Microgrids Connected to the Residential grid for Energy Management Utility Fuzzy Logic Controller Employed Hybrid Electric Vehicles

S. Prakash, K. Sakthivel, Anitha. S

Abstract*: — *In our research design presents the model of managing the energy for residential purpose and for hybrid vehicle simultaneously. This system integrated with reusable energy storage system such as PV panel and battery. Our energy management system approaches the goal to satisfy power needed and to minimize the fluctuation in power microgrid. We designed the model with the fuzzy logic controller in order to optimize the microgrid power constantly. The energy sources retrieved and given to hybrid electric vehicle and residential purpose. Now a day's most of the vehicles are hybrid mostly runs on either in fuel or by electric energy else by both energy sources. In order to achieve the maximum power throughput, we proposed the bidirectional converter is connected with PV panel and microgrid. The designed fuzzy logic controller to manage the lifetime of battery and to provide the constant discharge. The entire vehicle setup module is connected to microgrid.

Keywords: microgrid, fuzzy logic controller

I. INTRODUCTION

RENEWABLE ENERGY source such as Photovoltaic cell or solar PV used for electric energy generation. In modern vehicle the battery plays important role in hybrid power system applications. Hybrid Electric Vehicle must have driving parameters such as acceleration with braking system running with constant velocity also which needs the additional applications such as the efficient bidirectional converter to manage the battery level to charge and discharge hence the performance and efficiency is increases. Solar PV integrated with the power transmission microgrid simultaneously used for the purpose of residential and for hybrid vehicle. Here the external storage batteries are connected with the vehicle in order to provide constant power to loads. The compensating power driven from the microgrid given to the connected load is constantly managed. The content explains about the two key building blocks such that photovoltaic and microgrid system. The power driven from the solar i.e., PV module is maximum from the solar energy also the alternative supply from the microgrid system. The external battery storage source is connected with the solar PV module in such a way the its connected to the hybrid vehicle. Maximum power can be drawn by the method of Maximum Power Point Tracking system and neural Network Multi model. In modern hybrid vehicles uses multi energy driven system either by fuel or by electrical power or both the energy. These integrated system needs constant velocity, efficient braking system and energy management based on the battery storage capacity. In order to provide the efficient power driven the system is controlled with fuzzy logic control system in microgrid connected module. The major aim of introducing the fuzzy logic control scheme in order to reduce or minimize the fluctuations and to reduce the complexity also it produces the sum of net average power from the both the sources. Additionally for the efficient voltage in order to maintain constant velocity the system is coupled with the bidirectional converter to DC output link and hence the output driven voltage is constant[1],[3],[5]

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II. METHODOLOGY

The new systematic design with the aim of improving the efficiency and performance designs as well as simplifying the Fuzzy Logic Controller complexity (i.e. to reduce the controller inputs number and its rule-base), this work presents a new Fuzzy logic-based Energy Management System of only two-inputs, one-output and with the 25-rules. As it will be seen, the key factor of the new design is to consider the MG Energy Rate-of-Change (ERoC) as an input in order to anticipate the system behavior. The design methodology will follow the procedure and the optimization process developed (i.e. off-line controller parameter setting process). A comparison of SMA strategy, Fuzzy EMS-NPT, and Fuzzy EMS-ERoC approaches will be presented at simulation level, whereas the features of this last one will be tested on a real residential MG. [8],[10] ,[12]

III. SYSTEM MODELLING

In our research our model consist of major module such that in this implementation method consist of

(a) Fuzzy Logic Controller
(b) Bidirectional converters

Fuzzy Logic Controllers:

In our implementation method Fuzzy logic method plays important role this context explains about the major role of this logic implementation here in order to minimize the peak power fluctuation in the grid and interfaced devices. Also to reduces the system complexity and to suggest the average value i.e., the sum of the average value of grid power. The basic application of the fuzzy logic in power system is to provide the necessary process control also for the identification in order to diagnosis the problem and to estimation of the required power energy sources. This system is quite implemented with the numeric input and output mapping with the artificial neural network. This system also provide necessary user interface for the specific functionality. Fuzzy logic

system provides a vast application over power system design and drives design in order to give the optimum response and hence the entire system which is efficient in order to enhance the performance of the electrical generator speed such that wind turbine system which provides the maximum power output. The major advantages of our system provided with the fuzzy logic solution it provides necessary possible solution systematically when the operation of the system based on systematic rules. [2],[4],[6]

IV. MAXIMUM POWER POINT TRACKING ALGORITHM

In this research model we approach and implemented the power tracking algorithm called MPPT algorithm is Maximum Power Tracking Algorithm which is suitable for the PV solar module and the bidirectional DC converter in order to track or drive maximum power from the PV module also from the connected grid to manage the power supply to the connected load source such as the Hybrid electric vehicle and the residential load. The proposed MPPT algorithm is successfully designed and implemented in our research design module. In our research concerns about case study in MPPT algorithm.

The classification of MPPT algorithm:

(a) On-Line Methods

(b) Off-Line Methods

These are the major classifications in this algorithm used for driving maximum power sources.

