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# DESIGN AND IMPLEMENTATION OF SOLAR STREET LIGHT AND TRACKER SYSTEM

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**ABSTRACT:**
The electricity demand of the world has crossed 25 trillion Kwatts and increasing further continuously. The major contribution of conventional sources fulfills this demand. The fossil fuels use is continuously increasing over the years with developments of many countries. Use of conventional fuel is hazardous as it created pollution on the other hand the sources of such fuel are limited. To overcome these problems renewables technology is very effective and the only alternative. Renewable technology is going to through modifications for improvements in performance with considerations of various alternate technologies. Authors have designed and implemented the solar based streetlight. The study carried out to understand the potential of solar energy and results are presented in this paper.
**KEYWORDS:** Solar energy, renewable energy, street light, solar tracking, motor, microcontroller.

## INTRODUCTION:

Electricity can be considered as a basic need now a day as we are depended on it for many daily activities. Indian government is taking concrete steps to support renewable systems in India. Sun rays are available in India for around almost a year and have huge potential of generation of electricity. Cost of fuel is continuously increasing with increasing demand.

Photovoltaic despite of their cost and low efficiency is still very popular in electricity generation. For improvements in generation efficiency many solutions with materials to be used for solar cells are proposed and studied by the researchers. Tracking of maximum power is one of the basic methods to improve efficiency as the generation efficiency is good if sun rays makes exact 90 degrees angle with panel.

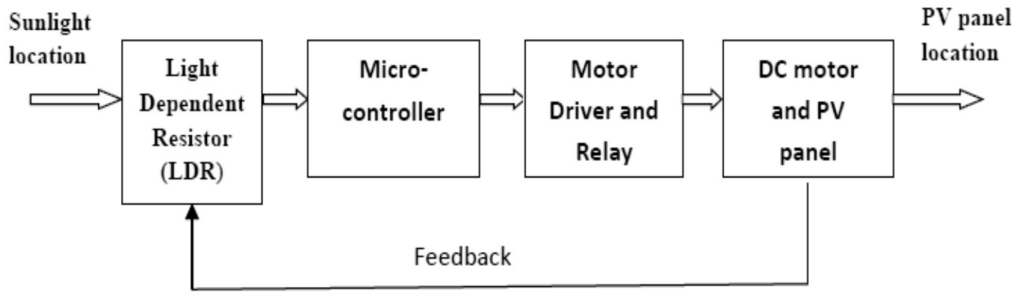


Fig.1: Block diagram representing solar tracking system

Figure drawn above is showing tracking system of solar rays in electricity generation. Light dependent resistor acts like measuring device for intensity of light. According to the direction of rays microcontroller operates motor and relays to change the position of solar panel.

## OBJECTIVES OF WORK:

The work is carried out to fulfill following objectives.

- Designing and developing solar street light system for applications of Indian villages
- Studying the nature of solar generation system
- Designing the system in CAD
- Implementing the system in hardware

## SYSTEM REQUIREMENT:

Following components are used for designing the system.

i. Gears
ii. Motors
iii. Solar Panel - 17V,75Watt
iv. Battery - 12V40
v. Street Light - 10Watt × 3 = 30Watt
vi. Solar Charge Controller - 12V
vii. Sensors - light depending resistor (LDR)
viii. Bearings
ix. Wire
x. Paints

**Dimensions of Solar Panel:**

i. Weight (kg) - 3kg
ii. Product dimensions (L*W*H)
iii. Height - 2.5Sq feet
iv. Width - 2.2Sq feet

**Technical Specification of Solar Panel:**

i. Wattage (wp) - 75
ii. Open circuit voltage (voc) - 21.90
iii. Short Circuit Current (Isc) - 4.59Amp
iv. Voltage at Maximum power (Vmp) - 17.96Volt
v. Current at Maximum Power (Imp) - 4.18Amp
vi. Maximum System Voltage - 1000Volt

**Battery Specification:**

i. Lead acid battery
ii. Voltage capacity - 12V40Ah
iii. Dimensions - 197×165×171mm (L×W×H)
iv. Weight - 14.30kg

## SYSTEM DESIGN:

1. **Input data:**
   Required backup = 12 hrs.
   Luminary streetlight = 20 watt.
2. **Battery:**

$$\text{Backup} = \frac{\text{Battery (VI)}}{\text{Load}}$$

Voltage = 12V - - - - - - -(standard)

$$12 = \frac{12 \times I}{20}$$

$$\frac{12 \times 20}{12} = I$$
$$I = 20A$$

Battery to be used = 12V, 20A

**3. Solar panel:**

$$\text{solar panel power} = \frac{\text{Battery (VI)}}{\text{Sunlight Active}}$$
$$= \frac{VI}{4.5}$$
$$= \frac{12 \times 20}{4.5}$$
$$= 53.33 \text{ Watt}$$
$$\cong 75 \text{ Watt}$$

