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Hybrid System tracking and Monitoring by Using IOT Technology for Industrial Automation

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ABSTRACT: In this paper author have focused on tracking and monitoring the hybrid energy system by using IOT technology for industrial automation. It has various combination of energy and all of them are alternative to each other like solar energy, wind energy, bio fuel, fuel cell, etc. But we are choosing the hybrid energy system. In this system of IOT plays an vital role in tracking the sun and find out the current and voltage. The main criteria being switching between the two sources of energy i.e. solar and wind energy. The data is transmitted wireless system and controlling the sources of energy. It is operated in manually and remotely using smart phone or personal computer. This system is very efficient, cheaper and flexible in operation.

KEYWORDS: Hybrid System, Tracking and Monitoring, IOT, Industrial Automation, Controlling.

I. INTRODUCTION

Energy has always been an important factor for socio-economic development of humans. Most of the energy is generated from fossil fuels in the world. Nevertheless, environmental aspects and depleting of fossil fuels causes increase of renewable energy utilization. The produced energy from renewable energy resources are transferred to grid or used in stand-alone systems. As energy generation depends on environmental conditions, efficiency and energy potential of renewable energy systems changes according to region of hybrid (wind and solar) installation. Hybrid systems arise when the continuous and the discrete meet. Combine continuous and discrete inputs, outputs, states, or dynamics, and you have a hybrid system. Particularly, hybrid systems arise from the use of finite-state logic to govern continuous physical processes (as in embedded control systems) or from topological and network constraints interacting with continuous control (as in networked control systems). This chapter provides an introduction to hybrid systems, building them up first from the completely continuous side and then from the completely discrete side. It should be accessible to control theorists and computer scientists alike.

The wind turbine can operate with maximum aerodynamic efficiency, and the power fluctuations can be absorbed as an inertial energy in the blades. In some applications, the wind turbine may be augmented by an additional power source, usually a diesel generator. The systems are called wind–diesel systems and may be used to supply electricity energy to stand-alone loads, e.g., small villages that are not connected to the main utility. Most diesel generation systems operate at a constant speed due to the restriction of constant frequency at the generator terminals. However, diesel engines have high fuel consumption when operating with light load and constant speed.

In order to improve the efficiency and avoid wet stacking, a minimum load of about 30% to 40% is usually recommended by the manufacturers. Variable-speed operation can increase the efficiency, where the fuel consumption can be reduced up to 40%, especially when operating with a light load. Moreover, the life expectancy can increase with a lower thermal signature. To avoid the frequent start/stop of the diesel generator, an energy storage system is often used. Topologies of the power electronic converter for maximum power point tracking (MPPT) and voltage conversion are studied in this project. The maximum power point of photovoltaic (PV) array is variation, so a search algorithm is

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needed according to the current–voltage ($I-V$) and power–voltage ($P-V$) characteristics of the solar cell. The perturbation and observation (P&O) MPPT algorithm is commonly used, due to its ease of implementation. It is based on the observation that if the operating voltage of the PV array is perturbed in a given direction and the power drawn from the PV array increases, which means that the operating point is moving toward the MPPT, so the operating voltage must be further perturbed in the same direction. Otherwise, with the operating point moving away from the MPP, the direction of the operating voltage perturbation must be reversed. By using the P&O method, impedance matching is conducted between a boost converter and PV array in order to realize the MPPT function.

