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Design and Development of Hybrid Charging Topology

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Abstract*: Implementation of this system is to ensure continuous output current to load utilizing both Photovoltaic (PV) energy and AC Grid. Utility interfacing PWM converter designed here to operate by both solar energy and storage batteries that highly satisfies the necessity in rural areas where National Grids are hardly available and power cut problem reduces the effectiveness of system. Solar energy gets priority here to charge storage battery rather than AC source that may save hundreds of megawatts power every day. To extend the battery lifetime and keep system components hazard-free, it includes exact battery-level sensing, charging-current controlling by microcontroller unit (MCU) charge to congregate maximum PV energy from AC Solar Modules. Investigation on improvement of power- interfacing control and optimization of overall system operation assent to intend usage recommendation in this exposition*

Keywords: Renewable Energy, Hybrid charging topology, Solar Panel, Battery

I. INTRODUCTION

Most of the recent commercial MPS system is the composition of PWM (Pulse Width Modulation) type converter, storage battery & converter-cum-charger transformer regardless of the concern for overload, overcharging or low battery cut problems. Exact voltage level sensing and battery-charge controlling are also unavailable. These phenomena result in degradation of battery lifetime and in the same time huge wastage of power and extends electricity bill. So, intelligent modification is needed in the existing MPS system. The proposed system utilizes a MCU (microcontroller unit) to successfully overcome these tribulations. Moreover, due to limited sunshine hours and non-ideal conditions, it is not only desired to accumulate maximum PV energy from panels but also to ensure maximum utilization. The designed system has been rigorously tested in extremely harsh environments to ensure reliable, trouble-free operation regardless of any change in climate. Hence, new research directions are explored for the utilization of solar energy, electrical engineering development and power electronics technology**.**hours.

II. LITERATURE SURVEY

For our project we are surveying some reports and references which are helping us to make it easy and simplest and they are as follows

S. Jain, and V. Agarwal, "An Integrated Hybrid Power Supply for Distributed Generation Applications Fed by Nonconventional Energy Sources," in these chapter a review of the literature is suggested about the modern techniques use in a hybrid power generation, its control and monitoring. Also introduce to the equipment's for controlling the hybrid power generation [1].

A. O. Ciuca, I. B. Istrate, and M. Scripcariu, "Hybrid Power-Application for Tourism in Isolated Areas," in these chapter a review of the literature is suggested about the regulatory changes has brought increasing opportunities for distributed power generation at small scale for meeting the requirements of a single house, a community, a commercial activity in an efficient way close to the point of demand than main grid connected to a large centralized power plant [2].

Non-conventional energy sources by smt. C. K. Rai, in these chapter a review of the literature is taken about how the actual hybrid power plant is being constructed in large scale, as it is very easy to set up a hybrid power plant [3].

Ahmed et al., "Power Fluctuations Suppression Of Stand-Alone Hybrid Generation Combining Solar Photovoltaic/Wind Turbine And Fuel Cell Systems, Energy Conversion," in these chapter a review of the literature is taken about a hybrid system model that included fuel cell generation along with wind and solar power. The fuel cell system was used as a backup resource, where as the main energy sources were the solar and wind systems. Results demonstrate that the system is reliable and can supply high-quality power to the load, even in the absence of wind and sun [4].

Deshmukh and Deshmukh, "Modeling of hybrid Renewable Energy Systems", Renewable and Sustainable Energy Reviews, in this chapter a review of the literature is discussed about methods of modeling and designing hybrid renewable energy systems, and also issues involved in increasing the penetration of such systems [5].

Yang et al., "Weather data And probability analysis Of hybrid photovoltaic-wind power generation systems" in these chapter a review of the literature is taken about the development of a hybrid wind/solar system which are used to calculate optimized combinations of PV module, wind turbine design of a hybrid power generation system, with the objective of maximizing power, while minimizing cost [6, 7].

Tina et al., "Hybrid solar/wind power system probabilistic modeling for long-term performance assessment", in these chapter a review of the literature is taken about assessed the long-term performance of a hybrid wind/solar power system for both standalone and grid-dependent applications by using a probabilistic approach to model the uncertain nature of the load and resources [8].

III. METHODOLOGY

The proposed system basically consists of three tiers:

a) Input power system,

b) Intelligent processing system and

c) Output power system.

The core part of this system is the intelligent switching circuit which is composed of PIC 18F4520 based MCU unit which ensure uninterrupted output power based on the available input. This pre-programmed section intelligently not only maintains maximum AC output power with greater efficiency but also DCsupply to small DC load that may reduce pressure of AC output. The following sub-sections give the details of entire system.