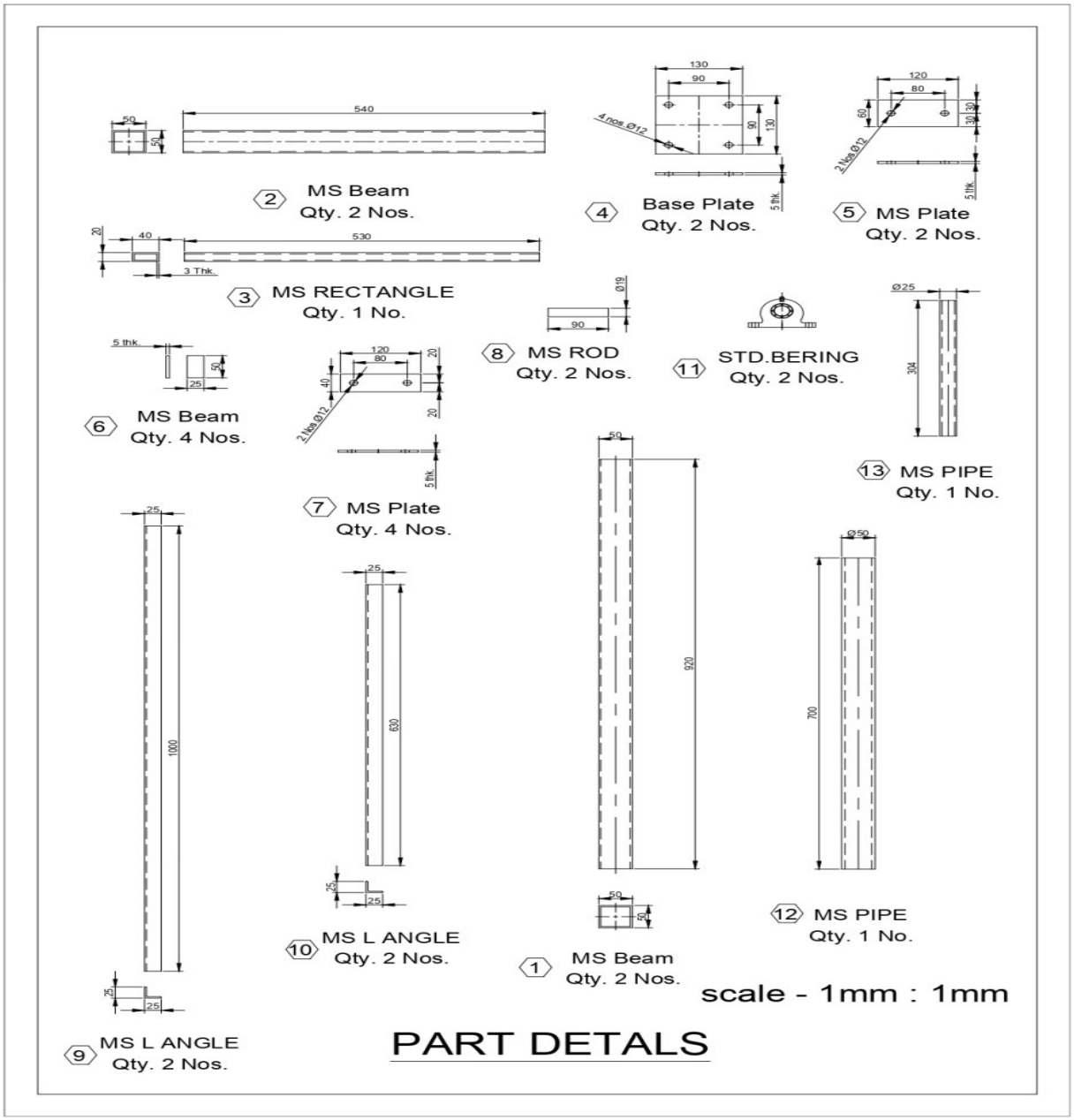


Fig.2: Drawing of various parts of system.

