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To Study Novel Design of a Dual-Axis Solar Tracking PV System and Wind Turbine

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ABSTRACT:Although solar street lighting systems powered by solar cells have presented for many years, they are not widely used in today application because of their high cost and low energy conversion efficiency and due to the regular interruption in sun rays. The proposed system use the movable pv module with solar tracker hybrid with wind turbine to energize White LED light sources that are operated by directly connected White LED ,resulting in much more power consumption and continuous use throughout the year. This paper proposed the use of hybrid model for street lightning with solar tracker, pv panel and wind turbine. These systems resulted in high efficiency power conversion, low power consumption, continuous use and long life of light of the white LED.

KEYWORDS: PV panel, solar tracker, wind turbine, charge controller.

I.INTRODUCTION

India, a developing country, nowadays is enlisted as one of the strong economy countries. In 2011, India's 121 crores population comprises of 17% of the world's total population. From 2001 to 2011 there has been a percentage growth of 17.64% in the population of India.Environmental pollution due to the conventional sources of energy and its limited quantity.The Global warming has increased the demand and request for green energy produced by renewable sources.Total energy requirement is also increasing rapidly to keep pace with the rapid modernization of mankind and with the rapid increase in population.According to a survey the primary energy demand is increasing by 1.5% per year and by 2030 the total energy demand willl increase of 40%. With this continuous increase in population, the electricity consumption of India will grow at an average rate of 3.3% per year through 2035 and to meet this increasing demand the total generation capacity of India should be increased by 235 MW [4]. Presently India's per capita electricity consumption is 531.34 kWh, which is presumed to increase day by day with more and more modernization

The continuous instability of fossil fuel prices, the amount of oil and natural gas reserves is getting lesser and the serious environmental degradation due to over-exploitation of existing energy reserves are among the reasons to develop an alternative energy generation system that based on renewable energy sources, such as a hybrid system that combined solar and wind energy.The street lamps are widely used in rural as well as in urban areas, in cities, in towns etc. but the load of sodium vapour lamp used for street lighting is very high. Also it required large amount of supply. Certain times because of load shedding it is not possible to glow the light every time in night. hus there is need to find the replacement for such street light. The solar street light is one of the best invention in the field of non-conventional. The use of solar street lamp is increase day by day and it is very eco-friendly. But still it is not used in overall in world because of its less efficiency, its initial cost, weather and etc

II.BASIC OF RENEWABLE ENERGY SOURCES

As the fears of climate change increase, the demands for devices that generate electricity that are environmentally friendly will steadily increase. Most of the electric power generated in the world comes from the burning of fossil fuels to generate a consistent supply of energy. Every year, the demand for electricity increases, pushing the current power plants and power distribution grids to their limits. To meet this growing need, more fossil fuel power plants are being constructed, thus increasing the pollutants dispensed into the environment. The need to develop clean energy-producing systems that can perform as reliably as fossil fuel plants must be implemented throughout the world in order to decrease the effects man has on the planet.

In order for a renewable energy source to be added to a power utility, the three conditions to be met are reliability, cost, and lifespan. Due to the high initial cost of building a renewable power source and a slower rate of return than fossil

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fuel plants, progress has been slow in the construction of renewable energy plants outside of wind power plants [7]. The design of this project focuses on using a renewable-energy-based stand-alone system to decrease the energy usage at times of low power consumption and promotes the use of an environmentally-friendly energy resource. There are many forms of renewable energy resources that are currently available for integration into the power grid; the top four energy sources are wind, sun, water, and geothermal.

The main types of renewable energy are wind energy, solar photovoltaic, hydroelectric, and geothermal. Every year, the demand for electricity grows. To meet this increased demand, countries have to decide what form of generation will provide reliable power that will fulfill the future needs of the people.

III.LITERATURE REVIEW

[1] Highly Efficient Low Power Consumption Tracking Solar Cells for White LED-Based Lighting System:-

TheerawutJinayim, SomchaiArunrungrasmi, TanesTanitteerapan, and NarongMungkung , World Academy of Science, Engineering and Technology 4 2007.

