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ijirset@gmail.com

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Hybrid Renewable Energy Powered Charging Station for Electric Farming Equipments

Priyanka Jankar¹, Utkarsha Patil², Puja Inamdar³, Sayali Shinde⁴, Tejal Patil⁵

Assistant Professor, Department of Electrical, Nanasaheb Mahadik College of Engineering, Peth, Sangli (MH), India¹

Student, Department of Electrical, Nanasaheb Mahadik College of Engineering, Peth, Sangli (MH), India²⁻⁵

ABSTRACT: The uses of electric appliances are increasing in nearly all sectors. The agriculture is one of them, where the farmers are using battery operated farming equipments such as battery powered fertilizer pump, tractor etc. but availability of electricity in farm is big concern. Therefore to ensure availability of electric supply at remote location like farm we can use renewable energy sources such as wind and solar which are easily available and reliable. The objective of this project is to design efficient and reliable Pico hybrid solar- wind power generating unit at farm to facilitate battery operated farming equipments with charging facility. The simulation is done by using Matlab software.

KEYWORDS: Matlab, Hybrid, Electric Farming

I. INTRODUCTION

A country's agricultural lands are at the heart of its economic development. As a result, it is the government's primary responsibility to conserve and safeguard the fields in every way possible. Science and new technology have progressed, yet nothing has been able to eliminate the reliance on agricultural farmland. New technologies have been offered for the benefit of farmers, in order for them to achieve a better outcome with greater accuracy and fewer labour, but with some restrictions.

India is currently ranked second in terms of farm output. More than 70% of rural households rely on agriculture as their primary source of income. However, as the population grew, so did the demand on farmers. As a result, per capita food grain availability increased to 528.77g per day, up from 395g in the early 1950s, resulting in increased non-renewable energy usage. Keeping in mind the practical issues that farmers face, we have attempted to provide an alternate agricultural paradigm for the benefit of future generations. To make it smarter, we combined numerous components such as soil moisture sensors, electronic scarecrows (PIR sensors), and GSM into a unified farm system. We have also incorporated remote monitoring of the system, control of water pump through cell phones, keeping track of more than one field and assessing the records of each field for future study, under a single system. As it may be a smart move towards the next generation agriculture, thus it can be called as 'Smart Agriculture System'.

II. LITERATURE REVIEW

M. H. Nehrir, et al [1] The authors propose that the IEEE PES Renewable Technologies Subcommittee form a special task force to study hybrid renewable/alternative energy (RE/AE) power production systems with an emphasis on energy sustainability. It elucidates several key concerns and obstacles in hybrid RE/AE system design and energy management. System configurations, sizing of generation units, storage requirements, and energy management and control are all discussed. There are also statistics on the current state and projected trend of renewable energy generation, as well as some key barriers to the broad deployment of RE/AE power generation technologies and a vision for future research in this field. The comprehensive list of references given at the end of the paper should be helpful to researchers working in this area.

Weijun Yu , Xianyi Qian [2] has proposed that 3KW wind and solar hybrid power systems be studied in terms of building design and control systems for 3G base stations. To preserve power, the system combines with 3G base stations, ensuring that base stations can supply power properly in any situation. Wind and solar hybrid power systems consist of three parts; the first part is wind power generation system, which is composed of a non-controlled rectifier, a boost converter and so on; the second part is mainly composed of solar cell panel power generation system, wind power



generation system and solar cell panel power generation system are complementary. The third part is single-phase power supply inverter, wind power and solar cell panel power connected parallel with reserved power of 3G base stations access into single-phase power supply inverter, and then turn into 220V, 50Hz power to supply for 3G base stations. On the different weather conditions, wind and solar hybrid are complementary. Wind and solar hybrid power systems is effective by system simulation on the different weather and load and simulation experiments of single-phase inverter.

Juan Manual Carrasco [3], IEEE member, IEEE Senior Member Jan T. Bialasiewicz The utilisation of distributed energy resources as a supplement and alternative to massive traditional central power plants is becoming increasingly popular. The specification of a power-electronic interface must take into account not only the renewable energy source itself, but also its consequences on power-system operation, especially when the intermittent energy source accounts for a major portion of the total system capacity. In this paper, new trends in power electric Integration of wind and photovoltaic (PV) power generators are presented

Ravikumar S Dr. H Vennila [4], Because the system is stable and complementary in nature, the most common renewable energy technology is a hybrid power system that combines wind and solar energy sources. In distributed generation, a hybrid wind/photovoltaic system is widely employed (DG). This paper proposes a new solution for improved voltage stability with quality power output. In this system voltage out from wind energy conversion system(WECS) and Photo voltaic panels are given to separate DC DC converters, independently controlled and connected to a common DC bus and from there it is inverted. In the proposed controller the voltage stability is obtained by applying adaptive Honey Bee Optimization (HBO) algorithm along with a PI controller. The implementation of the proposed method is done by using Simulink platform. The performance of the suggested co ordinate control system is analysed by comparing the computer simulation results with and without using controllers and it shows that the proposed system is more efficient.

