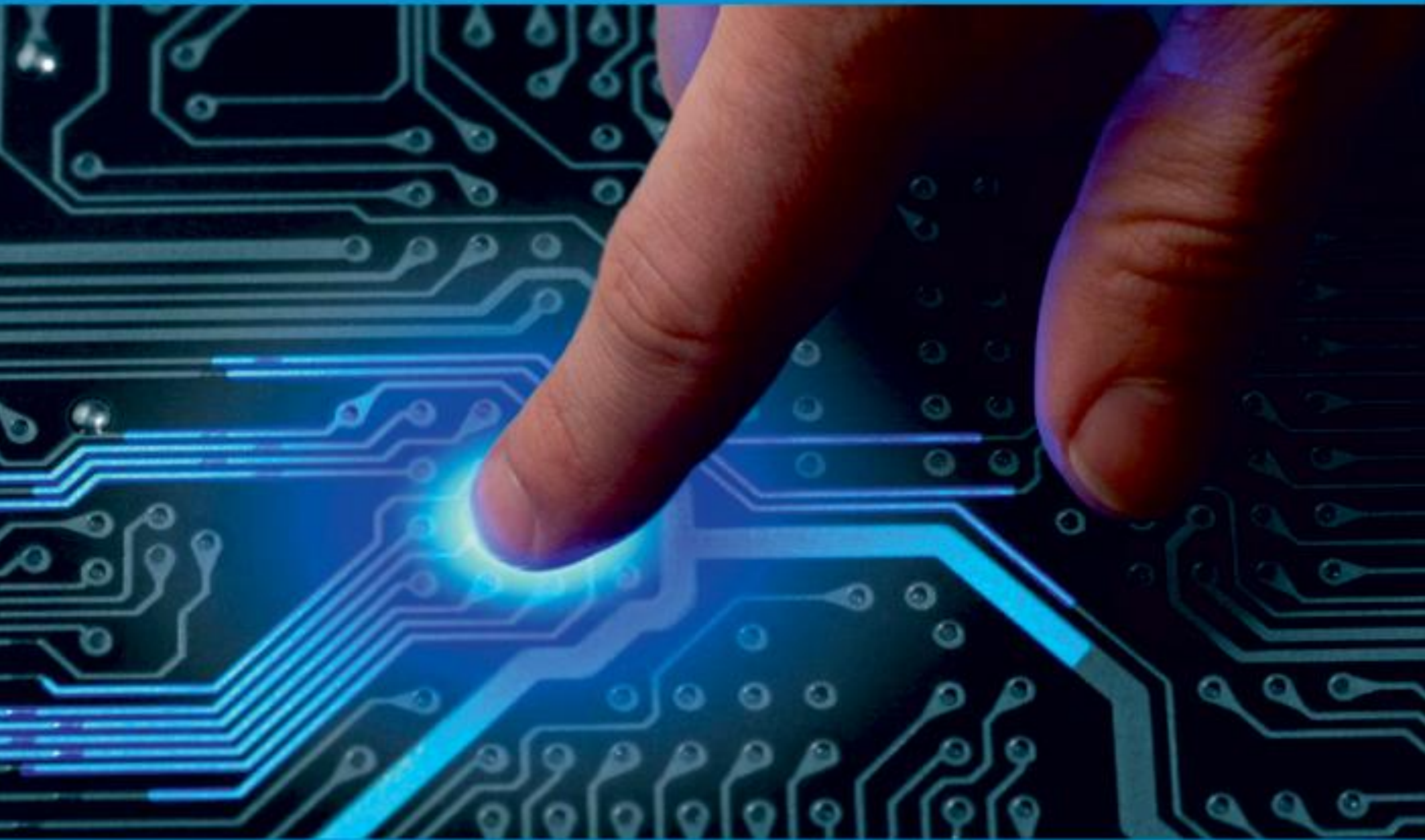
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 2, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 2, April 2024 ||

