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Bidirectional Solar Energy Meter

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ABSTRACT*:*A bidirectional solar energy meter with a database is a system that allows for the measurement and monitoring of energy production and consumption in a solar power system. The system can measure the amount of energy produced by the solar panels as well as the amount of energy consumed by the load, and it can store this data in a database for analysis and future reference. The bidirectional meter is able to measure the flow of energy in both directions, allowing for accurate tracking of energy usage and production.

The system consists of a bidirectional energy meter, a microcontroller, a database, and a user interface. The energy meter measures the energy produced and consumed, and sends this information to the microcontroller. The microcontroller processes the data and stores it in the database. The user interface allows users to access and analyze the data stored in the database, providing valuable insights into energy usage and production.

I. INTRODUCTION

A bidirectional solar energy meter with a database is a device that measures the amount of energy generated by a solar panel system, as well as the amount of energy consumed by a building or home. This type of meter is bidirectional because it can measure both the energy being produced by the solar panels and the energy being consumed by the building or home. The data from the meter is then stored in a database for analysis and monitoring.

The bidirectional solar energy meter typically consists of two meters, one for measuring the energy produced by the solar panels and the other for measuring the energy consumed by the building or home. The data from these meters is then sent to a central database for storage and analysis. This database can be accessed by homeowners, solar panel installers, or energy companies to monitor the performance of the solar panel system and track energy usage.

The bidirectional solar energy meter with a database is a valuable tool for homeowners who have installed solar panel systems. By monitoring the performance of their solar panels and tracking energy usage, homeowners can make informed decisions about their energy consumption and potentially reduce their energy bills. Additionally, the data from these meters can be used by solar panel installers and energy companies to optimize the performance of solar panel systems and improve energy efficiency.

II.PROBLEM STATEMENT

The increasing demand for renewable energy sources, especially solar energy, has led to the need for efficient monitoring and management of energy consumption. A bidirectional solar energy meter with a database is an essential tool for tracking the energy generated and consumed by solar panels.

The current problem is that traditional energy meters only measure the energy consumption from the grid and do not provide accurate measurements of the energy generated by solar panels. In addition, there is no way to track the energy generated and consumed over time, making it difficult to optimize the use of solar energy.

To solve this problem, a bidirectional solar energy meter with a database is required. The device should be able to measure the energy generated and consumed by solar panels accurately. It should also be able to store this data in a database, allowing for analysis and optimization of energy usage.

III.METHODOLOGY

The system mainly consists of the sensors that measures the voltage and the current, mainly the hall effect type SCT 013 Sensor is used to measure the current in the dc production and ac delivery lines.The same way the voltage

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sensors are used to measure the voltage across the DC And AC lines .These data's are communicated to the node MCU which in turn has the code to execute the required parameters.The processed data is transferred to the Blynk Cloud database.The data's are displayed in real time and also stored.It can be extracted in the form of report as per the users requirement. The user also has the access to delete the data in case of resetting the energy meter.
The process of transferring the data into the cloud takes place over the internet with the help of the Wi-Fi hotspot that can be provided with the mobile phone and the router. The datais safe and other users cannothave an access to it without a unique authentication key.

As shown in figure 1 first system will be connected to blink cloud using an app which is built, then the Wi-Fi status is checked and displayed. After displaying Wi-Fi status the datais acquired from the module and displaysthe value.

Figure 2 shows the block diagram of Bidirectional Solar Energy Meter. Here Node MCU acts as brain of the system. The inputs for Node MCU are came from Multiplexer and power supply. Multiplexer takes multiple inputs from the sensor namely, DC voltage sensor, DC current sensor, AC voltage sensor AC current sensor and also from the power supply board. The data from the sensor will be multiplexed and sent to the Node MCU and received data will be given to Blynk cloud which is connected through Android phone using Blynk IoT app. Data will be displayed through web dashboard.

