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# PV Fed Dc Micro Grid System for Integration of PMSM

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***ABSTRACT:***
*The aim of this design is to create a DC micro-grid system to integrate a Permanent Magnet Synchronous Motor (PMSM) and renewable energy sources. This micro-grid system is designed to provide reliable and efficient energy to the while reducing the environmental impact and cost of operation. The micro-grid system will combine a PMSM, renewable energy sources, power converters, and a control unit to ensure the system's reliability and safe operation. The control unit will ensure that the system is able to manage the power flow between the PMSM, renewable energy sources, and other loads connected to the micro-grid. Additionally, the control unit will be designed to prioritize the energy needs of the PMSM, ensuring that it is able to operate without interruption.*

***Key Words:*** *Permanent Magnet Synchronous Motors, Photovoltaic, IoT, DC-DC converter.*

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## I. INTRODUCTION

The world's energy demand is continuously increasing, and non-renewable energy sources are unable to keep up. Renewable energy sources like solar and wind energy can address this issue. Recently, the integration of Permanent Magnet Synchronous Motors (PMSM) in a DC-microgrid system powered by Photovoltaic (PV) sources has gained significant attention due to its reliability, efficiency, and eco-friendliness.

A PV FED DC-microgrid system is a renewable energy-based power system that utilizes solar energy to generate electrical power. This type of system consists of photovoltaic (PV) panels, which are used to convert solar energy into electrical energy, and a direct current (DC) microgrid system that is used to distribute the generated electrical power.

One of the most common applications of a PV FED DC-microgrid system is in the integration of permanent magnet synchronous motors (PMSM), which are widely used in various industrial applications. The PMSM is a type of electric motor that uses permanent magnets to create the magnetic field required for operation.

The integration of PMSM with a PV FED DC-microgrid system offers several advantages, including improved energy efficiency, reduced carbon emissions, and increased reliability. The integration allows for better utilization of the generated solar power, and the PMSM can be used to store excess energy in the form of kinetic energy, which can be used later when the demand for power increases.

Overall, the integration of PMSM with a PV FED DC-microgrid system is a promising technology that has the potential to revolutionize the way we generate and distribute electrical power, making it more sustainable and environmentally friendly.

## II. WORKFLOW OF THE PROPOSED APPROACH

This system comprises PV arrays, a DC-DC converter, a DC bus, a battery bank, a PMSM, a power electronics converter, and an Internet of Things (IoT) system as shown in Fig.1.

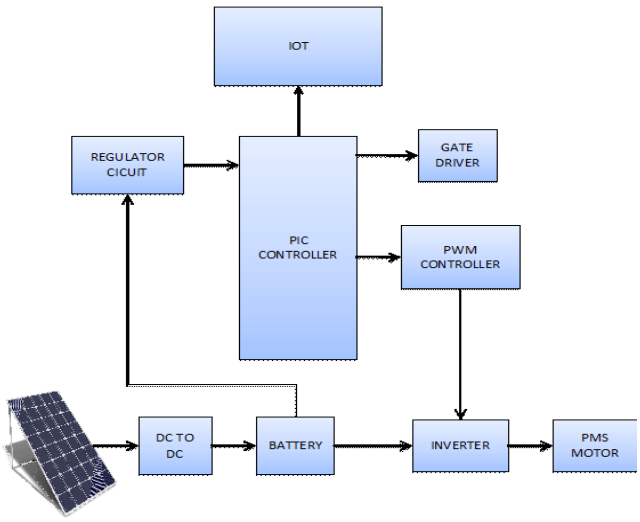


**Fig.1.Block diagram**

The proposed system can efficiently regulate the power flow between the PV arrays, battery bank, and load and control the PMSM speed through the power electronics converter [1]. The DC/DC converter controls the renewable energy source's power flow to the DC bus, and the DC/AC converter converts the DC power to AC power. An energy storage system stores excess energy and releases it when required. The DC bus ensures efficient power delivery to the PMSM and other micro-grid components[2]. The IoT system enables real-time monitoring of the system. Finally, the control system regulates the power flow between the components and the DC bus. This proposed system is a reliable and efficient alternative to traditional power systems for off-grid applications, as it integrates PMSM in a DC-microgrid system powered by PV sources[3].