International Conference on Recent Development in Engineering and Technology – ICRDET 24

Organized by

Dhaanish Ahmed Institute of Technology, KG Chavadi, Coimbatore, Tamilnadu, India

Multi- Agent System for Optimized Energy Management and Security in A Micro Grid

Tamilarasi M[1], Sathya Anusha S[2], Sowmiya D[3], Rithesh Kumar A[4], Mr. S. Ashwanth B.E., M.E[5]

UG Students, Dept of E.C.E., Velalar College of Engineering and Technology, Erode, Tamil Nadu, India[1 2 3 4]

Assistant Professor, Dept of E.C.E, Velalar College of Engineering and Technology, Erode, Tamil Nadu, India[5]

ABSTRACT: This concept focuses on the development of a multi-agent system for optimized energy management and security in a micro grid that uses a combination of wind and diesel generators, AC to DC converters, solar panels, batteries, DC to DC converters, DC bus, PIC microcontroller, and DC to AC converters. The main goal of this system is to effectively manage the energy generation and consumption in a micro grid while ensuring its security. The multi-agent system consists of intelligent agents that communicate with each other and make decisions based on real-time data from the micro grid. The agents are responsible for coordinating the various energy sources and loads, optimizing energy production and utilization, monitoring system health, and detecting and responding to potential security threats. The use of renewable energy sources, such as wind and solar, in combination with smart energy management techniques, makes the micro grid more sustainable and efficient. Additionally, the incorporation of the PIC microcontroller provides a centralized control and monitoring system for the agents, allowing for quick and effective decision-making. Furthermore, the integration of DC to AC converters and connection to the main grid enables the micro grid to sell excess energy and earn revenue, making it financially viable. Overall, this multi-agent system offers a comprehensive and intelligent solution for optimized energy management and security in a micro grid, providing a potential solution for addressing the ongoing issues of energy sustainability and security.

KEYWORDS: Multi-Agent System (MAS), Energy Management, Microgrid, Optimization, Security, Renewable Energy, Smart Grid, Distributed Energy Resources (DERs)

I. INTRODUCTION

Today, smart grid is considered as an attractive technology for monitoring and management of grid connected renewable energy plants due to its flexibility, network architecture and communication between providers and consumers. Smart grid has been deployed with renewable energy resources to be securely connected to the grid. Indeed, this technology aims to complement the demand for power generation and distributed storage. For this reason, a system powered by a photovoltaic (PV) has been chosen as an interesting solution due to its competitive cost and technical structure. To achieve this goal, a realistic smart grid configuration design is presented and evaluated using a radial infrastructure.

The economic problem of PV integration is the high installation cost due to lower PV penetration rate of these decentralized power stations. Indeed, electricity grids are stable systems contrarily to renewable energy plants (PV and Wind) which are decentralized, unpredictable and their connection to the grid could lead to instability while coupling them. These phenomena limit the integration of renewable energies into conventional grids and harm their sustainability. In general, They discuss smart grid concept and applications, design, sizing and optimal placement of the energy mix, small scale test-bed implementations in order to choose the best strategy to its implementation, voltage stability, overall system integration rate, global losses and many other factors which help economical and technical decision-making.

It implicitly promotes the reliability and sustainability of the power supply and lowering the peak demand. They presented a survey of potentials and benefits when enabling technologies such as energy controllers, smart meters and communication systems with reference to real industrial studies courses. At first, we will present an improved electrical grid model dedicated to any smart grid based on power load profiles estimation which can be integrated with grid connected PV plants and conventional power generation stations. The current and typical solution of smoothing renewable power generation fluctuations in power system. A BES based SOLAR power systems had a suitable control

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Refereed Journal |
|| Volume 12, Issue 2, April 2024 ||
International Conference on Recent Development in Engineering and Technology – ICRDET 24
Organized by
Dhaanish Ahmed Institute of Technology, KG Chavadi, Coimbatore, Tamilnadu, India

strategy that can effectively utilize the maximum power (MPPT) output from the DC to DC converter. As like split battery the output Inverter also classified in to TWO ratings that is called as load response inverter.