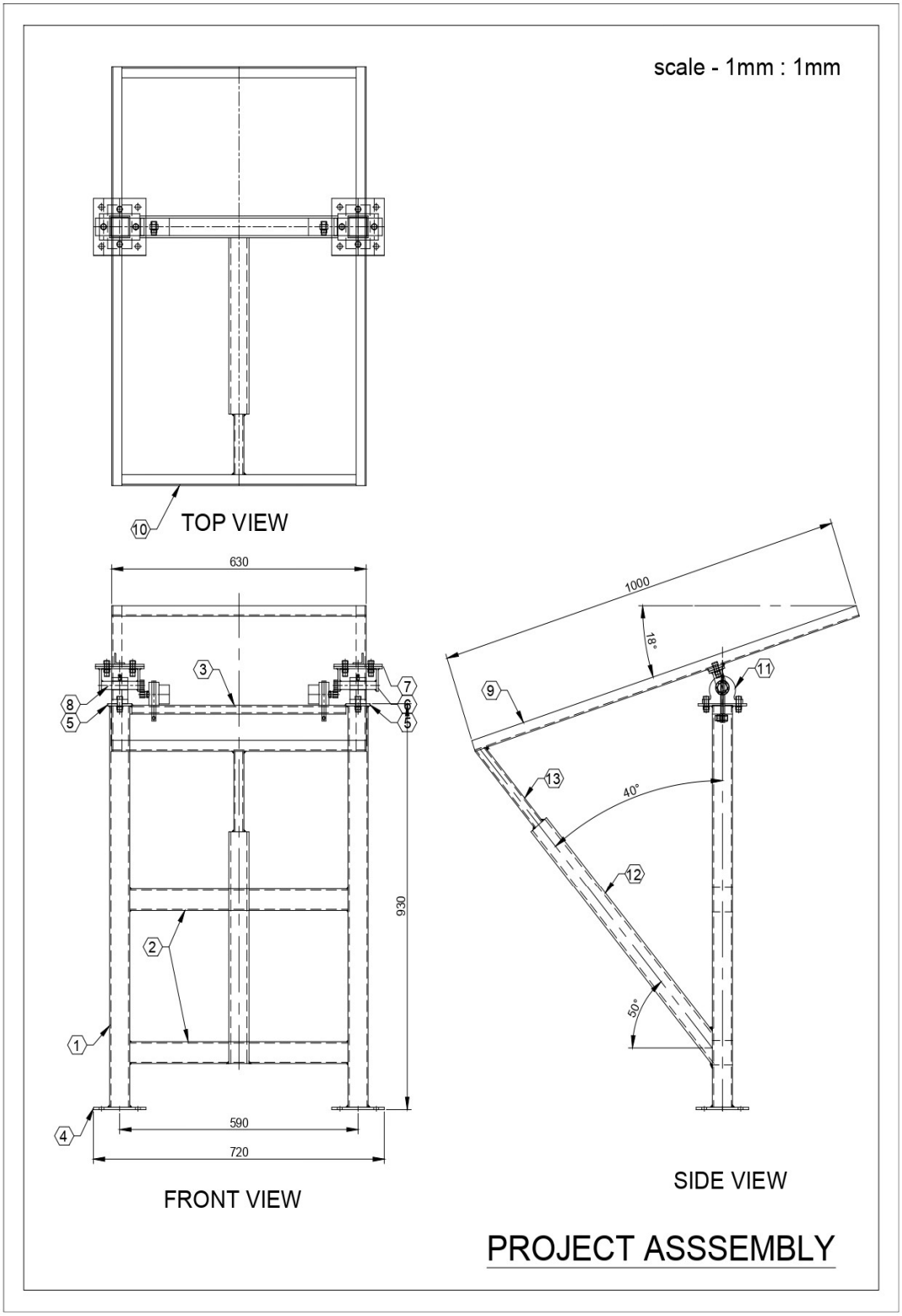


Fig.2: Drawing of assembly of system from different views

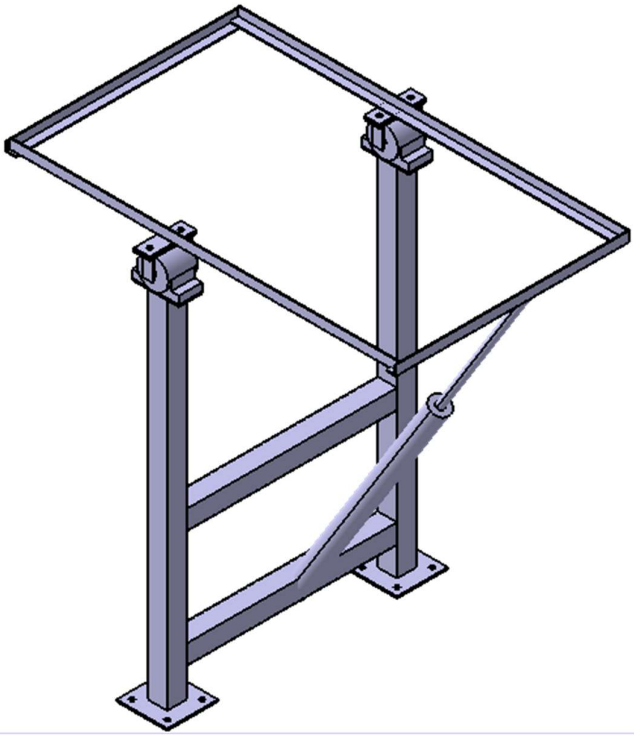

Fig.4: CAD Design for solar panel and tracking system

Fig.4: Installed setup for experimentation

## RESULTS:

Following two sets of readings are taken for experimental setup shown above. Authors have tested the system with various angles of solar panel and results are presented in table.

Table 1: Experimental results for angle 15º of panel with earth surface

| Sr. No | Time | LDR 1 Ω | LDR 2 Ω | LDR 3 Ω | Panel Angle (Degree) | Temperature | Starting Solar Panel Voltage. (V) | Battery Voltage. (V) |
|---|---|---|---|---|---|---|---|---|
| 1 | 8am | 84 | 80 | 78 | 15 | 31 | 20.3 | 8 |
| 2 | 9am | 84 | 86 | 84 | 15 | 31 | 20.5 | 8.8 |
| 3 | 10am | 86 | 106 | 84 | 15 | 32 | 21 | 9 |
| 4 | 11am | 108.6 | 118 | 98 | 15 | 38 | 22 | 10 |
| 5 | 12am | 110.6 | 128.7 | 103.3 | 15 | 38 | 22 | 11 |
| 6 | 1pm | 110.6 | 128.7 | 103.3 | 15 | 38 | 22 | 11.7 |
| 7 | 2pm | 110.6 | 128.7 | 103.3 | 15 | 38 | 22 | 12 |
| 8 | 3pm | 108.6 | 118 | 98 | 15 | 38 | 22 | - |
| 9 | 4pm | 100 | 98 | 118 | 15 | 38 | 22 | - |
| 10 | 5pm | 90 | 96 | 120 | 15 | 34 | 22 | - |
| 11 | 6pm | 84 | 86 | 106 | 15 | 32 | 21 | - |

Table 1: Experimental results for angle 18º of panel with earth surface

| Sr. No | Time | LDR 1 Ω | LDR 2 Ω | LDR 3 Ω | Panel Angle (Degree) | Temperature | Starting Solar Panel Voltage. (V) | Battery Voltage. (V) |
|---|---|---|---|---|---|---|---|---|
| 1 | 8am | 84 | 80 | 78 | 18 | 31 | 20.3 | 8 V |
| 2 | 9am | 84 | 86 | 84 | 18 | 31 | 20.5 | 8.8 |
| 3 | 10am | 86 | 106 | 84 | 18 | 32 | 21 | 9.6 |
