One-day analysis chart

In the following graph, we are showing here daily analysis of solar panels and the total output power of a weekly solar panel is 534 watts. In a given chart output power varies from 70 to 80 watts in a single day and the week is 500 to 550 watts. It is an eco-friendly source of energy that gives electricity from the sun. when we install this type of setup it is less land required as compared to another setup of solar tree. It is a lifespan up to 20 to 25 years.

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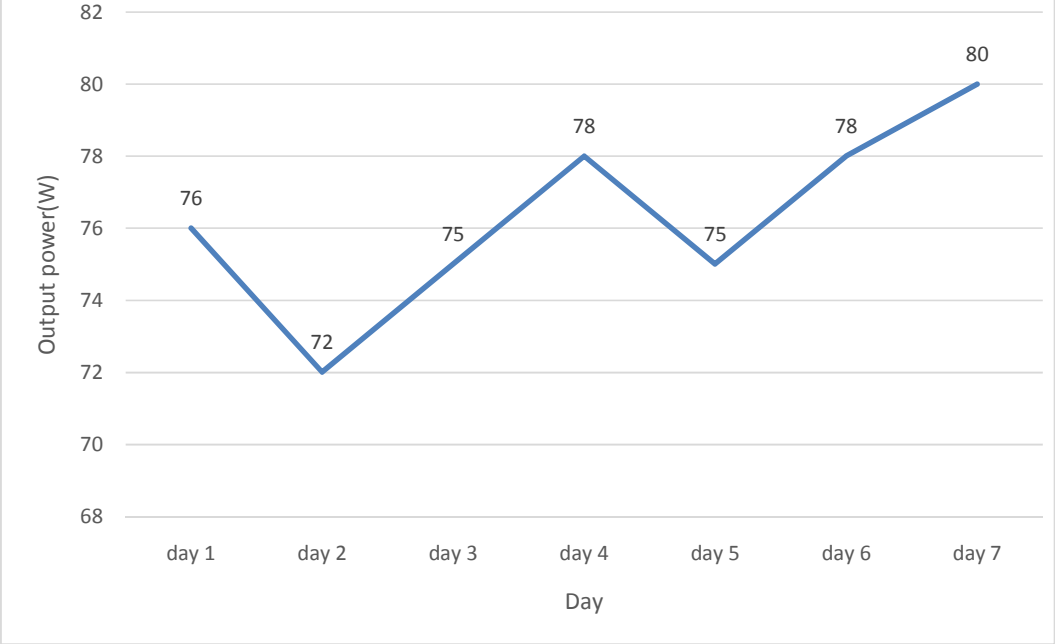

Figure1.9: One-week analysis chart

ANALYSIS:

Stress Distribution: The color-coded chart shows the stress levels across the beam. Red indicates the highest stress, while blue represents the lowest.

Stress Values: The von Mises stress values range from 2.845×10^{2} N/m^2 to 1.658×10^{8} N/m^2.

Yield Strength: The yield strength of the material is given as 4.700×10^{8} N/m^2.This is the stress at which the material starts to deform permanently.

Analysis Conclusion: If any region of the beam shows stress values above the yield strength, it indicates that the material in that area will fail or yield under the applied load. This analysis is crucial for ensuring the structural integrity of components subjected to various loads and is widely used in engineering design and analysis.