The general requirements of MPPT are: simple, low cost, quick tracking when condition changes and small output power fluctuation. The traditional methods are simple and low cost without good tracking performance, such as hill climbing, P&O, and incremental conductance, etc. Novel methods are developed with higher accuracy but complex process, such as the optimum gradient method, fuzzy logic control, neural networks (NN) & Adaptive Neuro Fuzzy Interfacing system (ANFIS). These techniques could also be costly, difficult to implement, and may not be stable enough. Now a day, the growth of wind and PV power generation systems has exceeded the most optimistic estimation. In this project, a stand-alone hybrid energy system consisting of wind & PV is proposed with the battery for energy storage. Wind and PV are the primary power sources of the system to take full advantages of renewable energy. The dynamic modeling and control of the system was studied. The concept and principle of the hybrid system with its supervisory control were delineated. Classical techniques of maximum power tracking were applied to PV array and the wind-turbine control. The ultimate objective of the project is to generate the maximum power and as an alternate source of power in requirement of demand. Here both the wind power and photovoltaic (PV) power generation techniques and their maximum-power-point tracking (MPPT) methods. A new stand-alone wind–PV hybrid generation system is proposed for application to remote and isolated areas. An Adaptive Neuro Fuzzy Interfacing system (ANFIS) is employed effectively as a controller for hybrid power generation system. The project experimental results confirm that the proposed hybrid generation system can provide maximum power generation, harmonic reduction, better voltage & current control.

II. COMPONENTS EXPLANATION

POWER SUPPLY

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

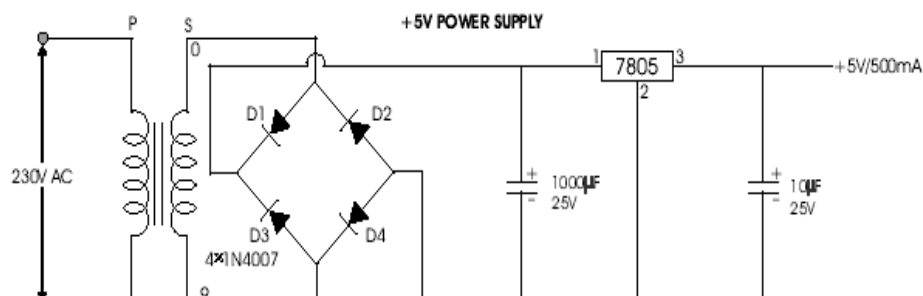


Fig no.1

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SOLAR PANEL

Solar PV cell Photovoltaic cell absorbs light energy (photons) from the Sun and converts it into electricity by the photovoltaic effect. Lots of modules are used to make wafer-based crystalline silicon cells or thin-film cells. The load contained number of modules that can either be the upper layer or the lower layer. It must be shielded from mechanical harm and humidity. Nearly modules are rigorous, but on the basis of thin-film cells, semi- malleable ones are feasible. All cells are connected in series electrically to each other. Apparently, MC4 connector types are used in nearly all photovoltaic modules to expedite simple weatherproof connections to other system. Individual solar module can generate less power; almost all connection consists of multiple modules. A photovoltaic cell usually associated of bundle of photovoltaic modules, an inverter and a storage battery, connection of wiring and alternatively a solar tracking mechanism.

WIND MILL

A windmill is a machine that converts the wind energy into rotational energy with support of vanes called blades. Wind turbines are the evolutions of the typical windmills that can be observe in more rural areas of the world. Their purpose is to lessen reliance on fossil fuels to create energy and also to create energy in a less wasteful manner. They function by using the kinetic energy of the wind, which pushes the blades of the turbine and spins a motor that transform the kinetic energy into electrical energy for consumer use. They supply clean and renewable energy for both homeand office. Wind Turbines are a wayto save money and make the environment clean and green. Essentially, there are two types of wind generators; those are vertical axis and horizontal axis. They can be used to generate electricity both onshore and offshore. We are using vertical axis wind generator to control.

WIFI- ESP8266



Fig no.2

This is WiFi serial transceiver module, based on ESP8266. The SOC has Integrated TCP/IP protocol stack. ESP8266 is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