Conclusion:-

The solar tracking used in this system is one axis; it can only track the sunlight only one direction. To improve the system efficiency, the researchers recommend using the dual axis for solar cell tracking mechanism.

[2] A Simplified Life Cycle Assessment applied to a coupled Solar and Eolic street light:-

P. D. Daidone, L.E. Ascani, Wind and solar-powered light post, United States Design Patent USD626686S,Nov. 2, 2010.

Conclusion:-

This methodology is described and applied to the study of a new type of street light using exclusively wind and solar energy and it is more efficient than the simple solar street lamp.

[3] Light Sensors for Solar Trackers:-

Green Econometrics, 2010, Understanding the Cost of Solar Energy, viewed 13 May 2010.

Conclusion:-

A new solar tracker is designed employing the new principle of using small solar cells to function as self-adjusting light sensors, providing a variable indication of their relative angle to the sun by detecting their voltage output.

[4] A Novel Low Cost Automatic Solar Tracking System:-

Carlos Andrés Giraldo-Castañeda and Lionel R. Orama- Exclusa, “Selective Hopping Solar Tracking Method for PV solar panel systems”,IEEE International Conference on Sustainable Energy Technologies, ICSET- 2008, 24th -27th November 2008, pp-459 -463.

Conclusion:-

In this paper, the hardware of a low cost automatic solar energy trapping system has been designed and successfully implemented. The designed that system which ensures 25 to 30% of more energy conversion than the existing static solar module system.

IV.PROPOSED METHODOLOGY

Here we proposed the hardware design and implementation of a system that ensures a perpendicular profile of the solar panel with the sun in order to extract maximum energy falling on it. Renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. The unique feature of the proposed system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum. The light dependent resistor’s do the job of sensing the change in the position of the sun which is dealt by the respective change in the solar panel’s position by switching on and off the geared motor. The control circuit does the job of fetching the input from the sensor and gives

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command to the motor to run in order to tackle the change in the position of the sun. With the implementation of the proposed system the additional energy generated is around 25% to 30% with very less consumption by the system itself.

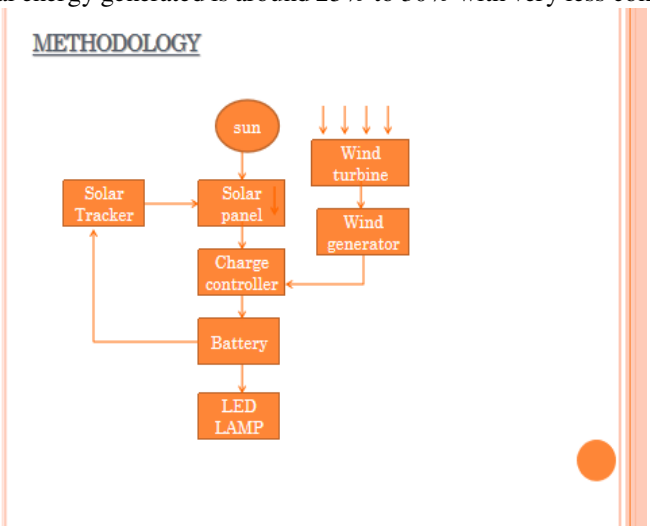

Fig. 1 Methodology hybrid system

We proposed here the hybrid model of photovoltaic panel with wind turbine coupled with alternator i.e. DC Generator and having solar tracker mechanism provide to the solar panel. The wind turbine is mounted at the top of pole where as the PV panel is keep in between the pole. There are two boxes were hold on pole one contains stepper motor with control circuitry of tracker and other contains the battery along with charge controller circuit.

V. PHOTOVOLTAIC SOLAR PANEL

The frame for the solar panel is made up of L shaped steel rod of 1"5" depth. The length is 1.22m and width is 0.54m. A square plate of dimensions 10x10 cm is made out of steel plate is fixed to the main structure at the height of 120cm from the base. A detailed blue print of the stand assembly has shown in figure.2. The main frame is also made up of L shaped steel rod.

Fig.2 Sample PV panel Assembly

VI. WIND TURBINE

Rotary engine in which the kinetic energy of a moving fluid is converted into mechanical energy by causing a bladed rotor to rotate opposite of a fan, turbine blades spin from the wind and make energy, instead of using energy to make wind .Wind rotates the turbine blade and spin the shaft connected with generator. Spin of the shaft in the generator produce electricity.

