Dual Power Generation Solar and Windmill Energy Plus Automatic Street Light

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Abstract. In today's world electricity is most needed facility for the human being. All the conventional energy resources are decreasing day by day. So, so we need to shift from non-renewable to renewable energy resources. Here combination of solar and wind energy system is implemented. This is the best process that gives sustainable energy resources without damaging the nature. We can give uninterrupted power by using hybrid energy system. The power generation capacity of dual power generation system is more than the individual generation capacity. They can charge the battery at faster pace than they would individually do. This paper focuses on an integrated hybrid renewable energy system consisting of wind and solar energy. The application and different theories related to the development of hybrid also discussed in this paper.
Keywords: Solar energy, Wind energy, Servo motor.,Smart Lighting,

1 Introduction

The Electricity is needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Electricity energy demand in the world increases so as to complete demand energy is to be generated. Now a day's electrical energy is generated by conventional energy resources like coal, diesel, nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages the nature therefore sustainable energy resources needed for environment friendly energy generation. The conventional energy resources are depleting day by day. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity. The new source should be reliable, pollution free and economical. The non-conventional energy resources should be good alternative energy resources for the conventional energy resources. There are many non- conventional energy resources like geothermal, tidal, wind, solar etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy needs very lager step to extract heat from earth. Solar energy and wind energy are clean, illimitable, and environmental friendly. The energy sectors were already attracted to use renewable energy in large scale. Day by day the power crisis increases in our country, the government also attracting the peoples to use renewable energy by giving 50% subsidy. Now we are in the exact time to elevate from conventional power generating system. Both sources are dependent on unpredictable factors such as climatic and weather conditions. Due to complimentary nature of our climate and also because of using both the sources we can overcome the weakness of the existing single source system. Thus we are placing both the sources near the load; it can also be called as hybrid distributed generation. This can also reduce transmission and distribution cost. The proposed system can also be used for home power generation and the capacity will depends on load requirement.

The hybrid lighting systems are self-sustaining, standalone solutions and also it reduces the transmission and distribution losses. This proposed system is supreme solutions for many applications in rural and urban areas. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine.system uses mono-crystalline or poly-crystalline panels and stores the energy in a lead acid battery. There will be a control system to control the battery charging and discharging. The battery should be selected depending on cost, return on investment, efficiency and cycle of operation. Influential factors such as response time (ms to hours/day), energy density (size and space requirements), environmental impact and charge time are also considered while choosing the battery. Automatic streetlight needs automatic switching ON and OFF without using manual control. The system itself detects the outside illumination level and controls the brightness of the LED. When outside illumination is very low then automatically LED is switched ON and when the outside illumination is high then the LED is switched OFF

2. Literature Review

A Study on IoT based Smart Street Light Systems, 2020, K. Vignesh, M. Sakthivel, K. Priya;This paper explores how the Internet of Things (IoT) is revolutionizing traditional street lighting systems to address the growing

demand for energy efficiency and automation in today's modern world, where people increasingly prefer a sophisticated lifestyle enriched with advanced facilities. As science and technology rapidly evolve to meet these demands, IoT emerges as a key enabler in automating various sectors such as healthcare monitoring, traffic management, agricultural irrigation, educational environments, and particularly, street lighting. The current reliance on manual systems to operate street lights results in significant energy wastage worldwide, highlighting the urgent need for transformation. This study delves into how smart street lighting systems powered by IoT can play a vital role in solving the global energy crisis while modernizing infrastructure. Additionally, it analyses various sensors and components integrated within the IoT ecosystem, which are not only commonly used but also highly effective and reliable in building intelligent and responsive systems.

Smart Street Light Using Hybrid System, March 2021, A. Elakya, S. Sellva Sindhoori, S. Selvendran This paper presents an innovative approach to enhancing the functionality of street lights by integrating smart technologies and sustainable energy sources. In recent years, street lighting has evolved significantly, with traditional systems increasingly being replaced by energy-efficient LED lamps and automated solutions powered by sensor-based communication technologies. The goal is to develop a highly efficient, intelligent street lighting system that reduces energy consumption and enhances functionality. This paper offers an optimal solution that not only incorporates smart control but also focuses on green energy harvesting to power the system independently of the traditional electrical grid. Specifically, it explores the use of thermoelectric generators (TEGs) for harnessing energy from heat generated by burning non- biodegradable waste, as well as incorporating piezoelectric sensors to convert mechanical stress—such as foot traffic—into electrical energy. In addition to these sources, the system leverages solar power, all of which contribute to charging a battery that stores the electricity required to power the street lights. This integrated multi-source energy model aims to create a self-sustaining, eco-friendly street lighting system for modern urban and rural environments.

Design of smart street light management system based on Internet of Things, October 2022, Hongyu Sun; Yu Chen; Luning Wang This paper proposes a smart street light management system designed to address the growing energy consumption challenges driven by rapid socio- economic development and urbanization, which have led to increasing scarcity of power resources. In alignment with the national green lighting strategy, the system leverages wireless sensor networks and Internet of Things (IoT) technologies to integrate urban street lighting into a modern smart city infrastructure. Each street light pole is equipped with a controller embedded with multiple sensors that collect real-time environmental data. This data is transmitted from the street light nodes using LoRa communication and subsequently uploaded to a cloud-based monitoring platform via NB-IoT technology. The platform efficiently gathers and stores detailed information about the operational status of each street lamp. Additionally, the use of WEBGIS technology enables the visual representation of critical parameters such as current, voltage, and power on an interactive electronic map. The system is capable of detecting abnormal data, performing analysis, pinpointing issues, and triggering alerts, thereby facilitating seamless information exchange between the street lights and the cloud. This ensures precise control, intelligent monitoring, and efficient management of the lighting infrastructure. Experimental results confirm the system's high stability and demonstrate its effectiveness in conserving energy, reducing consumption, and minimizing operational and maintenance costs.