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INVERTER

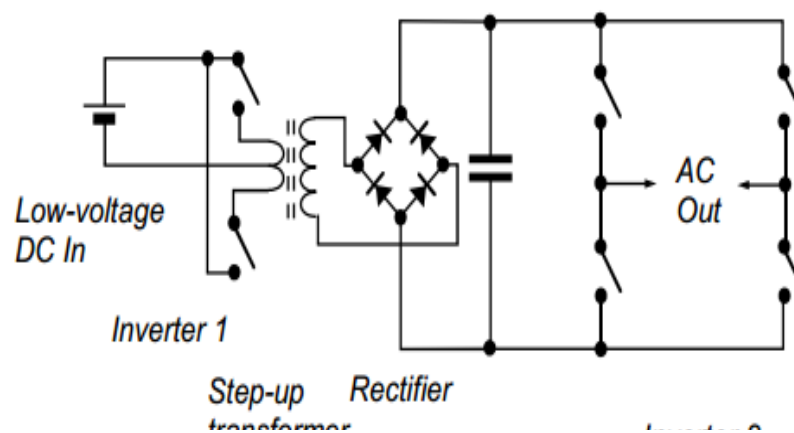


Fig no.3

Electrical power is usually transmitted and used in the form of alternating current. However, some kinds of electrical generation and storage devices produce direct current, examples being PV modules and batteries. An inverter is a power electronic apparatus which converts DC to AC, allowing the DC power from these generators to be used with ordinary AC appliances, and/or mixed with the existing electrical grid.

TRACKING MOTOR(SERVO MOTOR)

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc. Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motor's shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

MPPT

A typical solar panel converts only 30 to 40 percent of the incident solar irradiation into electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel. According to Maximum Power Transfer theorem, the power output of a circuit is maximum. When the Thevenin's impedance of the circuit (source impedance) matches with the load impedance. Hence our problem of tracking the maximum power point reduces to an impedance matching problem. In the source side we are using a boost converter connected to a solar panel in order to enhance the output voltage so that it can be used for different applications like motor load. By changing the duty cycle of the boost converter appropriately we can match the source impedance with that of the load impedance.

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STEPUP TRANSFORMER

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications. It is a step up transformer in which the primary winding is more than secondary winding. Due to this windings it can able to step up the voltage. A Transformer changes electricity from high to low voltage or low to high voltage using two properties of electricity.

DC TO DC CONVERTER

A boost converter (step-up converter) is a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element: a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).

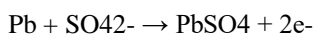
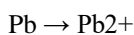
BATTERY

A battery is an electrochemical energy storage device that uses chemistry to store potential energy (voltage) in the form of electrons. When a resistive load is applied across the positive and negative terminals of a battery, the circuit is completed, and you can extract energy from the battery to perform work (like starting the engine in your car). In lead-acid batteries, this is most commonly accomplished with the following redox reaction under sulfuric acid (H₂SO₄) solution:

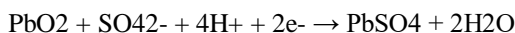
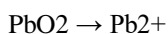


Which can be broken up into the following half reactions:

Oxidation at the Anode:



Reduction at the Cathode:



Much of electrochemical energy storage is about separating the two half reactions of a redox reaction — in the case of lead acid, the concentration of negative charge at the anode from the positive ions at the cathode. To fully understand how a lead-acid battery works, it's necessary to dive into the inner workings of a lead-acid cell.

PWM

The controlling analog circuits digitally, system costs and power consumption can be drastically reduced. What's more, many microcontrollers and DSPs already include on-chip PWM controllers, making implementation easy. In a nutshell, PWM is a way of digitally encoding analog signal levels. Through the use of high-resolution counters, the duty cycle of a square wave is modulated to encode a specific analog signal level. The PWM signal is still digital because, at any given instant of time, the full DC supply is either fully on or fully off. The voltage or current source is supplied to the analog load by means of a repeating series of on and off pulses. The on-time is the time during which the DC supply is applied to the load, and the off-time is the period during which that supply is switched off. Given a sufficient bandwidth, any analog value can be encoded with PWM.