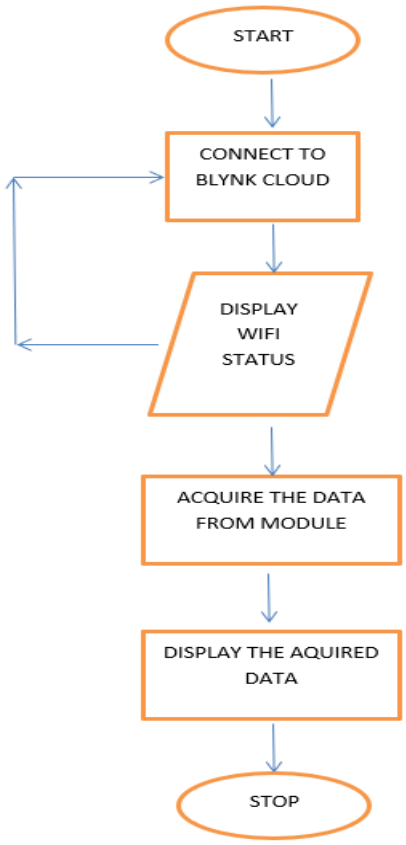

Fig1. Flowchart

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IV.BLOCK DIAGRAM

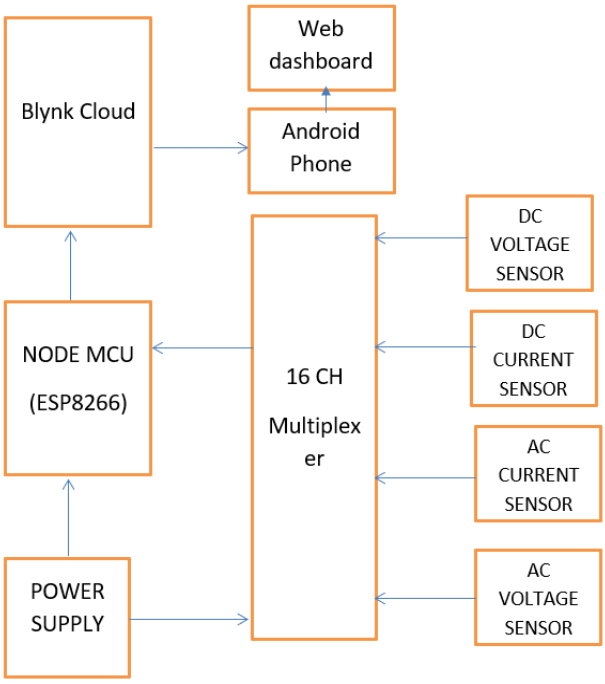

Fig 2. Block diagram of Bidirectional Solar Energy Meter

V.MATERIALS

NODE MCU:
NodeMCU is an open-source firmware and development kit that allows you to easily prototype IoT (Internet of Things) applications. It is based on the ESP8266 Wi-Fi Module and is compatible with the Arduino IDE.

VOLTAGE REGULATOR AMS1117:
The AMS1117 is a popular linear voltage regulator used to regulate the output voltage of a power supply. It is designed to provide a fixed output voltage of 3.3V, 5V, or other voltages depending on the specific version of the device.

AC CURRENT SENSOR CLAMP SENSOR:
It works by clamping around the conductor, creating a magnetic field that induces a current in the sensor coil, which is then measured and converted into an electrical signal.

SOLAR PANEL:
solar photovoltaic (PV) panels transform sunlight into useable electricity.

CD74HC4067 16-CHANNEL ANALOG DIGITAL MULTIPLEXER BREAKOUT BOARD:
The CD74HC4067 is a 16-channel analog/digital multiplexer IC (integrated circuit) that allows to connect multiple analog sensors or devices to a single analog input pin on a microcontroller or other digital circuit.

VI.RESULT

The device measured the energy generated by the solar panel and consumed for the utility purpose and sent to grid. It measured DC current, DC voltage, AC current , AC voltage, power imported and exported. The measured data that stored in the cloud is displayed through mobile application from the dashboard. The accuracy of the system is nearly 85 percent when its measured with multi meter.