3. Methodology

In this project solar and wind energy hybrid system is formed the hybrid power obtained from the source are connected to a dc and keep in battery. each output is uneven the rotation of the turbine could vary, it's depending on speed of air. The wind energy generation system is placed at middle of the straight light-weight pole. Use of the sunshine weight blades, will produced rotational motion at low wind. The star output additionally depends on the intensity of the sunshine. Flow chart of operating of hybrid power system is shows below.

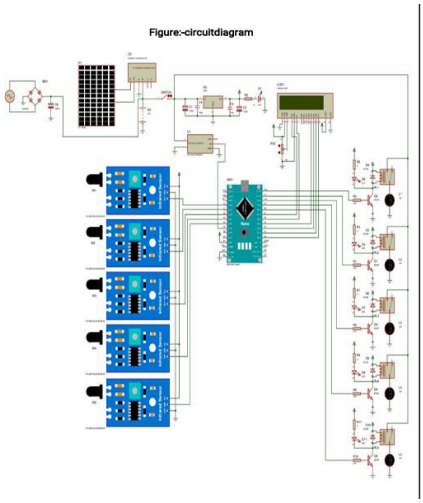

Figure 1. Circuit f working of hybrid power system

A stand-alone wind system with wind system and solar PV cell is the best hybrid combination of all renewable energy systems and is most appropriate for all the applications. This combination compensate the disadvantages of each other, for example, the high wind energy production during monsoon months compensates low output generated by solar. Similarly, during winter when the wind energy is minimum solar photovoltaic takes over. The hybrid solar wind power system is as shown in fig.1.

Applications of Proposed Solar-Wind Hybrid Power System are given below∟Remote and rural area electrification,∟General lighting systems for Residential colonies and apartments.∟Street lighting the use of proposed system the carbon emission and other harmful gases are reduced to approximately 80% to 90% in the environment

Working

The working of the proposed hybrid, sensor-based intelligent street light system is an orchestrated combination of renewable energy harvesting, automated control, and efficient lighting mechanisms. The system starts its operation with the collection of energy from two primary renewable sources: solar power and wind energy. During the daytime, the solar panel absorbs sunlight and converts it into electrical energy using the photovoltaic effect. This energy is then regulated and passed through a solar charge controller to charge a rechargeable battery safely, preventing overcharging and ensuring optimal power storage. In parallel, the wind turbine harnesses kinetic wind energy and converts it into AC electrical energy via a small wind generator. This AC energy is then rectified using a bridge rectifier and filter capacitor circuit, transforming it into stable DC voltage suitable for storage in the same battery unit. This dual-source energy input ensures that the battery remains charged in both sunny and windy conditions, guaranteeing uninterrupted operation regardless of weather variability. The stored energy in the battery is used to power the system's components during the night. A voltage regulator is employed between the battery and the microcontroller (Arduino Nano) to supply a constant and safe voltage level to sensitive electronic components. Once it is dark, and the natural lighting is insufficient, the streetlight system is activated. The system includes five LED street lights, each connected to an individual relay module and associated IR sensor. These IR sensors are positioned strategically to cover a specific detection area in front of each corresponding streetlight. When a pedestrian, animal, or vehicle enters the detection zone of any IR sensor, the sensor instantly sends a signal to the Arduino Nano. The Arduino then processes this input and triggers the respective relay to switch the associated LED light from dim mode to high brightness. This ensures that the area where motion is detected is well illuminated for safety and visibility. Meanwhile, all other lights that do not receive a signal from their corresponding IR sensors remain in dim mode, consuming only minimal energy. This selective lighting technique contributes significantly to energy conservation, as only the necessary lights are fully active at any given time. The Arduino Nano, programmed with a logic control algorithm, continuously monitors each sensor's input in real-time and updates the light status accordingly. If no motion is detected in any zone, all five lights stay in dim mode, just enough to provide background illumination for the area. The entire system is further enhanced with a 16x2 LCD display that acts as a user interface. This display provides real-time feedback on important system parameters such as sensor activity, light status (dim or bright), battery voltage, and current energy source. This helps the user or maintenance team to monitor the functioning of the system at a glance and identify any issues without the need for external tools. In case of a malfunction—such as a sensor failure or low battery level—the display can alert the user through custom messages, helping ensure prompt corrective action. The working flow of the system is continuous and cyclic throughout the night, with the Arduino consistently scanning for sensor input and adjusting the lighting based on real-time data. The system's power management is entirely automatic, with no human intervention required for switching between energy sources or light intensities. By combining renewable energy utilization, real time automation, and intelligent decision-making, the working of this system exemplifies a practical solution for smart and sustainable street lighting. It is especially valuable in rural or remote locations where grid electricity may be unreliable or unavailable, and it also serves as a cost-effective and ecofriendly solution for urban lighting infrastructures aiming to reduce carbon emissions and operational costs

4. Conclusion

As mentioned in the paper This combination of solar and wind is better than each individually. with safe and free energy to save the planet. Because of the somewhat complementary nature of the seasonal profile, It will get higher efficiency than individual systems. Vertical axis wind energy conversion system are practical and potentially very contributive to the production of clean renewable electricity from the wind even under less than ideal conditions. . It is hoped that they may be constructed used high-strength, low- weight materials for deployment in more developed nations and settings or with very low tech local materials and local skills in less developed countries. Which can lighten many houses in

urban as well as in rural areas for agriculture purpose small factory educational institutions, etc..

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