Input Power and Switching System Input power section allows three different sources of energy like grid line, storages battery and Photovoltaic energy. To minimize the burden on the grid line, the system is designed as follows: when Grid supply is present, switching circuitry gets informed about its availability from AC main sensing section and passes AC main's signal to converter output socket. In absence of AC grid supply, switching circuitry takes DC input from storage battery and turns on converter circuit i.e. composition of oscillator, MOS driver, output amplifier and transformer section and AC lowpass filter. Oscillator section generates 50 Hz MOS driver signal that gets amplified, sent to converter transformer using MOSFET switching and transforms into AC and injects AC energy to the AC-side output connection. Such periodical switching ON/OFF of MOSFET starts an alternating current with 50Hz frequency at primary winding of step-up transformer that results in 220V AC supply at the secondary winding. All these functionalities are done here by implementing PIC 18F25K22 MCU unit that resembles the change-over section of commercial MPS section implementing by analog circuitry.

Intelligent Processing and Battery Charging System-In absence of solar energy, it is mandatory to use AC mains to charge storage battery. But, in daytime, it prefers solar energy to AC grid in battery charging for power saving purposes. To ensure maximum possible PV energy, some intelligence is applied in this proposed system. With a regular charge controller, if the batteries are low at say 12 volts, then a 40 watt solar panel rated at 2.20 amps at 18.20 volts (2.20 amps times 18.20 volts = 40 watts) will only charge at 2.0 amps times 12.4 volts or just 25 watts, losing 35% of panel's capacity. In this case the system compensates for the lower battery voltage by delivering closer to 3 amps into the 12.4 volt battery maintaining the full power of the 40 watt solar panel. The intelligent charging section involves three level of charging like absorption level charging, bulk level charging and float charging. A bulk level charging is maintained for initializing charging process for a discharged battery. When Battery voltage exceeds a critical level, charge controller maintains adsorption level charging. A full charged battery gets only float level charging that maintains trickling current (i.e. one tenth of full charge current) causes available solar energy being unused.

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Output Power system- implementing such configuration described in previous section, maximum utilization of photovoltaic energy is not yet confirmed practically. In semi-urban areas, where load- shedding are not much frequent, almost 80% of available solar energy are being left unused. To utilize such power, this system contains an output pin that supplies additional DC power to small loads likes in mobile charging application, DC fan, DC light, DC iron, electric filters etc.

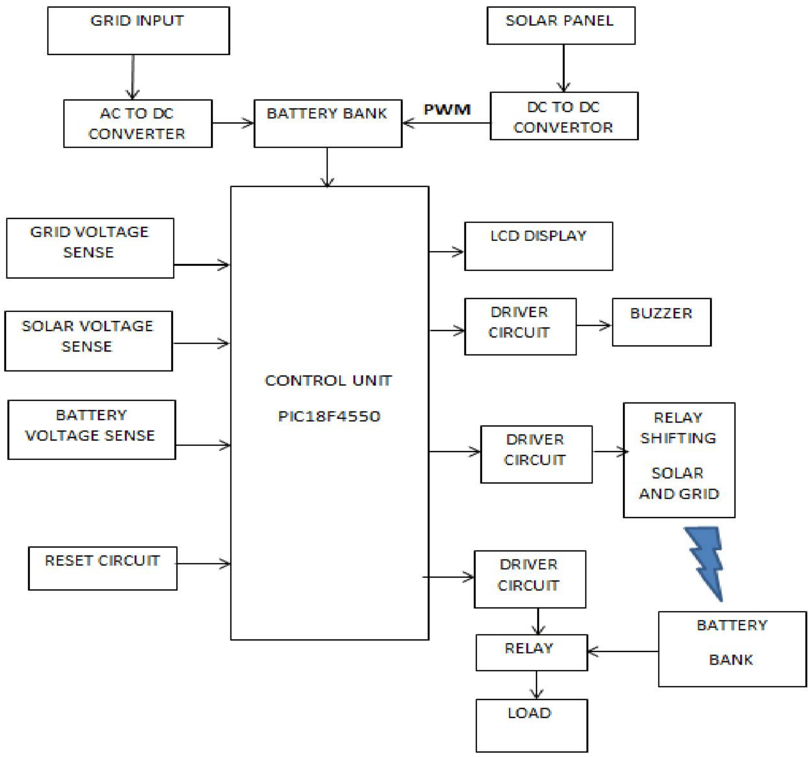

Fig. 1. Block Diagram

PIC18f4520 Microcontroller

The PIC18F4520 is a 28/40/44-Pin, High-Performance, Enhanced Flash, USB Microcontrollers with nanoWatt Technology. The following are the features:-

• High-Current Sink/Source: 25 mA/25 mA
• Three External Interrupts
• Four Timer modules (Timer0 to Timer3)
• Up to 2 Capture/Compare/PWM (CCP) modules:
  - Capture is 16-bit, max. resolution 5.2 ns (TCY/16)
  - Compare is 16-bit, max. resolution 83.3 ns (TCY)
  - PWM output: PWM resolution is 1 to 10-bit
• Enhanced Capture/Compare/PWM (ECCP) module:
  - Multiple output modes
  - Selectable polarity
  - Programmable dead time
  - Auto-shutdown and auto-restart
• Enhanced USART module: LIN bus support