II. RELATED WORK

M.A.M. Ramli, H.R.E.H. Bouchekara, A.S. Alghamdi, "Optimal sizing of PV/wind/diesel hybrid microgrid system using multi-objective selfadaptive differential evolution algorithm," Renew. Energy, which is to optimize the size of hybrid microgrid system (HMS) components, including storage, to determine system cost and reliability. Wang et al. published "Optimal Energy Management in Microgrids Considering Security Constraints":A methodology for effective energy management in microgrids that takes security restrictions into account is presented in this research. In order to maintain dependable functioning in the face of potential cyberattacks or errors, it addresses how to include security needs into the optimization process.[1] Thimmapuram et al.'s "Security-Constrained Energy Management for Microgrids with High Renewable Penetration" :For microgrids with a high penetration of renewable energy sources, the authors suggest an energy management technique that is bound by security. They optimize energy dispatch while maintaining system reliability, addressing security problems related to cyber-physical threats and uncertainty in renewable generation. " Dehghani et al.'s article , "Energy Management in Microgrids with Cybersecurity Constraints: A Stackelberg Game Approach,"A Stackelberg game-based method for energy management in microgrids with cybersecurity restrictions is presented in this research. By framing the issue as a leader-follower game between possible attackers and the microgrid operator, it minimizes security risks and optimizes energy scheduling.

III. PROPOSED SYSTEM

A. ***Overview***:

The proposed model is designed with the help of Solar and are connected with dc-to-dc converter to maintain the output voltage as constant. For dc-to-dc converter PWM is obtained from AI controller, the PWM is given to converter by the help of gate drivers. Batteries are monitored and controlled by Micro controller. Dc storage is utilized As a Ac output by the support of Inverter During low power load condition inverter 1 only in on condition when the load value increase the current sensor finds the value and its activate the secondary inverter.

Block diagram:

