Mobile Application Based Solar Power Inspecting Method

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***Abstract*--Considering solar energy is the ideal replacement for all traditional sources needed to generate electric power, it is now undergoing an increase in comparison to other sources of power. In addition, the characteristics like voltage and current are monitored by the sensors and shown by connected device technology. Any irregularities in the solar panels' operation will also be notified in mobile application. The solar radiation, or sunlight from the sun that is captured by solar panels and converted into useable energy in the form of heat and electricity, is used to describe this theoretical outline. The continuous monitoring controller precisely adjusts the incoming DC voltage that comes from the solar panels to the voltage range needed to charge the batteries. The PWM converter is used to get a signal at peak discharge of the charges. As the power sources become charged, the whole cutting-edge pulse sequence remains non-forestall; this degree of recharging is known as the bulk degree of charges. When wind renewable energy is additional power producing any electrical power, the charger enters an off-peak state (minimum solar electricity produced). All of the MOSFETs have been turned off to prevent the possibility that the solar panel may absorb energy from the battery in this instance. The outcome result with continuous monitoring through Arduino controller is to convert an analogue parameters input to a data the result, which is then shown on a mobile application.**

Keywords: Solar, Wind, Battery, PWM (Pulse Width Modulation).

I. INTRODUCTION

Chemical processes are fueled by electrical energy in the electrochemical process known as electrolysis. An electrolytic compound undergoes degradation when a current is passed across it. By passing a current through water when the proper substances, referred to as electrolytes, are present, the water is split into hydrogen and oxygen. Positively charged hydrogen ions are propelled by an electric current to the negatively charged cathode, where they are directed to produce hydrogen atoms. Together, the atoms will form gaseous hydrogen molecules (H2). The positively charged anode, which is the opposite electrode, produces oxygen. Two volumes of hydrogen and one volume of oxygen make up the reaction's stoichiometry. The most significant aspect of electrolysis unit design is the selection of appropriate electrodes to reduce the undesired reactions that generate contaminants in the hydrogen gas that is produced.

Geothermal Energy: By employing underground steam or hot water reservoirs, geothermal power captures the natural heat of the Earth. This heat is converted into energy by geothermal power plants. This energy source is very trustworthy since it is always available and unaffected by climate change. Organic resources such as wood, as well as agricultural and organic waste, are referred to as biomass energy. These materials can be converted into biofuels like ethanol and biodiesel or burned directly for heat. Because the carbon dioxide released while burning is about equal to the carbon dioxide absorbed by plants during development, biomass energy is regarded as renewable. The kinetic energy of ocean tides and washes is harnessed via tidal and wave energy to generate electricity.

The basic model used to explain how a hydrogen-storage renewable energy system (RESHS) operates. It consists of fuel cell, batteries, interfaces (buck and boost converters), and sub-models of the electrolysis device and power storage system. Problems with interdependence are addressed (production and consumption of hydrogen cannot be more than one).

The main components of the system are described in particular in the transient state, and the behavior of the RESHS is described for both short- and long-term operation using straightforward and plausible assumptions. When there is more demand for energy than there are renewable resources available, a fuel cell that runs on hydrogen that has been stored might provide a power balance.