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Fig. 2. PIC 18f4520

LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD

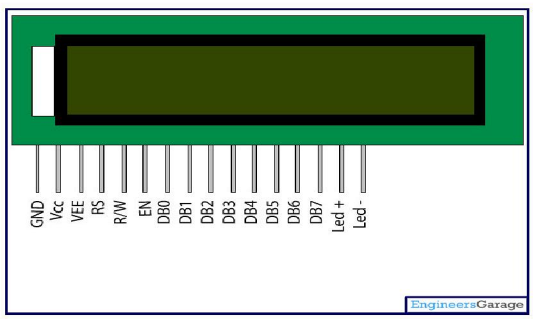

Fig. 3. LCD Display

Solar Panel

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Fig. 4.Solar Panel

Voltage Sensor

A voltage sensor is a device that measures voltage. Voltage sensors can measure the voltage in various ways, from measuring high voltages to detecting low current levels. These devices are essential for many applications, including industrial controls and power systems. A voltage sensor is a device that measures the voltage of an electrical circuit. Voltage sensors are used in many applications, including monitoring and controlling equipment and machinery. Different types of voltage sensors work in various ways; here is an example:

Electromagnetic. This type uses an electromagnetic field to detect changes in voltage. The sensor's exposure to an electric current generates a magnetic field. It induces currents in nearby conductors, such as wires or circuit boards, sensitive enough to detect these changes. This type of sensor is often used with microcontrollers since they can easily measure changes in electromagnetic fields around them with the help of built-in analog-to-digital converters (ADCs).

Fig. 5.Voltage Sensor

IV. CONCLUSION

This project presenting topology of hybrid charging system for sort of electric vehicle, which is generally used to reduce use of non-renewable source of energy, which is fairly significant. This study develops a system that provide a circuit by which we can charge EV's using solar as well as grid power, to mostly reduce pollutants emission from power generation and transportation sector in a suitable way. In future we can also implement a fine adjuster of output DC voltage level to power large possible and even tiny loads. A voltmeter can also integrate for this purpose at the output section to make this as user-friendly as possible.

V. ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on "Design and Development of Hybrid Charging Topology". We would like to take this opportunity to thank our guide, Prof. Kute Y.T., Professor, Department of Electronics and Telecommunication Engineering Department, Amrutnahini Polytechnic, Sangamner, for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful.

REFERENCES

[1] S. Jain, and V. Agarwal, "An Integrated Hybrid Power Supply for Distributed Generation Applications Fed by Nonconventional Energy Sources," IEEE Transactions on Energy Conversion, vol. 23, June 2008.

[2] A. O. Ciuca, I. B. Istrate, and M. Scripcariu, "Hybrid Power-Application for Tourism in Isolated Areas," World Academy of Science, Engineering and Technology 53 2009, pp. 264-269.

[3] Ahmed, N.A., Miyatake, M., and Al-Othman, A.K. "Power Fluctuations Suppression Of Stand-Alone Hybrid Generation Combining Solar Photovoltaic/Wind Turbine And Fuel Cell Systems, Energy Conversion.

[4] Deshmukh, M.K., Deshmukh, S.S. "Modeling Of hybrid Renewable Energy Systems", Renewable and Sustainable Energy Reviews, Vol. 12, No. 1, pp. 235-249

[5] Yang, H.X., Jurnett, B., and Lu, L. "Weather data And probability analysis Of hybrid photovoltaic-wind power generation systems In Hong Kong", Renewable Energy,Vol. 28, No. 11, pp. 1813-24, 2003.

[6] Yang, H.X., Lu, L., and Zhou, W. "A Novel Optimization Sizing Model For Hybrid SolarWind Power Generation System:, Solar Energy, Vol. 81, No. 1, pp. 76-84, 2007.

[7] Mazzeo D, Matera N, (2021) A literature review and statistical analysis of photovoltaic-wind hybrid renewable system research by considering the most relevant 550 articles: An upgradable matrix literature database. J Clean Prod 295. https://doi.org/10.1016/j.jclepro.2021.126070

[8] Wadi M, Shobole A, Tur MR, et al. (2018) Smart hybrid wind-solar street lighting system fuzzy based approach: Case study Istanbul-Turkey. In: Proceedings— 2018 6th International Istanbul Smart Grids and Cities Congress and Fair, ICSG 2018. https://doi.org/10.1109/SGCF.2018.8408945

[9] Ricci R, Vitali D, Montelpare S (2015) An innovative wind- solar hybrid streetlight: Development and early testing of a prototype. Int J Low-Carbon Technol 10: 420– 429. https://doi.org/10.1093/ijlct/ctu016