IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 6, June 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.282

9940 572 462 6381 907 438 ijareeie@gmail.com www.ijareeie.com

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 6, June 2021 ||

| DOI:10.15662/IJAREEIE.2021.1006007 |

Solar and Wind Hybrid Marine Propulsion for Green Tourism

Advaith R Nair[1], Arun Abi[2], Silpa Varghese[3], Akash K.A.[4] , Neetha John[5]

UG Student, Dept. of EEE, Mar Athanasius College of Engineering, Kerala, India.[1 2 3 4]

Associate Professor, Dept. of EEE, Mar Athanasius College of Engineering, Kerala, India[5]

ABSTRACT: Backwaters, being the most popular tourist attraction in Kerala uses conventional propulsion systems in their houseboats, which leads to marine pollution. The utilization of renewable energy sources like solar and wind, for energizing the propulsion system of houseboats can be the perfect solution for saving the marine ecosystem. The electrical energy obtained from the solar panels and wind turbines is stored in the battery, which is used for powering the motor of the propulsion system. A solar tracking system is also installed for obtaining maximum energy from the sun, during different lighting hours. The hybrid marine propulsion system can be a rapid response to global warming by reducing the dependence on fossil fuel consumption. Thus, the implementation of hybrid technology in water transport helps us to achieve the goal of a sustainable future.

KEYWORDS: Solar and Wind Hybrid Energy, Marine Propulsion, Solar Tracker, Vertical Axis Wind Turbine,Green Tourism.

I.INTRODUCTION

As we all know Backwaters of Kerala are famous all over the world and it is one of the most favorite tourist destinations. Tourists are attracted by Houseboats and the specialty of houseboats is that they required less power, and it is only required to move in cruise mode. At present, houseboats are using diesel engines which are polluting as well as are having high operating costs. Nowadays diesel engines are replaced by solar power engines but still, they have problems like less service on cloudy days, overnight grid charging which leads to additional charges and fixed panels causes changes in irradiation. These problems were noticed in India's first solar ferry, "Aditya" in Vaikom, Kottayam, Kerala.

So it is better to use a hybrid power source without depending on IC engines are the alternative source. The best choice is Solar and Wind since both are abundant in nature and there will be zero operating costs. To improve the efficiency of the solar subsystem, fixed panels can be replaced with Solar Tracker. The battery and other specifications are designed only for houseboat applications which are having only less running time.

II. SOLAR SUBSYSTEM

The proposed designis using solar and wind energy sources for driving the propulsion system of a houseboat. For the improvement of efficiency of the solar panels, the proposed design is having a solar tracker instead of fixed panels. To understand the importance of solar tracker the simulation of the Solar Subsystem is done. Fig 1 shows the Simulink model. The inputs are three irradiances and the SOC of the battery is checked in each case. The main aim of doing this simulation is to compare the charging time with the change in irradiance obtained by the Solar panel. In fixed panels, irradiance will vary while the boat moves, and the panels will not receive the maximum available irradiance that could be obtained. The irradiances chosen are 1000 W/m^2,900 W/m^2 and 750 W/m^2.

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 6, June 2021 ||

| DOI:10.15662/IJAREEIE.2021.1006007 |

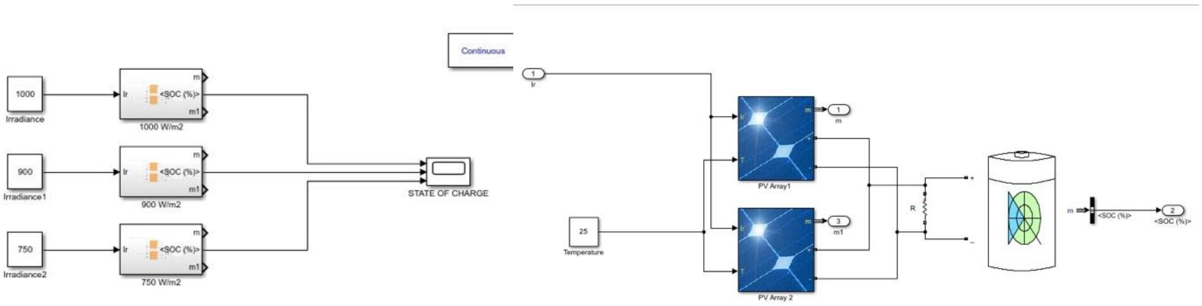


Figure 1. Simulink model of the Solar Subsystem with three different irradiances.