II. LITERATURE SURVEY

Maximum power point tracking, or MPPT, is used to run PV panels when the amount of energy produced by wind and solar panels is less than the load need. When more power is generated than is required, it is transferred to the battery, and the MPPT cuts off when it is thought to be impossible [1]. Batteries must be regularly monitored when charging and discharging since they are among the most expensive components of a rooftop solar power system and their performance varies based on factors such as humidity and charge design. Because solar radiation is variable and residential power user demand patterns are unpredictable, it is necessary to evaluate the performance of solar batteries deployed on rooftops using their actual and charge profiles [2]. The system's parts and control are built around a stack of water electrolytic systems with a set nominal power of 4.5 kW that use proton exchange membranes to transfer energy. As a result, by varying the electrolyte's baseline power, the final outcomes are scalable. Data gathered from an apartment building's solar photovoltaic system with a temporal precision of 300 s is used in the calculations. Using the particle swarm management technique, the system is improved [3]. Moreover, the optimal system total cost decreases by 36.5 percent when the uncertainty index is raised from 0.5 to 10%, while the unavailability value rises from 0.2259% to 9.9568%. Furthermore, the entire cost value rises by around 17.4% when the interest rate value rises from 1 to 7% [4]. Ground-source heat pumps have two uses, according to the research. Its primary application is as an energy source when there is a feed-in tariff; seasonal energy storage is the best usage in the absence of one. Moreover, studies have shown that although ground-source heat pump systems increase sustainability, they might not be financially advantageous for single-family houses with mild to moderate heating needs [5]. The first case uses a traditional photovoltaic battery system; the second uses only direct rainfall to integrate photovoltaic batteries with hydro systems; the third case uses a battery bank as the primary power backup; and the fourth case uses hydro systems as the primary power backup in addition to photovoltaic battery integration and pumped hydro [6]. Many tests were conducted in various conditions, including load fluctuations, in order to assess and validate the new architecture of the control strategy. A bidirectional converter is used by a storage unit, DC-DC, and DC-AC units to satisfy demand generated by photovoltaic power sources. Additionally, the two-stage management structure is part of the broader architecture [7]. Different levels of acceptance of electric cars are taken into consideration while determining the optimal location. PVCS approaches its best-placement problem using the multi-objective Grasshopper optimum algorithm (MOGOA). The EENS value for instances 1 and 2 is 13.9% and 6.18% greater, respectively, than the value for the simple case. [8]. Various levels of EV penetration are taken into consideration while determining the ideal location. PVCS solves its optimal placement problem using the multi-objective Grasshopper optimization algorithm (MOGOA). The EENS value for instances 1 and 2 is 13.9% and 6.18% greater, respectively, than the value for the simple case [9]. Large fixed step-size is used in the two zones that are furthest from the MPP (below 90% of the power-voltage range) to guarantee fast tracking speed. Moreover, the remaining areas use a tracking method akin to the adaptive P&O algorithm in the regions surrounding the MPP to reduce steady-state variations near the ideal MPP. [10]. Furthermore, a heuristic method for figuring out the best charging and discharging schedule for ZEB devices is offered. Three common house building scenarios and three distinct power pricing systems are taken into consideration in a comprehensive year-long techno-economic examination of the proposed system [11]. In an attempt to reduce the number of state variables, the boost circuit and PV capacitor characteristics are captured in the resulting DP-based two-stage inverter design utilizing a first-order lag filtering. However, the model is appropriate for reported transient analysis as long as the dynamics of the DC-link capacitor are preserved [12].

III. MATERIALS AND METHOD

Sunlight energy is absorbed by the solar panels and sent to the charge regulator. The temperature, voltage, and current sensors are all linked to the solar panel. With the assistance of a temperature sensor attached to the solar panel, the temperature of the surface and overall block diagram shown in figure 1. In order to prevent battery overcharging, a pulse width fee controller analyses the duration and importance of each pulse. The full cutting-edge pulses continue to be non-forestall as the batteries become charged during peak when they are being drained. This degree of charging is known as the bulk degree of charging. A signal is obtained with the help of the PWM charger. The energy from the solar panels is sent to the charge the controller which then transfers it to a PWM controller, which then transfers it to the equipment and loading

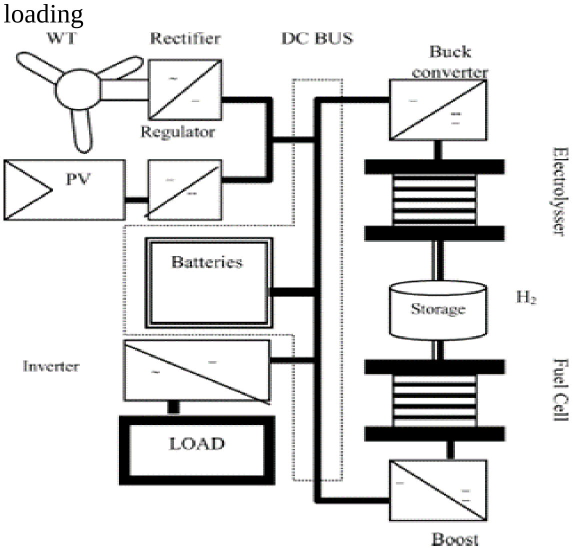

Fig. 1 Block diagram of a typical renewable energy system

A. Solar Energy

Solar panels or photovoltaic cells are used to capture sunlight in order to make photovoltaic energy. With the use of these cells, sunlight may be immediately converted into energy that can run entire networks or even buildings. Solar energy is widely available and abundant, particularly in areas that receive a lot of sunlight

$$\text{Maximum useful power} = Vm \times Im \quad (3.1)$$

Photovoltaic (PV) cells, sometimes referred to as solar cells, are devices that use solar radiation to produce electricity. The number of PV systems deployed increases yearly. Given this expanding applicability, it is advisable that all professionals in practice comprehend the computations related to photovoltaic cells. PV cells are widely used and come in a wide variety of materials.