## III.HARDWARE DESCRIPTION:

The design of a DC micro-grid system for the integration of a PMSM and renewable energy sources is shown in Fig.2.There are a variety of possibilities that can be explored to improve the efficiency of the system, such as:

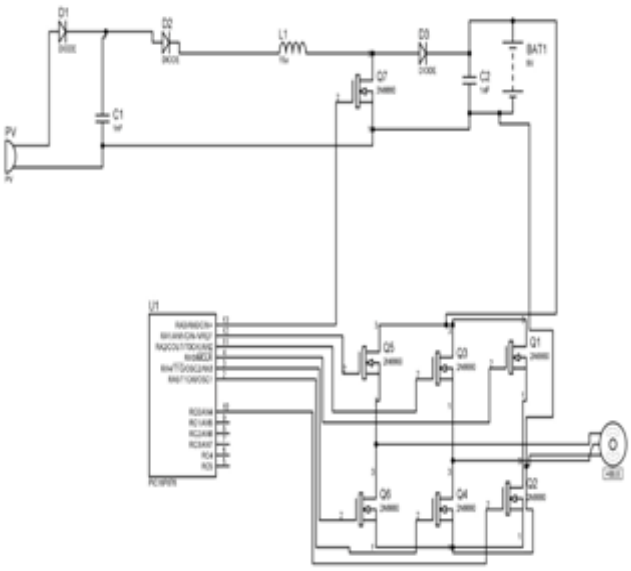

**Fig.2.Circuit Diagram**

1.High-efficiency inverters: The use of high-efficiency inverters can help reduce losses and improve the overall power quality of the system.
2.Load forecasting: With the help of advanced algorithms and data analytics, load forecasting can be used to predict future energy needs and optimize the operation of the micro-grid.

3.Smart grid control strategies: By incorporating different control strategies, such as demand response, the micro-grid can be made more efficient and reliable.
4.Battery storage: Battery storage can be used to store excess energy generated by the renewable sources and provide it to the when needed. This can help to reduce the cost of energy and improve the efficiency of the system.

5.Integration of other renewable sources: Other renewable sources such as wind turbines and solar panels can be integrated into the system to increase the energy generation and reduce the reliance on the grid.
6.Power quality monitoring: With the help of advanced monitoring systems, the power quality of the micro-grid can be monitored in real-time and any disturbances can be promptly addressed.
By exploring and implementing these technologies, the efficiency and reliability of the DC micro-grid system can be significantly improved, making it a viable option for the integration of PMSM and renewable energy sources.

**Fig.3.Hardware Implementation**

**ADVANTAGES:**
1.Reduced energy cost: The integration of a DC micro-grid system reduces the energy cost associated with the usage of PMSM and renewable energy sources, as the energy generated by the renewable sources is fed into the DC micro-grid and can be used directly without any additional transformation.
2.Increased efficiency: The DC micro-grid system ensures an efficient conversion of energy from the renewable sources to the PMSM, as the system is designed to reduce the losses caused by the conversion of energy from AC to DC and vice versa.
4.Enhanced safety: The DC micro-grid system improves safety, as it is designed to be protected against power fluctuations and surges.
5.Reduced maintenance costs: The DC micro-grid system reduces the maintenance costs associated with the PMSM s and renewable energy sources, as it eliminates the need for frequent maintenance and repairs.
6.Reduced carbon footprint: The DC micro-grid system reduces the carbon footprint of the PMSM s and renewable energy sources, as the energy generated from renewable sources is used more efficiently and thus reduces the amount of emissions.

Design of the micro-grid system as shown in Fig.3.: The design of the micro-grid system should take into account the specific requirements of the PMSM and the renewable energy source. The micro-grid should be designed to ensure that the PMSM has sufficient power to operate while still integrating the renewable energy source. This could include the use of advanced inverter technologies, such as multi-level inverters, or the use of battery storage systems.A control system should be designed to ensure that the micro-grid system is able to effectively regulate the power output of the PMSM and the renewable energy source. This could include the use of advanced control algorithms, such as droop control, or the use of energy management systems.

## IV.RESULTS AND DISCUSSION

The DC micro-grid system ensures a reliable and consistent supply of energy to the PMSM, as the system is designed to be robust and fault tolerant. To ensure that the micro-grid system is operating at maximum efficiency, the system should be designed to optimize power utilization. This could include the use of advanced optimization algorithms, such as particle swarm optimization, or the use of optimization techniques.

Graph for solar pv
The battery consumes 0.0 voltages from solar and maximum voltage of 12.36 volts from solar panel. This graph was plotted between voltage in y axis and date and time in x axis


Graph for batter:

The battery drains minimum voltage of 12.16 volts and on when the load increases the battery drains 12.35 volts from it.

The graph was plot between amount of voltage drain in battery when the load is connected and to the date at which the occurrence is happened.


The micro-grid system should be designed to limit the risk of power disruptions and system failures. This could include the use of advanced protection systems, such as over-current protection, or the use of surge protection systems.

The micro-grid system should be designed to ensure that the power quality of the PMSM and the renewable energy source remains within acceptable levels. This could include the use of advanced power conditioning systems, such as active filters, or the use of power factor correction systems.