In Figure 2, the considerable variation of the State of Charge concerning irradiance could be seen. When the irradiance is 1000 W/m^2, the SOC of the battery reached 100% after 3 hours whereas for 900 W/m^2 it took more than 3.5 hours and for 750W/m^2 the time is again increased. So, it should be made sure that the panel receives the maximum available irradiance of the sun. By doing this, the complications of the MPPT module can be avoided and the efficiency of the solar panel can be increased.

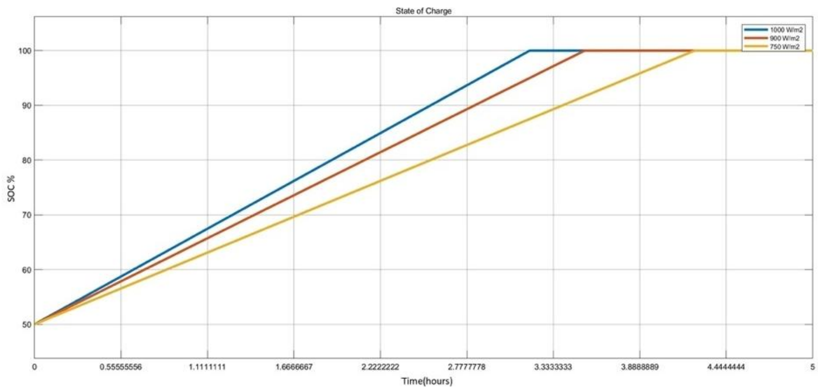


Figure 2. State of Charge of battery with different irradiances

The flowchart for the software of solar tracker is shown in Figure 3. The solar tracker makes uses two LDRs placed on opposites sides of panels and a DC wiper motor to rotate the panels.When the light intensity falling on both LDRs is greater than 400, the panels should not rotate. For this, the motor should not receive any input thus the value of two output pins remains 0. If the value of LDR1 is greater than or equal to 600 and the value of LDR2 is less than 800 then the output pin becomes 1 and the wiper motor rotates clockwise and vice versa when LDR2 is receiving more intensity of light.It helps to improve the efficiency of the solar panel by 30%. A solar tracker is programmed and controlled using a PIC microcontroller. To be specific, we are using a PIC16F877Amicrocontroller. It can be programmed in MP Labs The 2 output pins which are used to control the rotation of the wiper motor is RD0 and RD1.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 6, June 2021 ||

| DOI:10.15662/IJAREEIE.2021.1006007 |

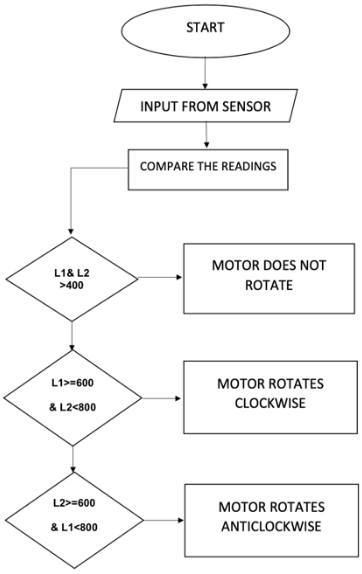


Figure 3. Flowchart of Solar Tracker

III.WIND SUBSYSTEM

The generation of wind power in the proposed design uses the Savonius vertical axis wind turbine. A vertical axis wind turbine is selected because it can be installed at lower heights for the rotation of turbines to generate the expected output when compared to horizontal axis turbines, which need to be installed at higher heights for the rotation of turbines. The Savonius vertical axis turbines are made by molding the aluminum sheets into curved surfaces of the turbines, which are technically known as scoops. These scoops are then attached to the main vertical shaft for the rotation of the turbine. When the wind blows, a positive force is created at the front part and a negative force is created at the backside of the scoops, thus the resulting difference in force made them rotate. A gear system is also being attached as it helps to increase the original speed obtained by the rotation of turbines to a higher speed for the generation of expected output power. These turbines have lesser vibration and are much quieter during their operation. The main advantage of this turbine is that it can produce electrical energy even at very low wind speeds. Thus, the electrical energy obtained by the wind turbines is stored in the battery.

IV. PROPULSION SYSTEM

The proposed model is shown in Figure 4. The solar and wind subsystem mentioned above as using in the propulsion system.