Sefania Gomes Relva, Dorel Soares Ramos [5], Miguel Edgar Morales Udaeta has proposed objective of this work is evaluating the long term hybrid power supply from wind and solar energy resources determining the optimized ratio concerning installed capacities to attempt the power demand of a region. The Brazilian Northeastern region (Açurua) is the case study for the complementarily, among wind and solar energy resources, on hourly and monthly bases through nine scenarios combining representative capacity factors of both resources. The results show the ideal range for the optimized participation of photovoltaic installed power on hybrid power depending on capacity factors assumed. The range of number of each equipment may be used as preliminary information to long-term planning for companies interested on hybrid farms on Acurua region.

Sumit Wagh, Dr. P.V.Walke [6], The demand for electricity power is increasing day by day, which cannot be met with the satisfied level without non-renewable energy resource. Renewable energy sources such as wind, solar are universal and ecological. These renewable energy sources are best options to fulfill the world energy demand, but unpredictable due to natural conditions. The use of the hybrid solar and wind renewable energy system like will be the best option for the utilization these available resources. The objective of this research paper is to study the various aspects of hybrid solar and wind system.

Problem Definition:

Nearly 80 percent of India's 140 million farming families own two acres of land. Because land holdings are small, more people are forced to labour on farms in rural areas, and this, along with the outdated technology of conventional manual methods, limits productivity and lowers farm revenues. Due to lack of techniques of Electricity generation in remote areas of farms, Farmers are unable to use the electric equipments.

III. METHODOLOGY

- a) To identify the problems faced due to the electricity scarcity in remote areas in farm.
- b) To design the equipment of electricity generation by wind and solar power stations
- c) Simulation of the electricity generation by wind and solar power stations
- d) Fabrication of Final Design and assembly of required components.

designed this block such that when the battery SOC become 90% then give the signal 0 to relay and relay will give signal to switch to cut off the supply from generator. In this the torque given to generator is variable which given by turbine by varying the wind speed.