There are generally two types of wind turbine:-

1. Horizontal axis wind turbine.
2. Vertical axis wind turbine.

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Fig. 3 Savonius Vertical Wind Turbine

The Savonius turbine is S-shaped if viewed from above. This drag-type VAWT turns relatively slowly, but yields a high torque. It is useful for grinding grain, pumping water, and many other tasks, but its slow rotational speeds make it unsuitable for generating electricity on a large-scale.

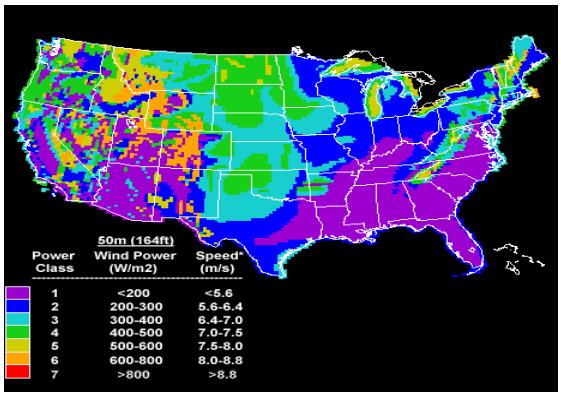

Fig. Annual Wind Power Resources

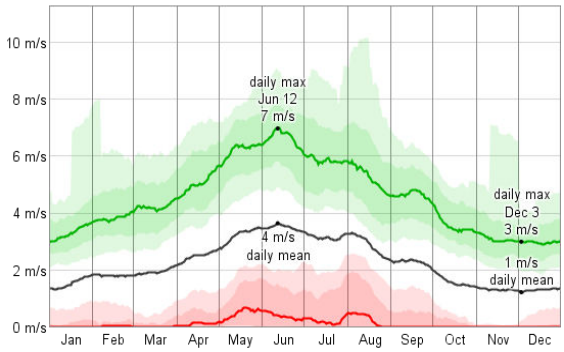

Fig.4 wind speed in India

The average daily minimum (red), maximum (green), and average (black) wind speed with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile).

Over the course of the year typical wind speeds vary from 0 m/s to 7 m/s (calm to moderate breeze), rarely exceeding 10 m/s (fresh breeze). The highest average wind speed of 4 m/s (gentle breeze) occurs around June 12, at

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which time the average daily maximum wind speed is 7 m/s (moderate breeze). The lowest average wind speed of 1 m/s (light air) occurs around December 3, at which time the average daily maximum wind speed is 3 m/s (light breeze).

Fig.5 Anemometer

VII. RESULT AND DISCUSSION

Given data:- Solar panel- 36 watt, 12 volt

Sunshine hour-8 hr/day (as perthe observation)

Load - 10watt, 12 vol

Total Energy generates/day = 36 watt * 8 hr

=288 watthr/day (0.288 Kwhr./day)

Load rating = 10 watt, 12 volt

I = 10/12

I =0.83 amp

Current consume in Ahr.= 0.83*10 hr=8.3 Ahr.

Battery Backup Calculated:- 9 Ahr.

Energy consume by load 10hr/day = 10watt * 10 hr

=100watthr

= 0.10 kwhr.

A 10 watt bulb work in 10 hr/day, as per standard value

1 unit = 1 kwhr

The total no. of unit for 10 hr. will

10 watt = 0.01 kwhr

0.01 kwatt * 10 hr = 0.1 unit/day

No. of units for 1 year = 0.1 * 365 days

= 36.5 units/year

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We designing solar tracker by using Light Dependant Resistor(LDR).We designing the high speed low torque wind turbine.We propose here a combination of PV module with solar tracker and wind turbine.We are used LED lamp.Also we used here S-Spiral wind turbine in place of S-Savonius wind turbine.

VIII.CONCLUSION

Hybrid street lamp using LED has better efficiency and luminous with good performance compare to conventional High Pressure Sodium vapour lamp and has proven it is eco-friendly and very economical.Power supply reliability under varying weather condition and the corresponding system cost are the two major concern in designing solar and wind power generation system. In order to utilize renewable energy resources of solar and wind energy both efficiently and economically minimize selecting appropriate system configuration, but also finding size components like wind turbine height , slope angle as given limitation..

