

WELCOME
TO
OUR PRESENTATION

Design & Construction of Solar Based Gearless Transmission System

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Objective

- Use solar energy sustainably.
- Design a gearless transmission system.
- Reduce power losses from traditional gears.
- Simplify design for cost efficiency.

Introduction

The project presents a Solar-Powered Gearless Transmission System, using solar panels and an elbow mechanism for power transmission, creating a lightweight, compact, and low-maintenance solution.

Components

(1) Aluminum Flexible Coupler



- Flexibility
- Lightweight
- Vibration & Dampening

(2) Pillow Block Ball Bearing



- Inner Diameter:8mm
- Outer Housing Lubrication

(3) Linear Motion Ball Bearing



- Bore Diameter is 8mm
- Ball Bearing Insert

(4) Linear Shaft



- Shaft Diameter 8mm
- Straightness

Components

(5) DC Motor



- **Rated voltage**: 12V
- **Rated current**: 0.92A
- **Output speed**: 800 RPM
- **Shaft diameter**: 6 mm

(6) Solar Panel



- Power Output: 10W
- Operating Voltage: 12V Current: Approx. 0.59A
- Dimensions: 450mm x 280mm x 25mm
- Material: Monocrystalline

(7) Solar Charge Controller



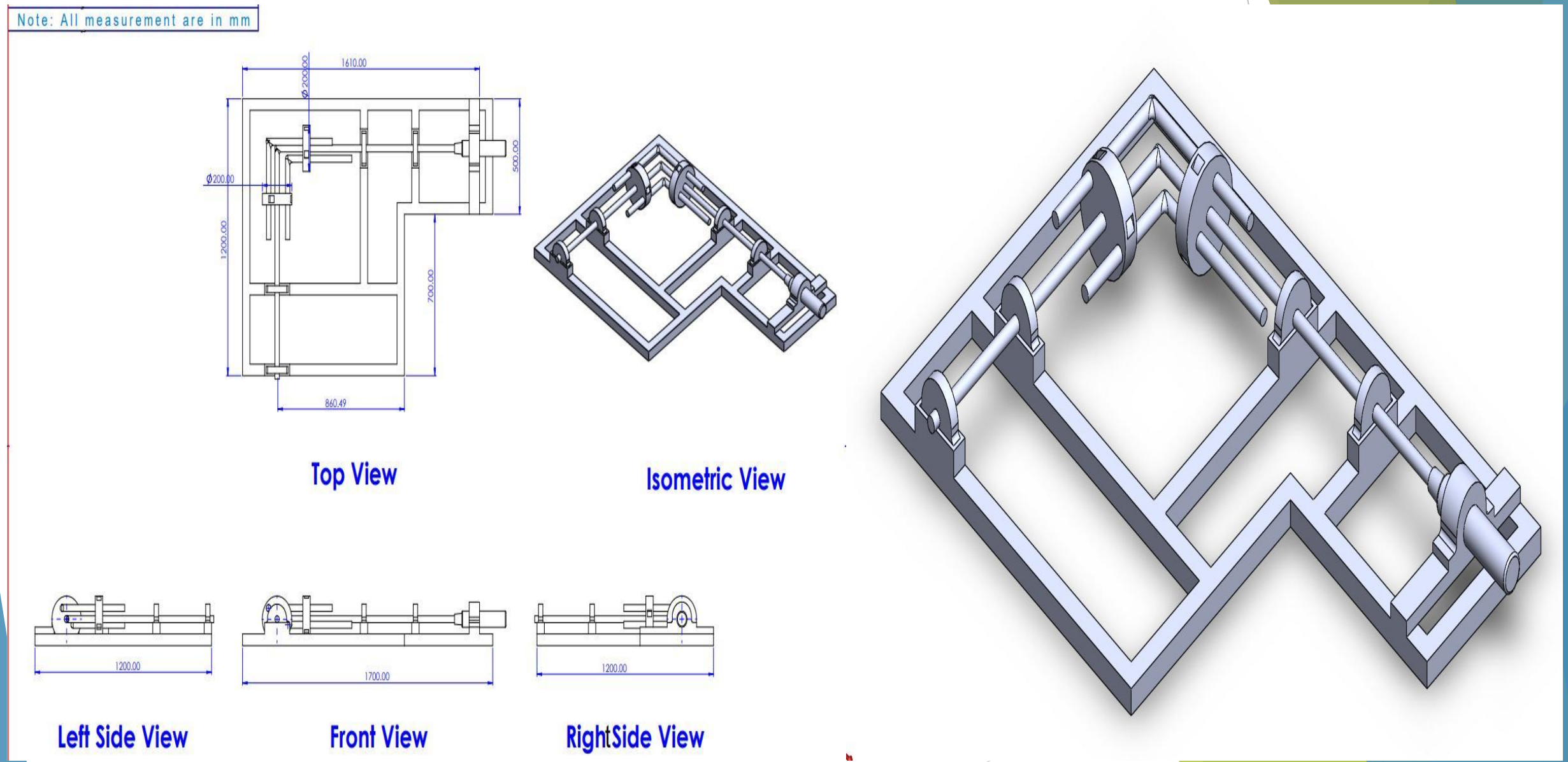
- Capacity: 12V- 10A.
- Microcontroller Based
- PWM Battery Charging
- Over Charge Protection