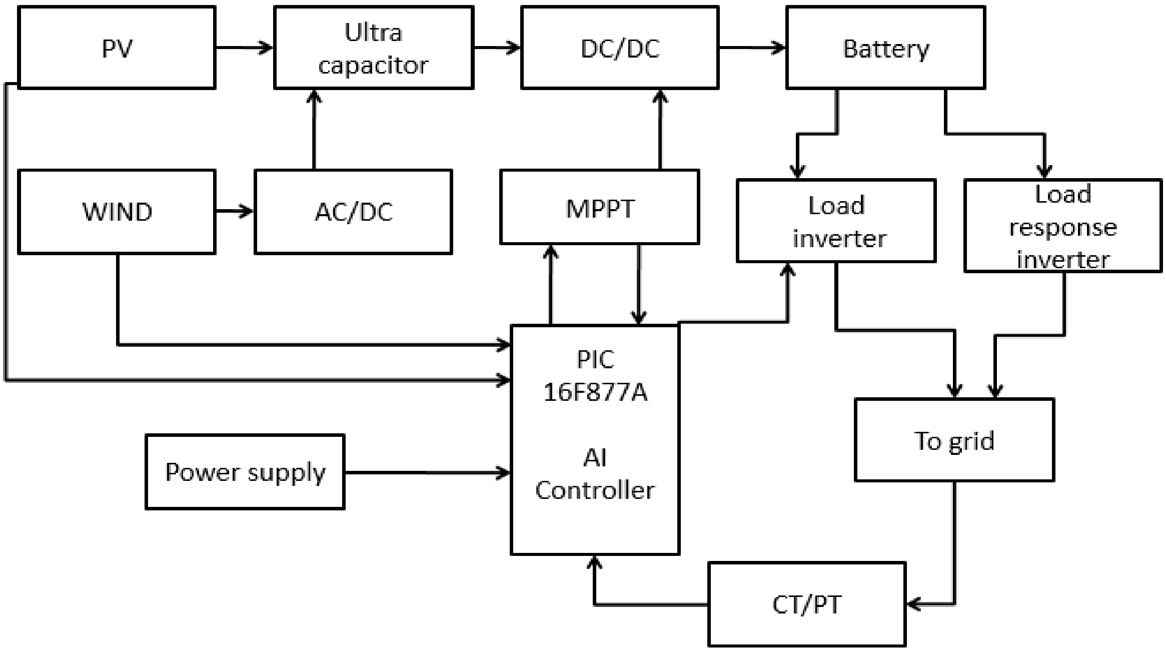


Fig. 1. Block diagram

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 2, April 2024 ||

International Conference on Recent Development in Engineering and Technology – ICRDET 24

Organized by

Dhaanish Ahmed Institute of Technology, KG Chavadi, Coimbatore, Tamilnadu, India

The above block diagram fig.1. shows the blocks such as windmill, solar panel, MPPT, Load inverter, PIC 16F877A, Grid and power supply. The DC/AC inverter will convert the DC power, supplied by the DC/DC converter, to AC power. Current transformer and potential transformer is also used.

B. **Working principle:**

Solar and are connected with dc to dc converter to maintain the output voltage as constant. For dc to dc converter PWM is obtained from AI controller, the PWM is given to converter by the help of gate drivers. Batteries are monitored and controlled by Micro controller. Dc storage is utilized as a AC output by the support of Inverter. During low power load condition inverter 1 only in on condition when the load value increase the current sensor finds the value and its activate the secondary inverter. MPPT checks output of PV module, compares it to battery voltage then fixes what is the best power that PV module can produce to charge the battery and converts it to the best voltage to get maximum current into battery. It can also supply power to a DC load, which is connected directly to the battery.