B. Wind Turbines

Numerous turbine wind farms are often located in areas with consistent and strong wind patterns. Because wind energy is more environmentally friendly and scalable than fossil fuels, its use has increased. The method of producing energy from flowing water, such as rivers or dams, is known as hydroelectric power.

C. Arduino ide

Writing code and uploading it to the board while connected to the internet is made easier by the Arduino Software (IDE). Everyone suggests it to those with sluggish or nonexistent internet connections. Any Arduino board may be used with this the class. The Arduino IDE is now available in two versions: 1.x.x and 2.x. A new major version, the IDE 2.x is faster and more capable than the IDE 1.x.x. It offers a more dynamic user interface, an editor that is more up to date, and cutting-edge features that help users with authoring and debugging. The following instructions will assist you in employing the offline IDE (IDE 1.x.x and IDE 2.x are your options).

D. Battery

It only takes a few seconds to click the arrow in the upper left corner to add it to your board, and users shouldn't disconnect the board at this point. The message "Done with uploading" will appear in the bottom output zone if the upload is successful. The device's yellow LED with the letter L next to it should start to flicker when the upload is complete. Reload the Blink prototype after increasing the blinking rate by setting the delay value in parenthesis to 100.

State-of-charge, or SoC, measurement is a commonly used method for determining a battery's remaining energy content. There are several techniques for determining SoC, from the very simple Voltage Procedure (which is incredibly wrong) to Impedance Spectrum Copy and Complex Quantum Magnetism. Battery acid solutions are one area where hydrometers are commonly employed. Professional laptops and portable devices employ the Coulomb Counting approach to measure SoC. It measures the current that enters and exits the battery, which is almost equal when the battery is completely charged.

E. Voltage sensor

Generally speaking, sensors are machines that are able to recognize, interpret, and react to particular types of electrical or optical signals. Traditional current and voltage measuring techniques may now be effectively replaced by the use of voltage sensor and current sensor approaches. It is possible to combine current and voltage measurements into a single, small physical device. It is possible to locate, observe, and assess the source of voltage with a voltage sensor. It has the ability to determine voltage levels in both AC and DC. After receiving voltages as an input, the voltage sensor outputs switches, noise signals, frequency manipulated results, analogue voltage knowledge, and even analogue current thresholds.

A capacitive voltage sensor consists of two conductors or plates, with a non-conductor between them. That non-conducting substance is referred to as dielectric. When an AC voltage is applied across these plates, current begins to flow due to the attraction or repulsion of electrons via the voltage on the opposite surface. The electromagnetic field between the plates will result in a full AC circuit with no hardware connection. Next, we'll talk about voltage division in two capacitors connected in parallel. In series circuits, high voltage often develops across the element with the highest resistance. For capacitors, capacitance and impedance (capacitive reactance) are perpetually proportional to one another.

F. Power supply

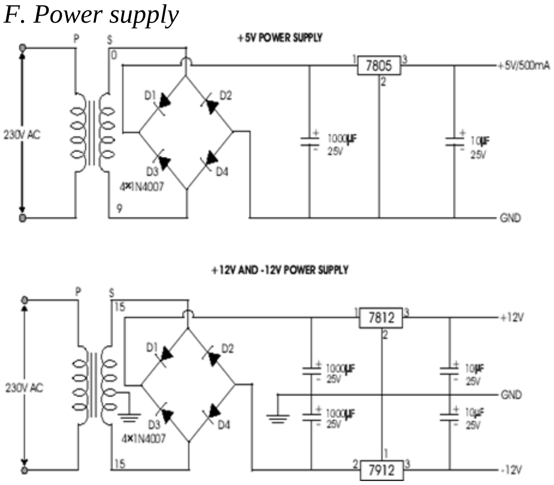

Fig. 2 Power Supply Circuit

As seen in the diagram, four diodes are connected to form a bridge rectifier circuit. The circuit's input is received by the two diagonally opposed corners of the network, while its output is produced by the other two corners. For the duration of this discussion, let us assume that the transformer is functioning properly and that points A and B have positive and negative potentials, respectively. D3 will undergo forward bias and D4 will experience reverse bias due to Point A's positive potential. The negative potential at point B will cause D2 to be reversed and D1 to go ahead unfairly. Current may now flow through D3 and D1 since they are forward distorted. Due to their reverse bias, D4 and D2 will prevent current from flowing.