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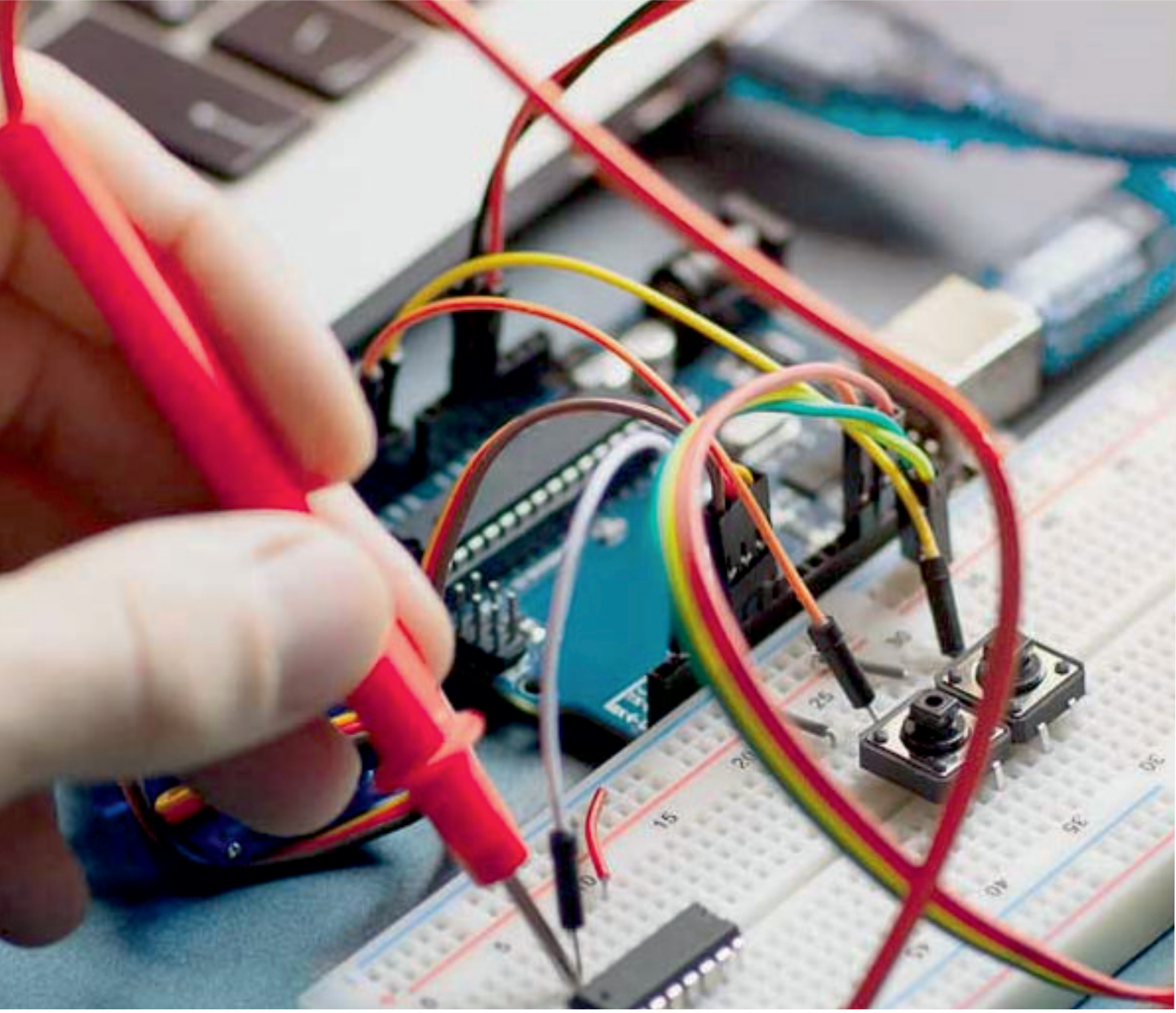

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