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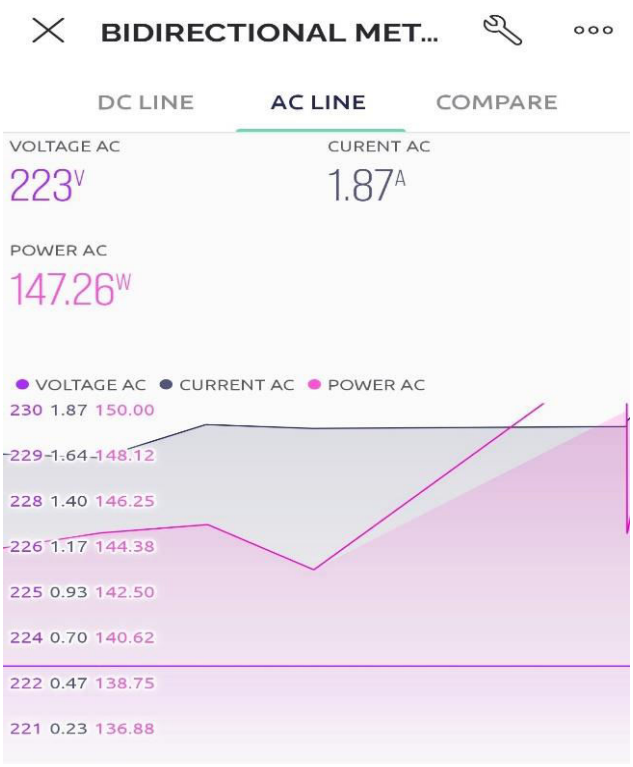

Fig 3. AC voltage ,current and power measurement

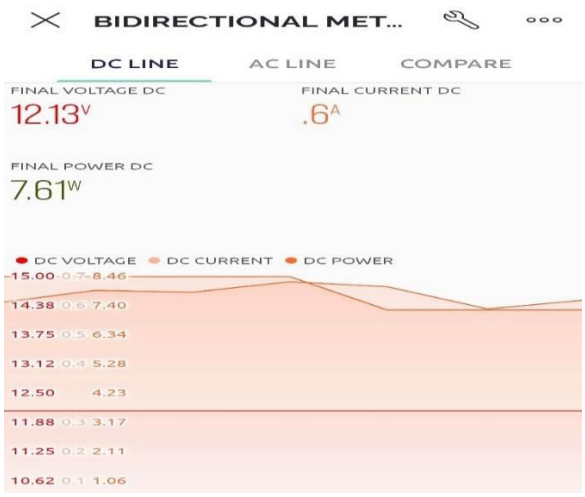

Fig 4. DC voltage ,current and power measurement

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Fig 5. Imported and Exported power

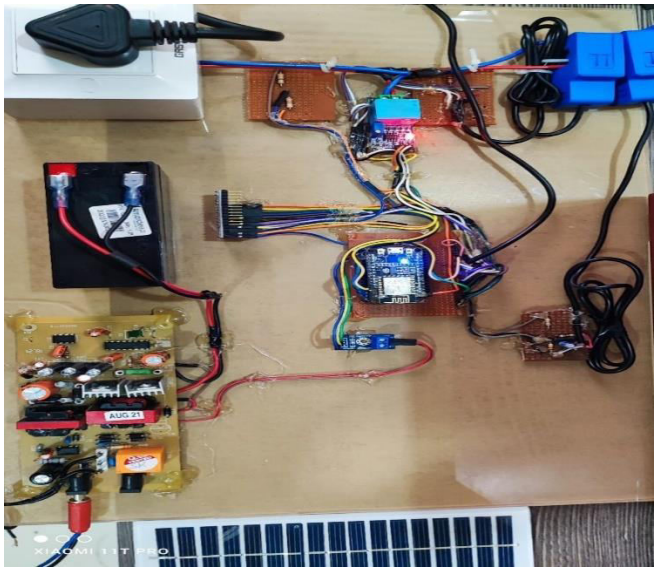

Fig 6. setup of Bidirectional Solar energy meter

VII.CONCLUSION

A bidirectional solar energy meter with a database is a useful tool for monitoring and managing energy consumption and production in a residential or commercial solar energy system. With this system, users can track the amount of energy generated by their solar panels, as well as the amount of energy consumed from the grid and the amount of excess energy fed back into the grid.

The inclusion of a database allows for the storage and analysis of energy usage data over time, which can provide insights into energy consumption patterns and help identify areas for energy efficiency improvements. This can help users save money on energy bills and reduce their carbon footprint.

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