| 4 | 11am | 108.6 | 118 | 98 | 18 | 38 | 22 | 10.2 |
| 5 | 12am | 110.6 | 128.7 | 103.3 | 18 | 38 | 22 | 11 |
| 6 | 1pm | 110.6 | 128.7 | 103.3 | 18 | 38 | 22 | 12 |
| 7 | 2pm | 110.6 | 128.7 | 103.3 | 18 | 38 | 22 | - |
| 8 | 3pm | 108.6 | 118 | 98 | 18 | 38 | 22 | - |
| 9 | 4pm | 100 | 98 | 118 | 18 | 38 | 22 | - |
| 10 | 5pm | 90 | 96 | 120 | 18 | 34 | 22 | - |
| 11 | 6pm | 84 | 86 | 106 | 18 | 32 | 21 | - |

## FUTURE SCOPE:

The future scope of work which can be carried out is to enhance mechanical structure for improvements in load carrying capacity of structure. Reduction in cost of structure and calculation related to how to improve on recovery of cost for this setup by reducing electricity bills. Implementation of various panels for electricity generation and carrying out analysis of which panel is suitable with maximum efficiency is future scope of work. This project must be implemented for small villages in India.

## CONCLUSION:

Considering the future of solar systems in electricity generation applications, authors have developed a street light with tracking system to generate maximum power. CAD modeling of the system is done and presented in this paper. Results with different angles of solar panel are presented and it is observed that

battery charging time is less with angle of 15º than angle of 18º. Authors have implemented this system from perspective of Indian villages. Renewable systems are contributing to a good amount for electricity generation. Indian geographic conditions are very much supporting to use of solar based electricity generation.

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