(8) Lead-Acid Battery

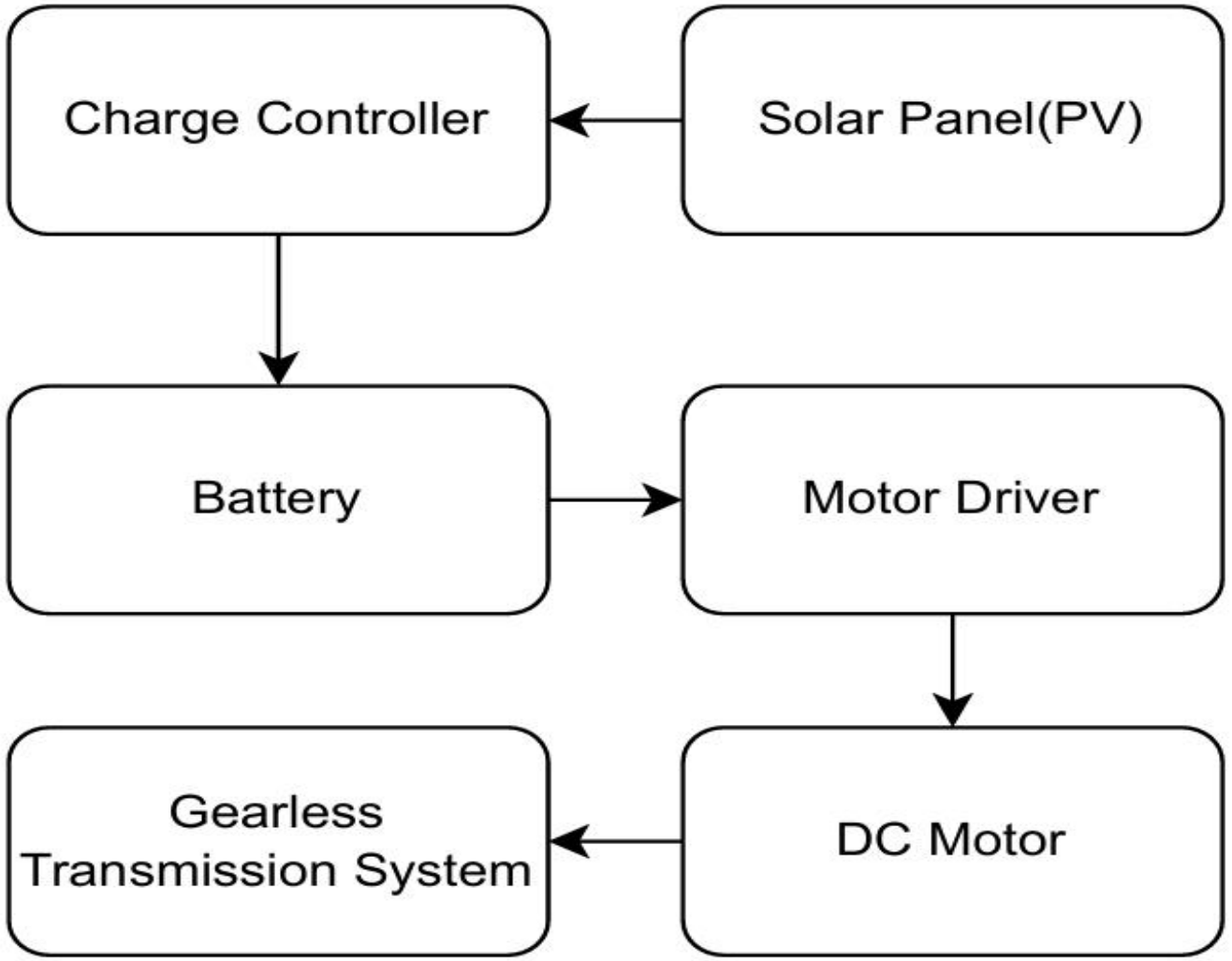


- **Rated voltage**: 12V DC
- **Rated current**: 9A

SolidWorks Model



Block Diagram of Project



Working Principle

- Solar panels convert sunlight into electricity.
- Stored in batteries.
- A DC motor uses this energy to drive the system for removing a gearbox.

Calculation

Given,

Power of motor, P = 60 Watt.

The speed of the motor, N =800 rpm.

Torque equation,

$$T = \frac{60\mathrm{P}}{2\pi N}$$

Where, P is power, T is torque, N is speed,

So, $T = \frac{60\text{x}60}{2\pi x800}$ = 0.72N-mm.

(a) **Check Shaft Diameter (Using Shear Stress)**

The formula for shear stress is τ,

$$\tau = \frac{T}{J} \times r$$

Where,

T is the torque (Nm)

J is the polar moment of inertia of the shaft cross-section (J= $\frac{\pi d^4}{32}$) for a circular shaft.

r is the radius of the shaft, r = $\frac{d}{2}$

For d=8 mm = 0.008 m

The radius r = 0.004 m

Calculation

The polar moment of inertia J is,

$$J = \frac{\pi d^4}{32}$$

$$J = \frac{\pi x (0.008)^4}{32}$$

$$J = 4.021 \times 10^{-10}\ m^4$$

Now, calculate the shear stress τ,

$$\tau = \frac{T}{J} \times r$$

$$\tau = \frac{0.72 \text{ x } 0.004}{4.021 \times 10^{-10}}$$

$$\tau = 7.16 \text{ x} 10^6 \text{ Pa}$$

$$\tau = 7.16 \text{ MPa}$$

The calculated shear stress (7.16 MPa) is well below the typical shear strength of stainless steel, which is about 60 MPa, indicating that the 8 mm diameter shaft is safe for the application.