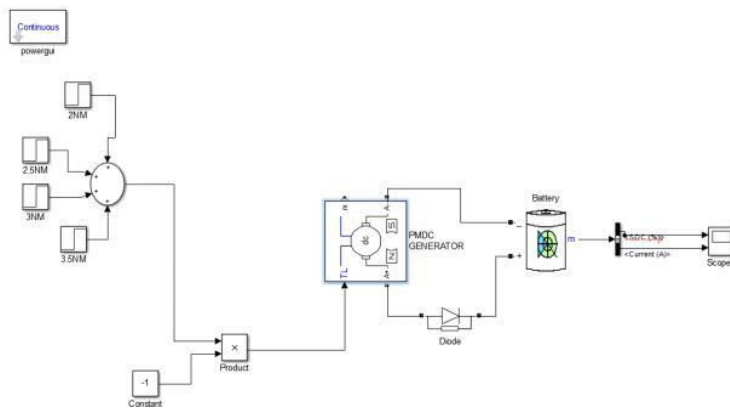


Fig 3. MATLAB Simulink model of PMDC generator

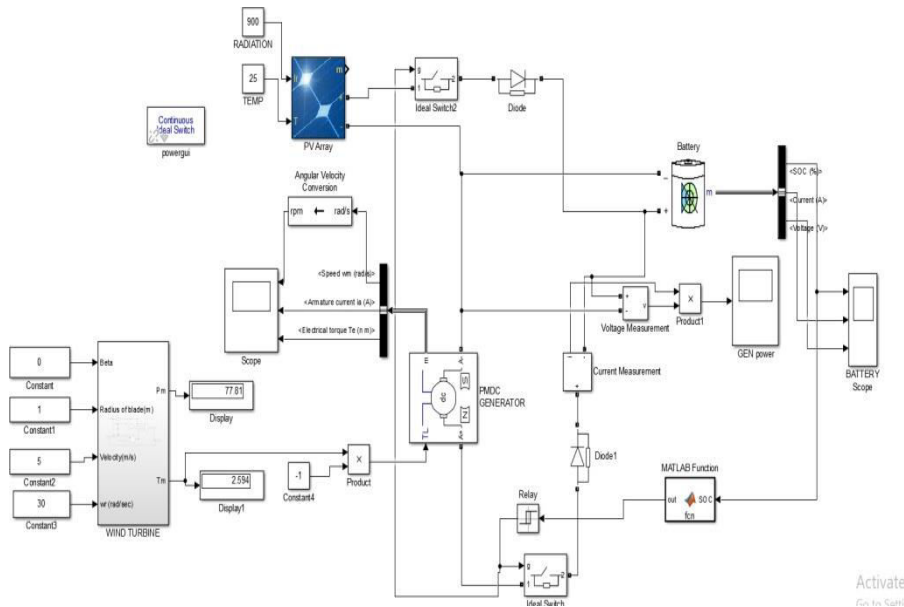


Fig 4. wind and solar hybrid system Simulink

Wind and solar hybrid system simulation is as shown in fig. It is similar to the single wind turbine system using PMDC generator only solar panel is added and battery is connected in the parallel of the system.



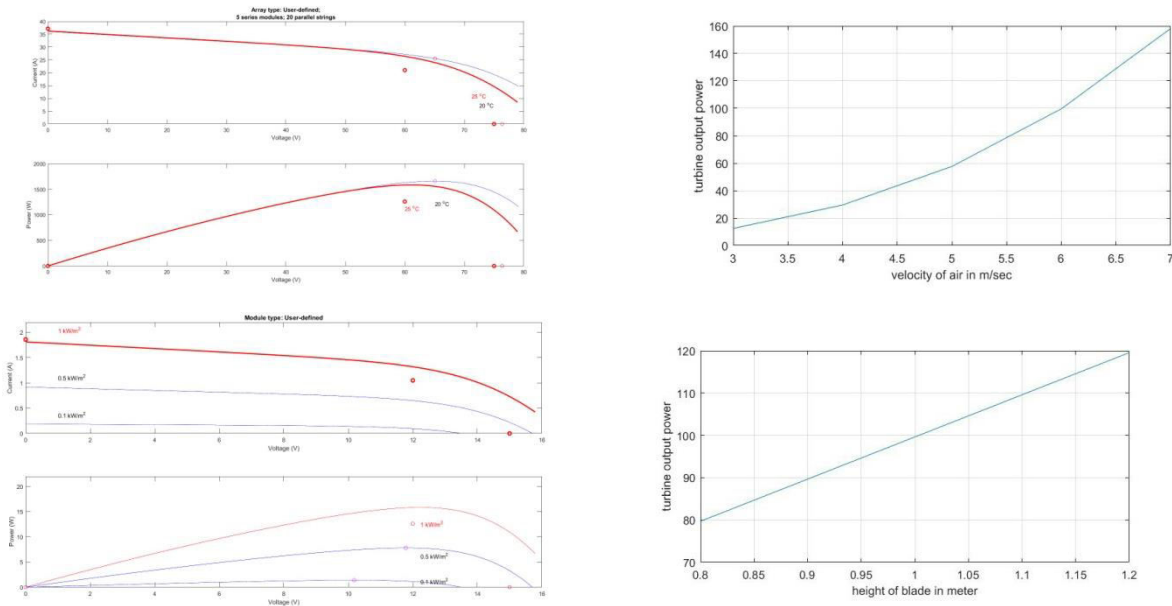
VI. RESULT AND DISCUSSION

The below table shows the performance of the PMDC generator

Table No1 : PMDC Generator

Sr No	Torque	PMDC		
		Output Power (W)	Load Current (A)	Load Voltage (V)
1	2	16.2	1.17	13.95
2	2.5	18.5	1.5	12.87
3	3	23.2	1.8	13.55
4	3.5	27.2	1.9	14.23

The preceding analysis was carried out utilizing PMDC generators with the identical torque levels. In comparison to a dc machine, the output power of the three phase synchronous generator is the highest. In the case of a three-phase synchronous generator, the load current is also at its maximum.



VII. CONCLUSION

The output power of a PV system is highly dependent on solar radiation, while the output power of a dynamic machine is dependent on wind velocity. To address this shortcoming, both systems were combined to form a hybrid system with increased dependability and output power. For a 50-minute simulation, the developed system and its control strategy performed admirably. The generated power from the hybrid system is both cost-effective and efficient. If more power is needed, the system can easily be expanded by connecting the necessary number of solar panels.

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