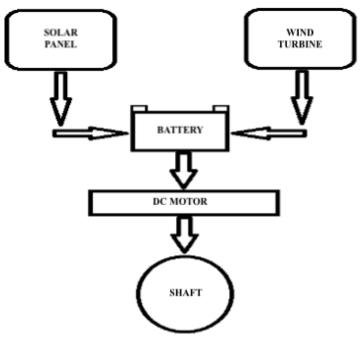


Figure 4. Block Diagram of Hybrid Propulsion System

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 6, June 2021 ||

| DOI:10.15662/IJAREEIE.2021.1006007 |

The proposed system has a suitable design and in Figure 5, the solar and wind system are placed neatly and compactly also wind turbine gear set, and DC wiper motor gear set is placed close to each other with mechanical stability and the propeller is made in the separate base which is movable. The battery can be charged simultaneously using solar and wind energy without using a circuit breaker. In the prototype, two 12V panels are used and a stepper motor of .75 A/step is used for converting wind energy. The battery used for the prototype is 7.2 Ah 12V. The control board in the system contains two switches. One for charging and another for propulsion motor. A high-speed DC motor of rated current 7.2 amperes is used.

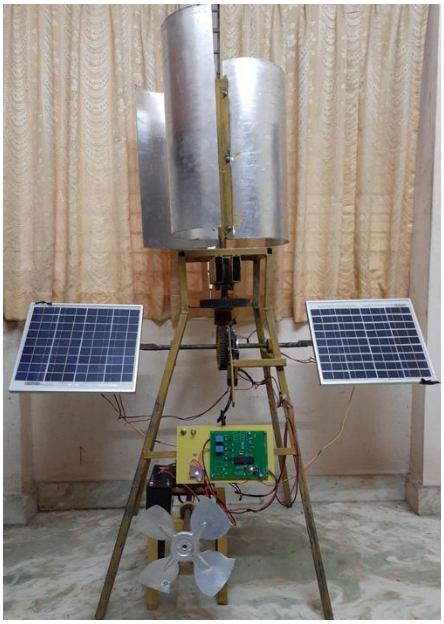


Figure. 5 Prototype of the Solar and Wind Hybrid Marine Propulsion System

V. EXPERIMENTS RESULTS

The charging time of the battery in different modes was noted. The results are shown in Table 1. The battery was discharged to 50% and the time required to charge the battery to 100% was compared working in three different modes of using the two sources of energy

Table 1. Expected Vs Actual Results of Charging

OPERATION MODE	EXPECTED TIME	ACTUAL TIME
SOLAR ONLY	3	3.5
WIND ONLY	4.8	5
COMBINED	1.84	2.25

Seeing the results from Table 1, the proposed system is suitable for Houseboat since the motor has to work for at most one hour. The battery is discharged to 50% after 30 minutes of the running of the DC motor. The charging current obtained from one solar panel is 0.56 and thus 1.2 A will be obtained from Solar Subsystem and 0.75 A charging current will be obtained from the Wind subsystem. Thus, the battery can be charged when the houseboat is made still in the water. The seasonal changes will not affect the system as the proposed system uses the two types of abundant energy available in nature

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 6, June 2021 ||

| DOI:10.15662/IJAREEIE.2021.1006007 |

VI.CONCLUSION

An efficient solar and wind hybrid marine propulsion system with zero operating cost is developed. The utilization of two renewable energy sources for providing electrical energy to drive the motor of the propulsion system helps to reduce the fuel cost and marine pollution. The solar tracking system to control and monitor the solar panels based on the intensity of light is installed successfully and reduced the complications of the Maximum Power Point Tracker. The percentage efficiency of the system in energy conversion increase when the tracking system is implemented. This hybrid technology is more efficient than the normal conventional systems and also it contributes towards a sustainable future.

REFERENCES

[1] Waleed Obaid, A K Hamid and ChaoukiGhenai, "Wind-Fuel-Cell-Solar Hybrid Electric Boat power design with MPPT system", in 8th International Conference on Modelling Simulation and Applied Optimization, April 2019.