IV. RESULT AND DISCUSSION

Environmental Benefits: A major decrease in greenhouse gas emissions is one of the main results of using renewable energy resources. Both air quality and climate change mitigation benefit from this. Renewable electricity contributes to reducing emissions of pollutants that are bad for both the environment and human health, such as mercury, nitrogen oxides, and particulate matter, by moving away from traditional energy sources. Energy Assurance: By broadening the energy mix and lowering reliance on imports of fossil fuels, renewable energy sources improve security of supply. Investing in renewable resources at home makes a nation less susceptible to changes in the value of fuel globally Requires and tensions in geopolitics pertaining to obtaining energy

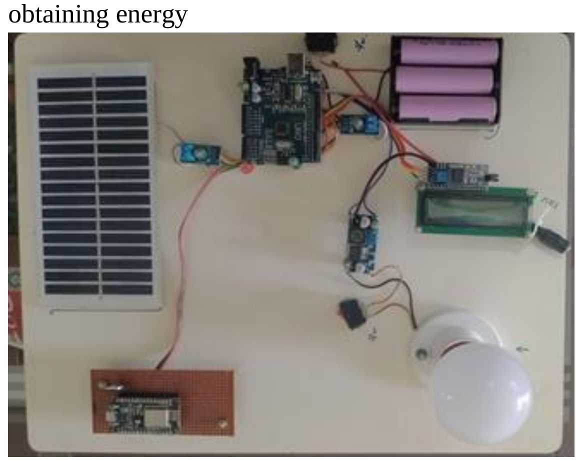

Fig. 3 Porotype model of proposed method

The erratic nature of renewable energy sources, such as solar and wind, poses a serious problem. The wind and the sun don't always blow in the same direction. Batteries and pumped hydro storage are two examples of energy storage technologies that are essential for holding extra energy during high output and releasing it during low production. The development of economical and efficient storage systems is necessary for a stable and dependable renewable energy infrastructure

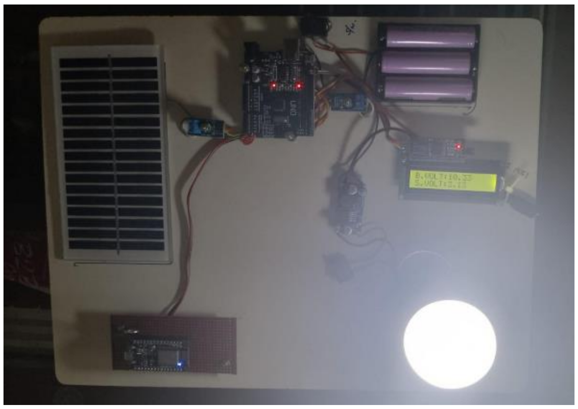

Fig. 4 Running model of proposed method

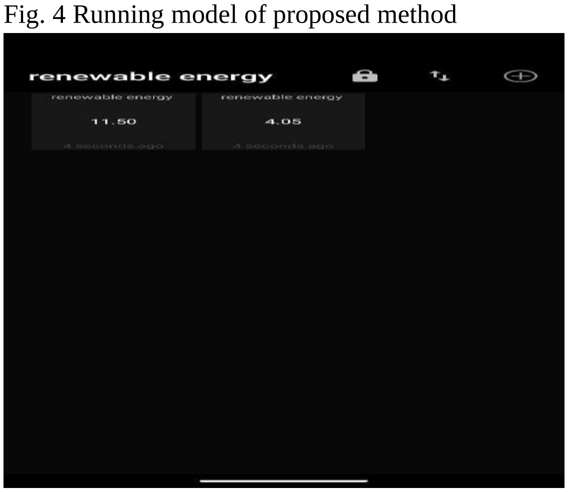

Fig. 5 Output result

V. CONCLUSION

A comparative analysis of DC-DC converters for renewable energy systems is presented in this work. Simulation and experimental studies demonstrate that the power boost gained with this approach enhances the pace of hydrogen synthesis and storage from wind-photovoltaic equipment. DC-DC converters with transformers have been shown to have the ideal characteristics for electrolysis purposes. For the purpose of to ensure ZVS for all main switches, the converter runs in lagging PF mode for a very wide range of fluctuations in load and supply energy. As load current increases, the peak current across the switches drops. The output of the inverter is almost sinusoidal, according to the findings of the simulation and the testing. Because an LC filter is present at the rectifier's output, the output is pure DC. It is evident that a DCDC converter with a transformer has a 15% higher efficiency than one without one.

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