IV. RESULTS

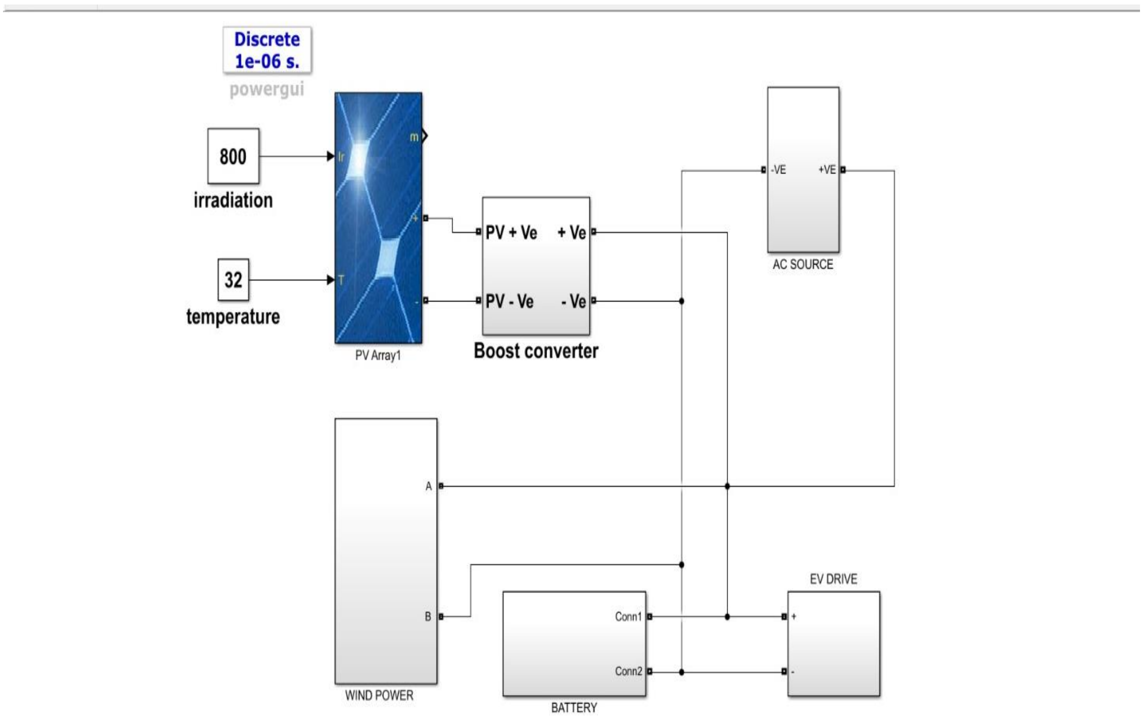


Fig. 2. Software implementation

The software implementation is shown in Fig. 2. The software for this project is simulated using Simulink which is a model based design that supports system level design in the matlab platform. This is then verified successfully. It shows the four portcharging which includes EV drive, battery, wind power, Ac source, boost converter.

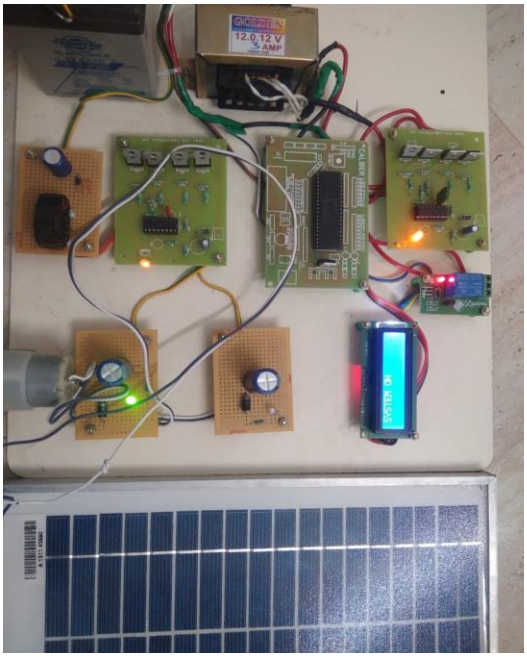


Fig. 3. Hardware implementation

The hardware implementation is shown in the fig. 3.which consist of renewable resources such as solar panel , wind power as input connected to transformer and capacitor with MPPT system and displayed in the LED and bulb as output in the above system.

Fig. 4. Output in LED display

Fig. 4. shows the output as 'system on' in the LED which is to convey that the system obtain constant power from the renewable resources without any error in the connection.