A. *FUZZY LOGIC CONTROLLER MODULE:*

The following module described about the Fuzzy Logic Control scheme.

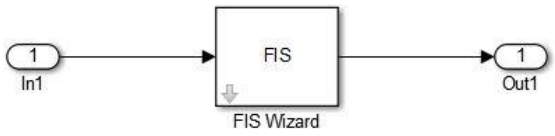


Figure1:Fuzzylogic controller

The above circuit diagram shows the design of fuzzy logic controlled has been designed using the MATLAB. Thus the functional units of input and the output were successfully verified. [7],[9] ,[11]

Bidirectional Converters:

As for as our new research concern with the typical module called bidirectional converters. Several topologies have been referred by the case studies also with theoretically with extensive references these converters plays systematic role in power systems. This method is applied in the electric grid and hybrid vehicle system. [13], [15] ,[17]

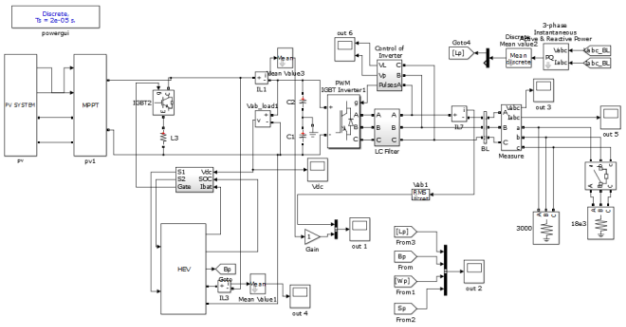
There are two major classifications witch divided into

i) ON board Bidirectional Converters.

ii) OFF board Bidirectional Converters.

These consist of larger power rating with defined structure of specific size typically in such a way that it's designed for the purpose of rapid charging and discharging purpose. As mentioned above two major classifications in most of the applications OFF board bidirectional converters are used for rating and to increase the efficiency.

b. PROPOSED SYSTEM DESIGN:



Our proposed implementation design described here we designed the module with the photovoltaic cell and the gird with any electrical source as the main input sources. They are arranged in such a way that connected in series with the battery unit for the efficient power sources. Here we introduce the bidirectional converter unit connected with the battery module in order to provide the compensated power supply. The entire system provides the sufficient power supply to multiple energy sources [14],[16], [18]

This system is enhanced with the maximum power point tracking algorithm in order to track or receive the maximum gain to the connected load. The power can deliver to the residential load and the Hybrid vehicle simultaneously. There by the system is capable for maintaining the constant power sources. In order to provide the power supply with minimum and neglected fluctuation in grids the Fuzzy logic controller has been implemented in our proposed

c. PV MODULE DESIGN

The design structure shows the module design of the PV module.

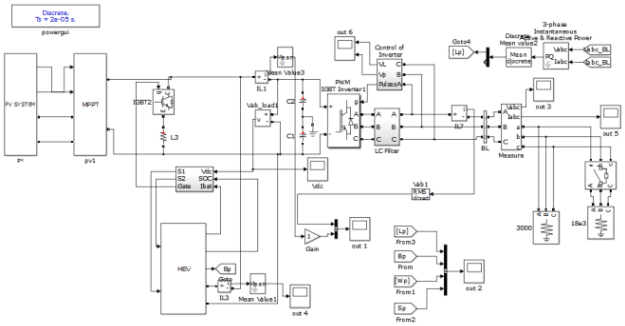


Figure 3: Proposed System design

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D. PV MODULE DESIGN:

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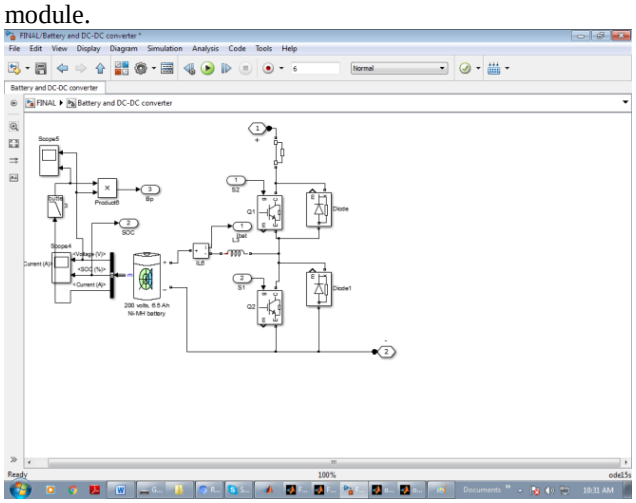

The above design methodology clearly describing about the design and implementation of PV module. As for as for our design purpose we have used the designing tool called MATLAB-Simulink tool, in our proposed method PV module plays important role in power generation scheme in order to provide reliable and constants in stability on energy sources. While designing the PV module the factors must be consider that it must be capable to provide the maximum energy source with relevant output load the simulation is carried out with the modular design