So, the shaft diameter of **8 mm** is suitable for the given motor power and RPM

Calculation

(b) Design of HUB,

$$Mt = \frac{\pi}{16} \times \tau_n \times \frac{Do^4 - Di^4}{D_o}$$

$$9 = \frac{\pi}{16} \times \tau_n \times \frac{101^4 - 32^4}{101}$$

$$\tau_n = \frac{16 \times 9}{\pi \times 1019919.06}$$

$$\tau_n = 44.941 \times 10^{-6}\ N/mm^2$$

Here, Allowable shear strength for ss is $70N/mm^2$

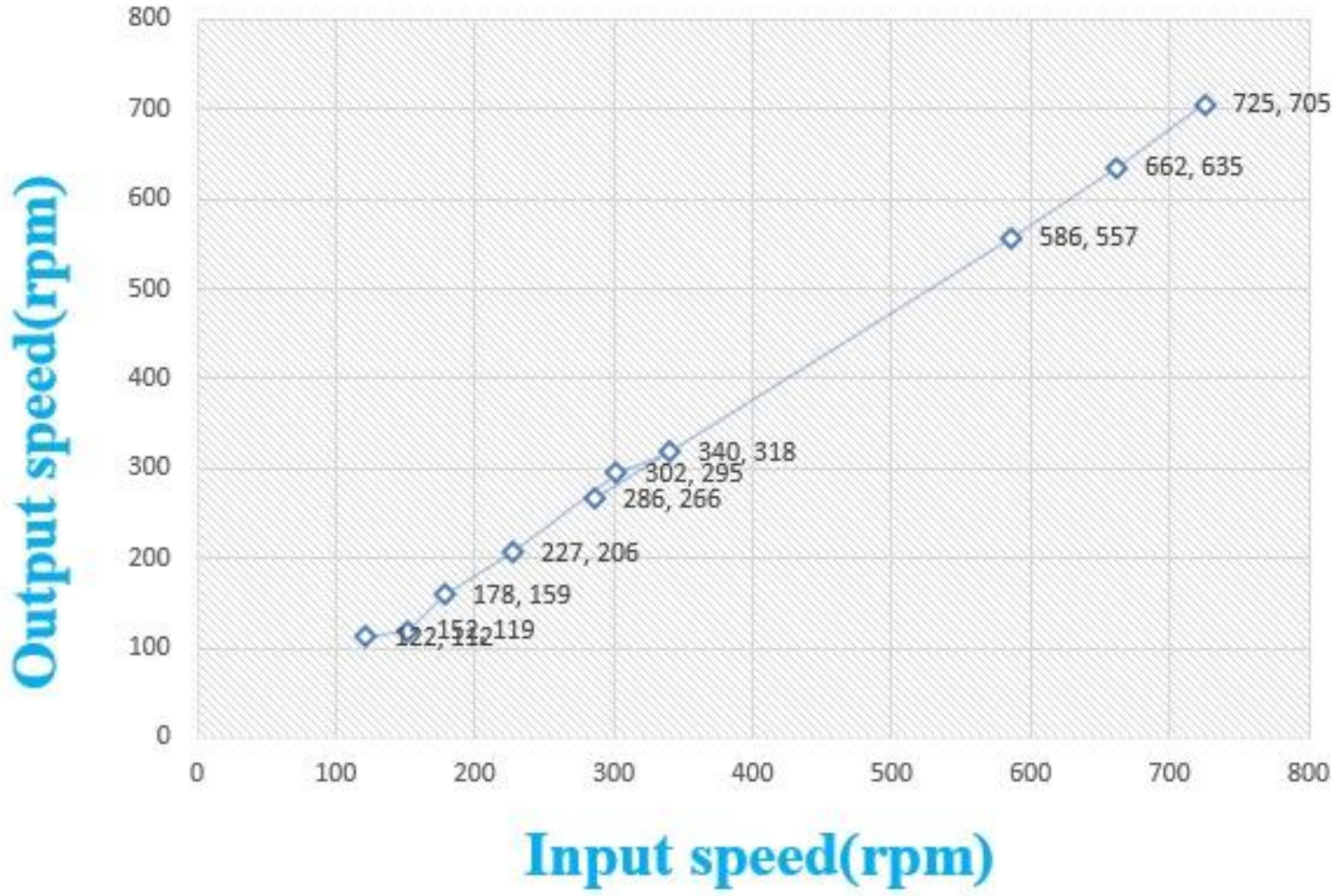
$\therefore \tau_n = 44.941 \times 10^{-6}\ N/mm^2$ is less than allowable shear strength.

So, design of hub is safe.

Data Table

SL NO	Input speed(rpm)	Output speed(rpm)	Efficiency (%)
1	122	112	91.80327869
2	152	119	78.28947368
3	178	159	89.3258427
4	227	206	90.74889868
5	302	295	97.68211921
6	340	318	93.52941176
7	286	266	93.00699301
8	586	557	95.05119454
9	662	635	95.92145015
10	725	705	97.24137931

Graph


Output speed(rpm)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
725, 705
662, 635
586, 557
340, 318
302, 295
286, 266
227, 206
178, 159
152, 119
122, 112
Input speed(rpm)

Advantage

- Solar energy as the primary power source.
- Noise free.
- Maintenance cost is low.
- Instant can transmit power.
- The elbow mechanism ensures smooth motion.

Disadvantage

- Higher initial cost.
- Limited speed range.
- Less suitable in heavy duty.

Applications

- Solar-Powered Vehicles.
- Renewable Energy Systems.
- Automated Systems.
- Off -Grid Applications.
- Energy Storage.
- Mobile and Portable Devices.
- Material Handling Systems.

Discussion

- The Solar-Powered Gearless Transmission System proved efficient, with minimal energy loss and reliable motion transmission. The system sustainably met energy needs with solar power and reduced maintenance and operational costs through a simple design. The system is an eco-friendly, durable alternative to traditional gear-based systems.

Future planning

- Adapting the system for industrial machinery or heavy-duty transportation.

Project View





Thank you so much