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BLOCK DIAGRAM

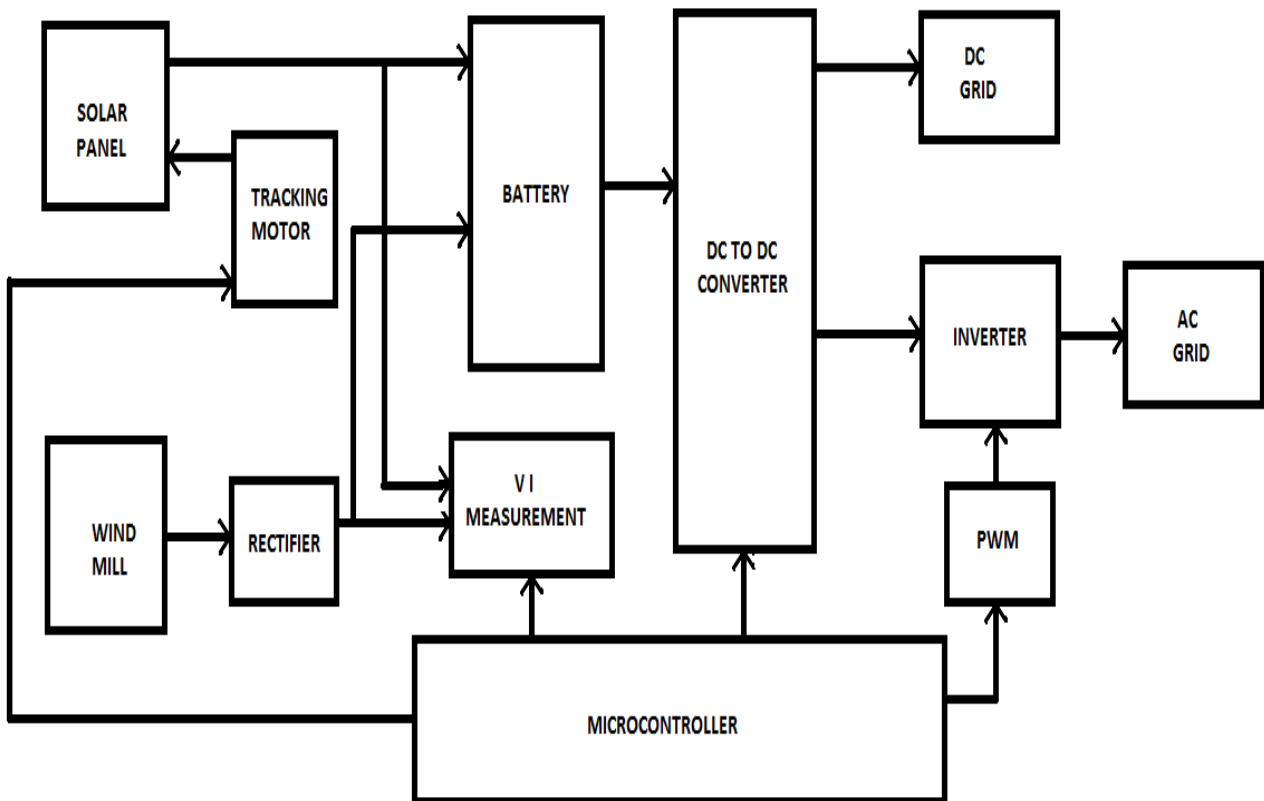


Fig no.4

This block diagram depicts to understand our project easily. The hybrid (Wind and solar) renewable energy source are connected to DC-DC converter. The converter boost the renewable energy. MPPT Is used to give PWM to this converter to maintain the voltage stability. The motor driver will generate the pulse in stepper motor based on the tracking position. The PV panel tracks the maximum sun light position. When it reaches the maximum sun light position (maximum voltage and current) the pulses of the motor driver will stop automatically and the PV panel maintain the constant position. When the sun light position changes, driver will resume pulses of the stepper motor and it will search the maximum sun light position. Here V, I measurement blocks are used to measure the voltage and current of the renewable sources .In this measured voltage and current will be send to the ESP module & display. The ESP will send the data through our website, for monitoring the parameters into the sources. The solar and wind energy source are stored into the battery. Then the battery supply is connected to the DC grid. In that battery will connect to the PWM inverter. It will convert DC supply into AC supply based on pulse width modulation (PWM). The PWM is applied with firing angles through the continuous conduction mode and maintain the constant AC voltage. The AC supply is connected to the AC grid.