In addition, a detailed report will be given to the user containing all necessary information as illustrated in table 1.

| created_at | entry_id | field1 | field2 |
|---|---|---|---|
| 2023-04-02T09:19:18+00:00 | 1 | 0 | 12.33 |
| 2023-04-02T09:19:34+00:00 | 2 | 0 | 12.33 |
| 2023-04-02T09:19:50+00:00 | 3 | 0 | 12.29 |
| 2023-04-02T09:20:06+00:00 | 4 | 3.46 | 12.35 |
| 2023-04-02T09:20:22+00:00 | 5 | 12.36 | 12.29 |
| 2023-04-02T09:20:38+00:00 | 6 | 1.93 | 12.29 |
| 2023-04-02T09:20:55+00:00 | 7 | 1.49 | 12.29 |
| 2023-04-02T09:21:11+00:00 | 8 | 1.49 | 12.29 |
| 2023-04-02T09:21:27+00:00 | 9 | 1.49 | 12.29 |
| 2023-04-02T09:21:42+00:00 | 10 | 1.49 | 12.29 |
| 2023-04-02T09:21:58+00:00 | 11 | 1.49 | 12.29 |
| 2023-04-02T09:22:14+00:00 | 12 | 0.02 | 12.33 |
| 2023-04-02T09:22:30+00:00 | 13 | 0.02 | 12.33 |
| 2023-04-02T09:22:46+00:00 | 14 | 0.02 | 12.33 |

| | | | |
|---|---|---|---|
| 2023-04-02T09:23:02+00:00 | 15 | 0.02 | 12.33 |
| 2023-04-02T09:23:18+00:00 | 16 | 0.02 | 12.33 |
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| 2023-04-02T09:24:06+00:00 | 19 | 0.02 | 12.33 |
| 2023-04-02T09:24:22+00:00 | 20 | 0.02 | 12.33 |
| 2023-04-02T09:24:38+00:00 | 21 | 0.02 | 12.33 |
| 2023-04-02T09:24:54+00:00 | 22 | 0.02 | 12.33 |
| 2023-04-02T09:25:10+00:00 | 23 | 0.02 | 12.33 |
| 2023-04-02T09:25:26+00:00 | 24 | 0.02 | 12.33 |
| 2023-04-02T09:25:42+00:00 | 25 | 0.02 | 12.33 |
| 2023-04-02T09:25:58+00:00 | 26 | 0.02 | 12.33 |
| 2023-04-02T09:26:14+00:00 | 27 | 3.57 | 12.33 |
| 2023-04-02T09:26:30+00:00 | 28 | 5.55 | 12.27 |
| 2023-04-02T09:26:46+00:00 | 29 | 4.16 | 12.31 |
| 2023-04-02T09:27:02+00:00 | 30 | 4.16 | 12.31 |
| 2023-04-02T09:27:18+00:00 | 31 | 4.16 | 12.31 |
| 2023-04-02T09:27:34+00:00 | 32 | 4.16 | 12.31 |
| 2023-04-02T09:27:50+00:00 | 33 | 4.16 | 12.31 |
| 2023-04-02T09:28:06+00:00 | 34 | 4.16 | 12.31 |
| 2023-04-02T09:28:22+00:00 | 35 | 4.16 | 12.31 |
| 2023-04-02T09:28:38+00:00 | 36 | 4.16 | 12.31 |
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| 2023-04-02T09:30:31+00:00 | 38 | 3.15 | 12.31 |
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| 2023-04-02T09:31:02+00:00 | 40 | 3.19 | 12.27 |
| 2023-04-02T09:31:17+00:00 | 41 | 3.12 | 12.27 |
| 2023-04-02T09:31:33+00:00 | 42 | 3.1 | 12.25 |
| 2023-04-02T09:31:48+00:00 | 43 | 2.94 | 12.27 |
| 2023-04-02T09:32:04+00:00 | 44 | 3.02 | 12.27 |
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| 2023-04-17T14:16:47+00:00 | 48 | 0 | 12.19 |
| 2023-04-17T14:17:04+00:00 | 49 | 0 | 12.16 |
| 2023-04-17T14:17:21+00:00 | 50 | 0 | 12.19 |

**Table.1. Detailed Report**

## V.CONCLUSION

This paper has presented a new vision for the motor operation, which is the PMSM with dc micro grid system used for all purposes. A full and detailed description was made for every part of this system. This paper has also offered a user Internet of thing based data of the knowledge. In addition, the wireless monitoring method has been introduced and developed. As soon as the driver runs the motor, this system will begin saving the events of the corresponding voltages. With the dc micro grid we can efficiently manage and improve the efficiency of the system. The data saved can be retrieved at any time it needed and calculate it accordingly. Using serial transmission, a PIC program will read the voltage current from the measuring unit and display it to the user in Graphical format and also in word format.

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