E. VEHICLE BATTERY CHARGING CIRCUIT

The below design module shows the vehicle battery charging circuit

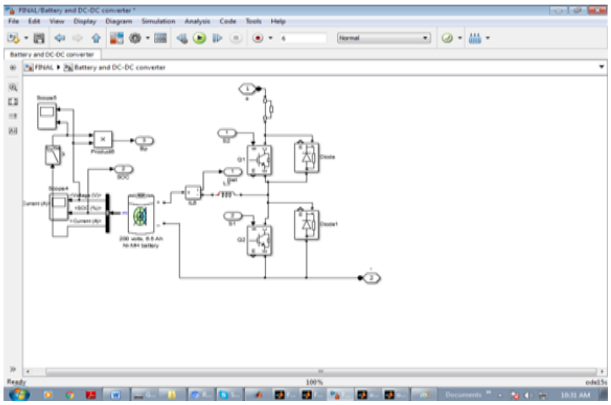

Figure 5.: Vehicle battery charging circuit

The above circuit diagram shows the module of the vehicle battery charging unit, on considering the charging system such as the battery the parameters must be consider must satisfy the high charging capacity in order to meet the necessary requirement to manage the power consumed by the connected load. Also it must have good charging and discharging capabilities with reduced short circuit.

V. RESULT & DISCUSSION:

OUTPUT VOLTAGE:

The below design shows the Output voltage

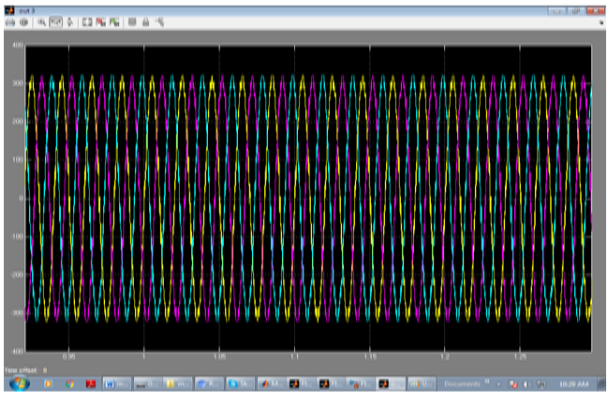

Figure (5): Output Voltage

OUTPUT CURRENT

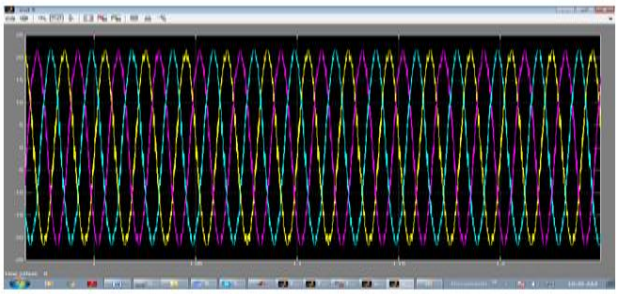

Figure (6): Output Current

INVERTER VOLTAGE:

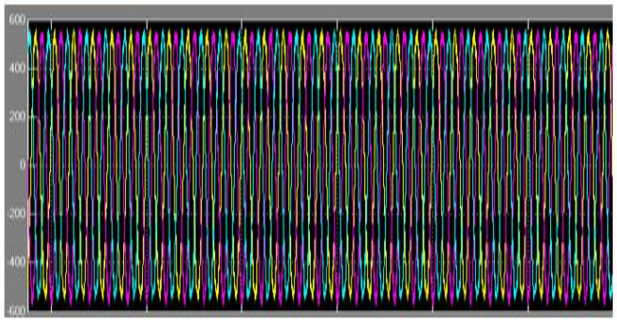

Figure (7): Inverter Voltage

DC LINK VOLTAGE

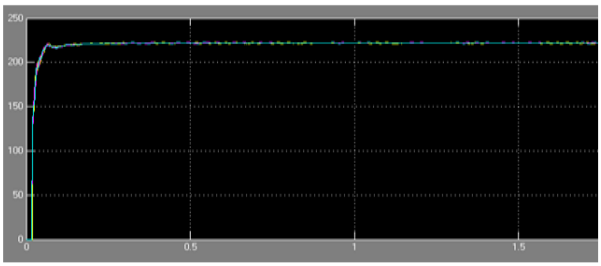

Figure (8): DC Link voltage

The above all graphical representation shows the simulation output for our research which has been designed and simulated by the simulating tools called MATLAB – Simulink.

VI. CONCLUSION

This simulated research has presented the new design of the power transmission micro grid connected multiple load such that residential load and the hybrid electric vehicle connected parallel in order to it. Our energy utility system integrated with Photovoltaic module and applied algorithm for driving maximum power usingMaximum Power Point Tracking algorithm. Hence the system is more efficient in our first phase research. Here we proposed the fuzzy logic based maximum power point tracking for the micro grid applications connected with the multiple loads allows bidirectional. Our system provides high efficient output rather than the existing methodologyon comparing with the other approaches with same goal we analyzed the simulation using real time data has been studied for the future improvements. However the former concept with drawbacks is consequently reduced in our design research. Furthermoreresearch in future our system can utilize for the Hybrid power generation and management process with renewable sources, Hence demand in electrical energy is probably reduces also abandoned utilization of electrical energy can be compensated. Thus our system can able to maintain and give the constant output stability more than sufficient level.

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