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FLOW CHART

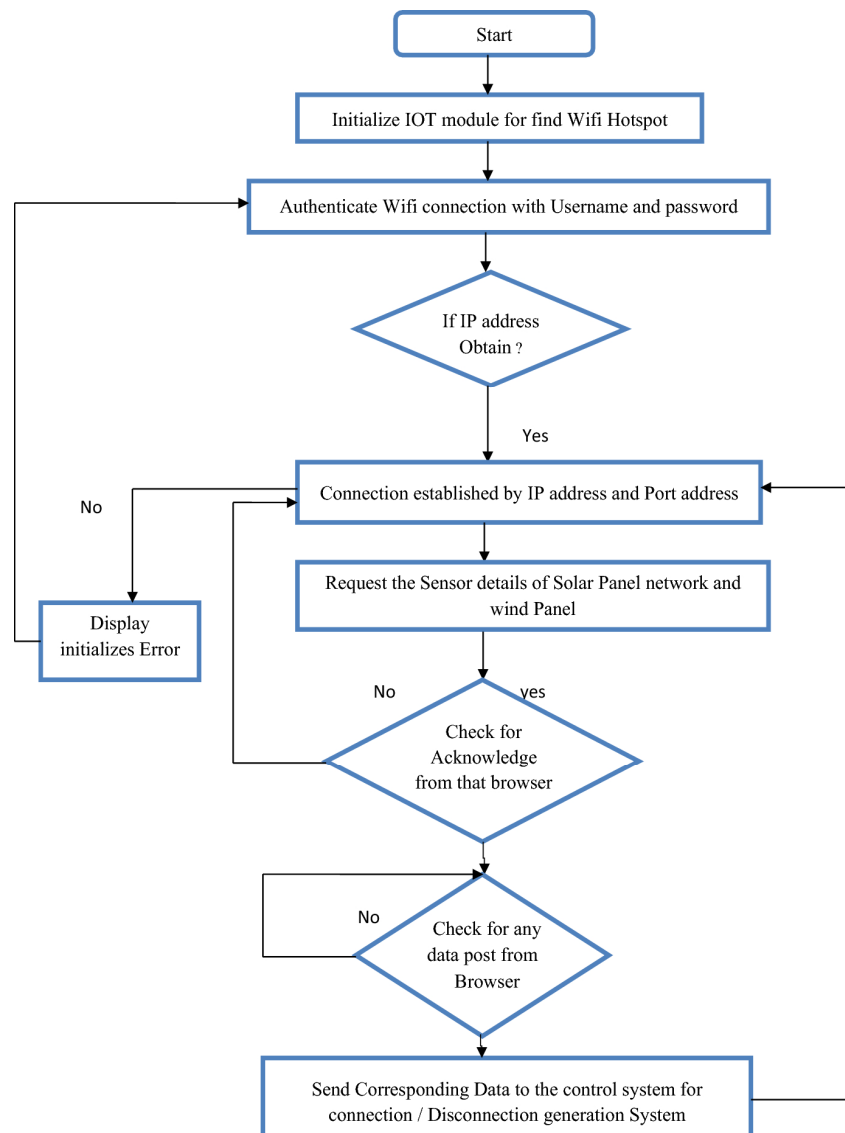


Fig no.5

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III. CONCLUSION

In today's world of changing technology and need for energy, there is also a great demand for energy management and monitoring. Thus, this demand for monitoring has led to the development of systems such as Iot has helped us achieve this goal. The integrated wind and solar energy system model get its efficiency increased once it's linked to internet of things. This monitoring helps to work over distances. The power consumption of the system is also very less. The availability of web interface makes it easier to access the output of the system on devices such as smartphones and personal computer.

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