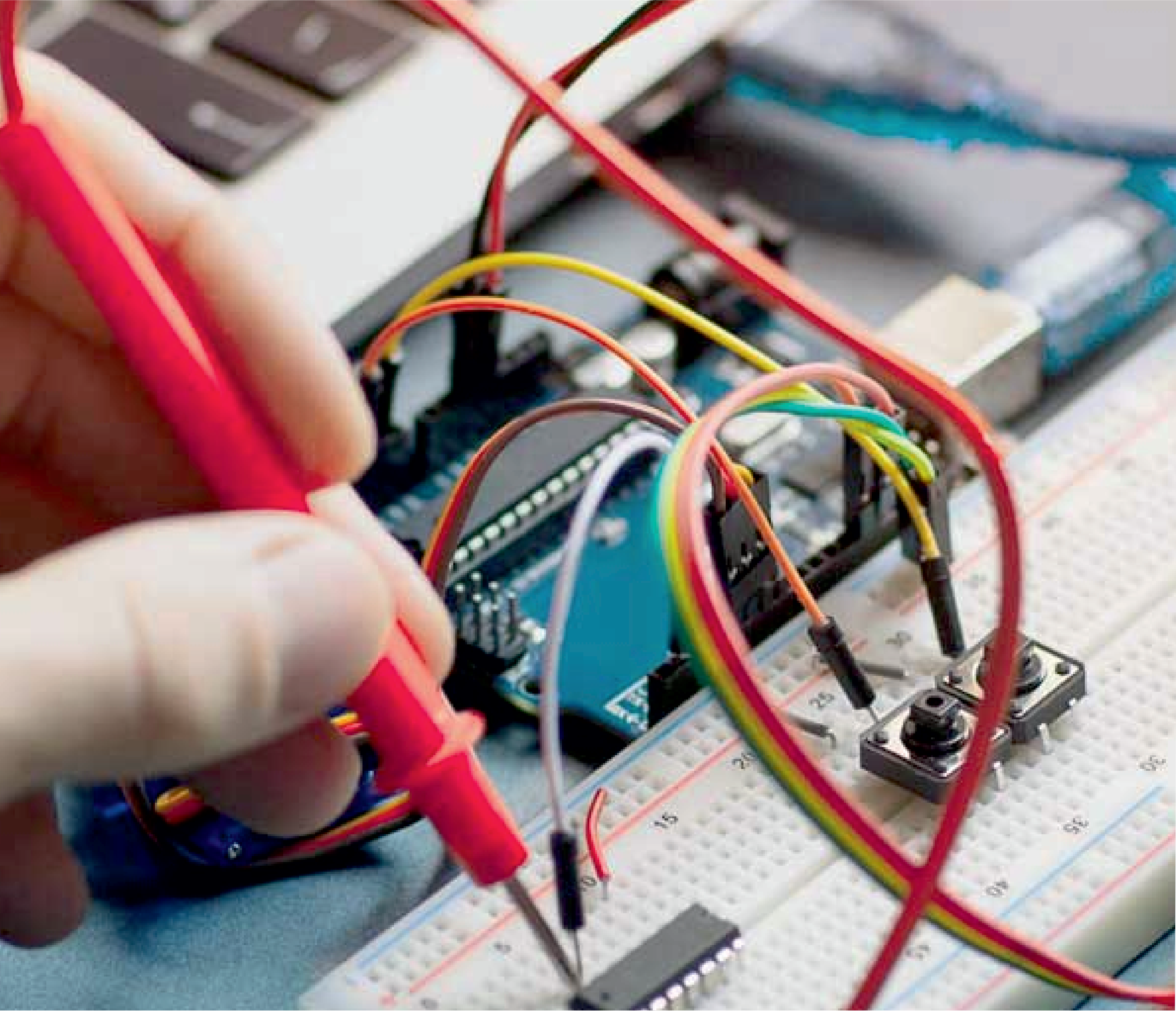
[2] Ligade Gitanjali Vasant, V. R. Pawar, "Solar-wind hybrid energy system using MPPT", Intelligent Computing and Control Systems (ICICCS) 2017 International Conferenceon, pp. 595-597, 2017.

[3] Jumaat, Siti & Tan, Adam & Abdullah, Mohd Noor &Radzi, Nur Hanis& Hamdan, Rohaiza&Salimin, Suriana& Ismail, Muhammad. "Horizontal Single Axis Solar Tracker Using Arduino Approach". Indonesian Journal of Electrical Engineering and Computer Science, pp 489-496, 2018

[4] Jairo Plaza, Cristian Daza and Euler Coral, "Design, Construction and Implementation of a low-cost Solar – Wind hybrid energy system", in IEEE Latin American Transactions, vol 13, October 2015.

[5] Chunhua Liu, KT Chau, and Xiaodong Zhang, "An efficient Wind – Photovoltaic hybrid generation system using doubly excited permanent magnet brushless machine", in IEEE Transactions on Industrial Electronics, March 2010.

[6] Tiecheng Wang, Haifang Yu, and Chunbo Zhu, "Hybrid Energy Sources for Hybrid Electric Vehicle Propulsion", in IEEE Vehicle Power and Propulsion Conference (VPPC), China, September 2008.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 7.282

doi crossref

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details