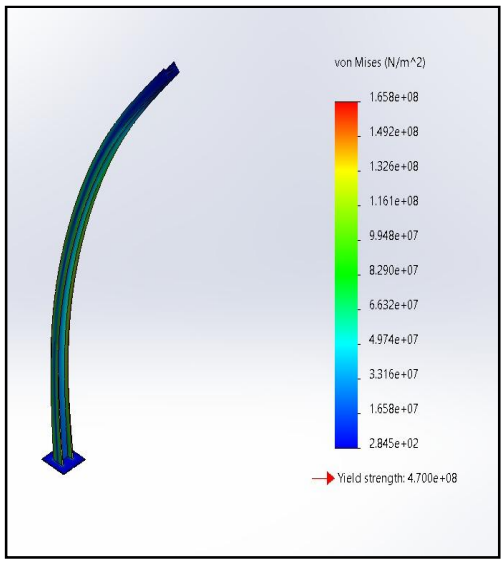

Figure 1.10: Analysis of I channel

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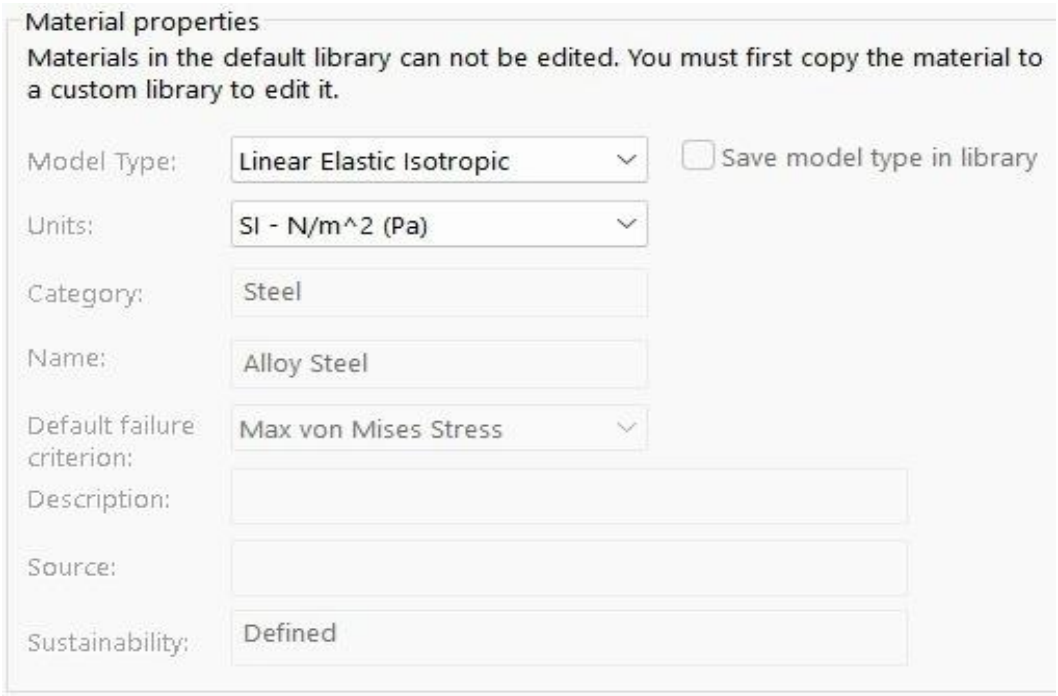

Property	Value	Units
Elastic Modulus	2.1e+11	N/m^2
Poisson's Ratio	0.28	N/A
Shear Modulus	7.9e+10	N/m^2
Mass Density	7700	kg/m^3
Tensile Strength	723825600	N/m^2
Compressive Strength		N/m^2
Yield Strength	620422000	N/m^2
Thermal Expansion Coefficient	1.3e-05	/K
Thermal Conductivity	50	W/(m·K)
Specific Heat	460	J/(kg·K)
Material Damping Ratio		N/A

Figure 1.11: Material Properties

VI. APPLICATION

- It is used in metropolitan and provincial regions**.**
- It is utilized for road lighting**.**
- It is material for modern power supply.
- It can likewise be valuable for a ceaseless power supply.
- It is utilized in battery charging of cell phones, PCs, and tablets.
- Significant in donning parks, and city parks.

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ADVANTAGE:

- It is eco-friendly.
- It is Pollution-free.
- Solution of future related energy problems.
- People can save money.
- Less land required.
- Future energy source**.**

DISADVANTAGE

- It is expensive to install.
- It can cause difficulties in eyesight due to solar reflections.
- It is not easy to clean the panel.

VII. CONCLUSION

In this work, the presentation of an organized sun-based tree and a customary fixed board with a limit of watts has been looked at as far as their result power when the sun-oriented irradiance falling on both the sun-oriented tree and the decent board is something similar. It is seen that the boards on the sun based tree are better at improving the subsequent power contrasted with the customary fixed board. From the recorded information, it is apparent that the sunlight-based tree created 50 watts more than the proper board during the all-out working season of 7 hours. It can likewise be derived from the sun based irradiance information falling on each board of the sun-oriented power plant that the variety in irradiance impacted the result power from the decent board more than the absolute result power from the sunlight-based tree. From the outcomes, it tends to be inferred that sun based trees can be a more successful technique for changing over falling irradiance contrasted with customary fixed boards. Accordingly, legislatures ought to go to suitable lengths to empower their utilization and establishment by giving fundamental monetary and strategy support.

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