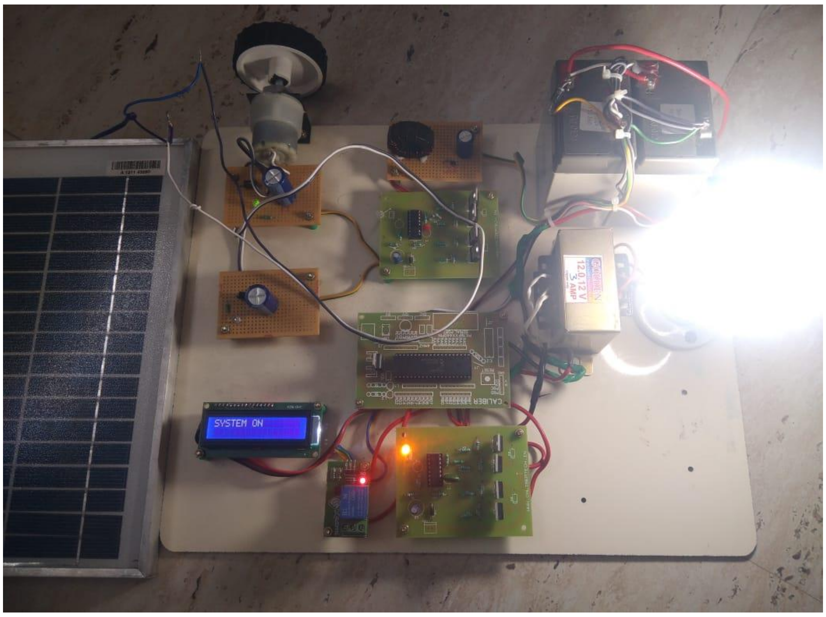


Fig. 5. Output displayed in bulb and LED

Fig. 5. shows the circuit connection and their output in the form of LED and bulb. The LED shows the output that the energy is obtained without any error and the bulb output shows no error in the security of grid.

V. CONCLUSION AND FUTURE WORK

The wind and PV power generation is their unstable power output, which can impact negatively on utility and micro grid operations. The power control strategies for large scale renewable hybrid power systems taking into account the optimum capacity of SES and battery aging will be discussed. Proposed system is going to demonstrates that the control strategy can manage Segmented Energy Storage power and load response inverter control within a specified target region. The future works are aimed at implementing our accurate model in an embedded system using a Raspberry PI prototype.

REFERENCES

1. M.A.M. Ramli, H.R.E.H. Bouchekara, A.S. Alghamdi, "Optimal sizing of PV/wind/diesel hybrid microgrid system using multi-objective selfadaptive differential evolution algorithm," Renew. Energy, Vol. 121, pp. 400–411, 2018, doi:10.1016/j.renene.2018.01.058.
2. Global Energy Review 2020 – Analysis - IEA. https://www.iea.org/reports/global-energy-review-2020.
3. M. H. Saeed, W. Fangzong, B. A. Kalwar and S. Iqbal, "A Review on Microgrids' Challenges & Perspectives," in IEEE Access, vol. 9, pp. 166502-166517, 2021, doi: 10.1109/ACCESS.2021.3135083.
4. Layadi, T., Champenois, G., Mostefai, M.: 'Modeling and Design Optimization of an Autonomous Multisource System under a Permanent Power-Supply Constraint', IEEE Trans Sustain Energy, 2015, 6, (3), pp. 872–880.
5. S. Mu, J. Yin, J. Yuan and S. H. Ng, "Design of experiments for simulation models with stochastic constraints," 2009 IEEE International Conference on Industrial Engineering and Engineering Management, Hong Kong, China, 2009, pp. 2094-2098, doi: 10.1109/IEEM.2009.53731
6. Xi Fang, Satyajayant Misra, Guoliang Xue, Dejun Yang, ―The New and Improved Power Grid: A Survey‖, IEEE Communications Surveys & Tutorials, Vol. 14, No. 4, pp. 944-980, 2012.

7. Wided Medjroubia, Ulf Philipp Müllerb, Malte Scharfb, Carsten Matkea, David Kleinhansa, ―Open Data in Power Grid Modelling: New Approaches Towards Transparent Grid Models‖, Elseiver Energy Reports, Vol.3, pp. 14-21, November 2017.
8. Hany E. Farag ,E.F. El-Saadany,Ramadan El Shatshat,Aboelsood Zidan, ―A generalized power flow analysis for distributed systems with high penetration of distributed generation‖, Elseiver, Electric Power Systems Research, Volume 81, Issue 7, pp.1499-1506, July 2011.
9. Abbas Azarpour, Suardi Suhaimi, Gholamreza Zahed, Alireza Bahadori, ―A Review on the Drawbacks of Renewable Energy as a Promising Energy Source of the Future‖, IEEE power & energy magazine, Vol. 38, Issue 2, pp 317–328, February 2013.
10. Rakibuzzaman Shah, N. Mithulananthan, R.C. Bansal, V.K. Ramachandaramurthy, ―A review of key power system stability challenges for large-scale PV integration‖, ELSEVIER, Renewable and Sustainable Energy Reviews, vol. 41, issue C, pp. 1423-1436, 2015.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE
SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING