

Home Energy Management System Including Renewable Energy Based on GSM and IOT

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Abstract — Grid- connected renewable energy sources are used extensively in the power request moment. The quantum of electricity used at home tends to increase in direct proportion to the growth in the number of large electric outfit. Electric home appliances can be controlled and covered through domestic power lines by using Power Line Communication (PLC) technology. Yet, photovoltaic (PV) systems for ménage guests bear bilateral interfaces to partake energy and data. Domestic consumer benefactions also need to be secure and with guaranteed sequestration. Day ahead dynamic pricing is one of the incitement- grounded demand response styles that has substantial goods on the integration of renewable energy coffers with smart grids and social weal. Different metering mechanisms of renewable energy coffers similar as feed- in tariffs, net metering, and net purchase and trade are important issues in power grid operation planning. In this study, day- ahead dynamic pricing of grid- connected home renewable energy coffers under colorful metering schemes is carried out using the optimum condition corruption approach. The smart ends design that's suggested in this study takes into account energy generation and consumption coincidentally. Energy covering modules grounded on GSM are used to track how important energy is utilised by lighting and home appliances. To track the energy product of renewable powers, a PLC- grounded renewable energy gateway is stationed. The home garçon collects information on energy product and consumption, evaluates it for energy estimation, and manages the house's energy use schedule to reduce energy costs.

Keywords: Renewable energy, Photo Voltaic, PLC, HEMS, GSM

I. INTRODUCTION

HEMS (Home Energy Management Systems) control energy use to strike a balance between energy conservation and a comfortable living. HEMSs laboriously work to make the stylish use of electricity by, for illustration, running heat pump water heaters or washer- dryers during times when solar panels are generating redundant power, in addition to reducing energy consumption by using rainfall, detector, and other types of information to identify gratuitous energy use and control Home appliances consequently. The installation of batteries and their optimal functioning to achieve energy savings while also conserving comfort will play a pivotal part in icing a harmonious force of electricity as the volume of power produced by rainfall-dependent renewable energy sources rises. By performing centralised operation of energy consumption, a ends can offer guidance on how to use electricity more effectively grounded on factors like the rainfall or the stoner's geste patterns, in addition to furnishing" visualisation" of electric power use to give the

stoner an easy way to view their own operation on a television or computer screen.

II. RELATED WORK

A. Literture Review

- 1) Jinsung Byun, Insung Hong, and Sehyun(2020) has proposed green IT and smart grid technologies have changed electricity structure more efficiently. Environment- apprehensive power operation systems are made possible by recent advancements in wireless and mobile dispatches technology, which enable situation- grounded services in the digital home.
- 2) Namsik Ryu, Jae-Ho Jung, and YongchaeJeong(2020) have proposed the high- effectiveness power amplifier(PA) with uneven bias is proposed. The suggested amplifier is made up of a motorist amplifier, class AB poisoned power stages for the main amplifier, and class C poisoned power stages for the supplementary amplifier. To drop affair stage loss and space, the amplifier, unlike former CMOS papas, uses a current- mode motor- grounded combiner. The amplifier can thereby increase effectiveness and drop inert current.
- 3) Basil Hamed(2019) proposed smart home, which employs information technology to cover its surroundings, manage its energy appliances, and interact with the outside world. The technology of the" smart house" is sophisticated and ever evolving. To give a more affable and simple living terrain, a smart home robotization system has been designed to automatically do several everyday tasks.
- 4) Alphy John, I.BildassSanthosam(2019) have proposed to inculcate the Home Energy Management System(HEMS) grounded on ZigBee communication using remote regulator and detector. This system reduces power operation in the home area by utilising a more effective home energy operation system. We believe that a ménage appliance's IR remote control can fluently manage the area. Power outlets, a light, a detector, and a ZigBee mecca are present in the space. An electrical outlet- connected home appliance's IR remote control signal is educated by the ZigBee mecca's IR law literacy point. The room's light and electrical outlets may also be controlled by it.
- 5) Rajesh v. Sakhare, b. T. Deshmukh(2017) have proposed to inculcate the Home Energy Management System(HEMS) predicated on ZigBee communication using remote controller and sensor. This system reduces power operation in the home area by utilising a more effective home energy operation system. We believe that a ménage appliance's IR remote control can easily manage the area. Power outlets, a light, a sensor, and a ZigBee mecca are present in the space. An electrical outlet- connected

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B. Existing System

The stylish home energy operation system to make house energy consumption simple to gain, optimization of home power consumption grounded on power line communication has been delved. A module for controlling connected ménage appliances. A green home appliance monitoring and control system (ends). The power system should handle demand response and cargo balancing with the power storehouse device as renewable energy generation and storehouse bias grow in number. These power systems combine the electricity generated by renewable energy sources with the electricity delivered by the mileage. When integrating renewable energy sources into conventional power networks, the varied frequency and voltage are significant issues. It's necessary to do exploration on distribution and transmission with the integration of the renewable energy system.

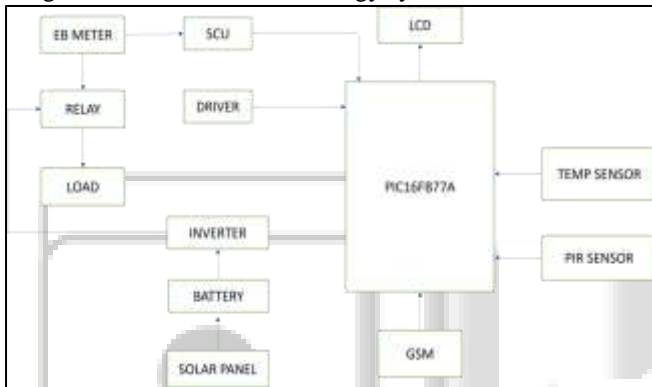


Fig. 1: Block Diagram of Existing Method

III. THE PROPOSED SYSTEM

A. Proposed System

A smart ends design that takes into account energy generation and consumption using a renewable energy gateway (regulation) grounded on PLC and GSM, independently. Each solar panel may be maintained under the vigilant eyes of this PLC monitoring system. Grounded on a rainfall vaticination, the home garçon may determine the energy product. The home garçon may manage the home's energy consumption schedule to reduce energy costs using the energy information it has collected. Using smart widgets, druggies may pierce information about their home's energy use. The ends compares and analyses how important energy is used in each hearthstone. The suggested armature is anticipated to ameliorate domestic energy operation and reduce the cost of energy by taking into account both consumption and generation. Both data on energy product and consumption are collected by the Home garçon via GSM and REG, independently. The home garçon improves ménage energy utilisation by counting for both consumption and generation.

B. Proposed System Block Diagram

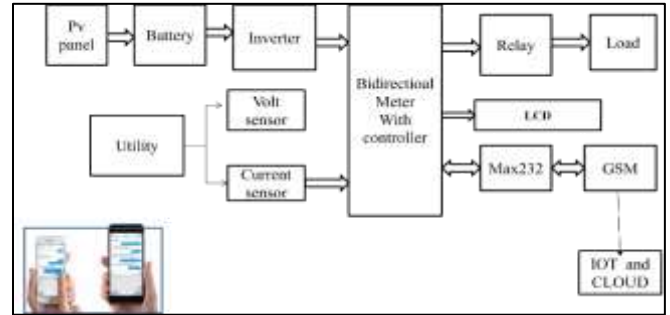


Fig. 2: Block diagram of proposed method.

C. Hardware Components

1) PV Panel

A solar cell, also known as a photovoltaic cell, is a type of electrical appliance that uses photovoltaic technology to convert light energy directly into electricity. A device whose electrical parcels, similar as current, voltage, or resistance, change when exposed to light is a type of photoelectric cell. The foundation of photovoltaic modules, occasionally appertained to as solar panels, are solar cells. In discrepancy, a solar thermal collector uses sun as a heat source to induce heat- grounded electricity either directly or laterally. In discrepancy, a "print electrolytic cell"(print electrochemical) is a device that directly divides water into hydrogen and oxygen using only solar irradiation. Exemplifications of similar bias include the Edmond Becquerel photovoltaic cell and contemporary color- acclimatized solar cells.



Fig3: PV panel

2) Battery

The process of charging Sealed Lead Acid(SLA) batteries does not feel to be particularly delicate, but dragging the battery life is a pivotal step. Simple constant current/ constant voltage dishes will do the job for a while, but using similar crude dishes will significantly reduce the battery future prognosticated by the manufacturer. Using an intelligent bowl to extend the life of your SLA battery isn't only practical, but it's also healthier for the terrain. It's important to understand battery drugs and what occurs during typical charge and release cycles before looking at the colorful charging procedures. generally, lead dioxide is used to make the positive plates in a SLA battery and wipe lead is used to make the negative plates. Defensive partitions between the plates to a large degree consume and hold the electrolyte, which is generally sulfuric sharp combined with a gelatinizing agent.

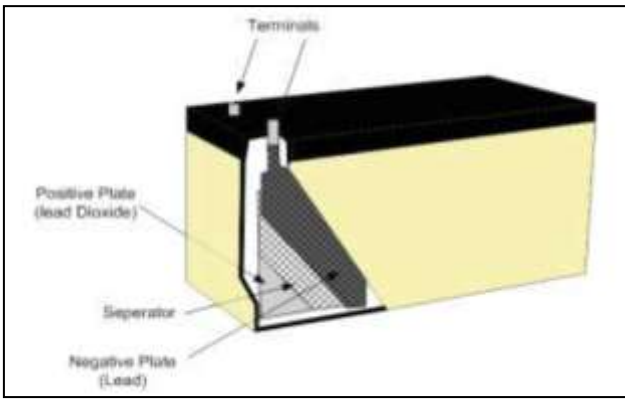


Fig. 4: Battery

Lead sulphate is created when a SLA battery is drained, turning the lead (Pb) on the negative plate and the lead dioxide (PbO₂) on the positive plate into lead sulphate (PbSO₄). Sulfuric acid (H₂SO₄) is turned into water coincidentally (H₂O). Typically, the chemical response is reversed during a charge. Lead, lead dioxide, and sulfuric acid are produced electrochemically from super eminent sulphate and water. During a full charge cycle any feasts created need to be recombined in a so called 'oxygen cycle'. In the after phases of the charge cycle, oxygen is produced at the positive plates; this interacts with and incompletely discharges in the sponger lead of the negative plates. The oxygen that's produced while the battery charges also mixes with the hydrogen that's being created on the negative plate to make water. The feasts created during the charge cycle will be completely mixed into the negative plates and returned to the water in the electrolyte with proper and precise cell voltage operation.

3) Relay

An electrically controlled switch is a relay. Other working principles are also utilised, still electromagnets are constantly used in relays to mechanically spark a switching medium. Relays are employed when several circuits need to be controlled by a single signal or when a low- power signal is needed to control a circuit with perfect electrical insulation between the control and controlled circuits. The foremost relays were utilised in long- distance telegraph circuits to duplicate and retransmit signals from one circuit to another. To carry out logical processes, relays were extensively utilised in early computers and telephone exchanges. A contactor is a particular kind of relay that can manage the high power necessary to directly operate an electric motor or other loads. With no moving factors and switching performed by a semiconductor chip, solid- state relays regulate power circuits. Electrical circuits are defended from load or blights by relays with calibrated operating characteristics and sometimes multitudinous functional coils; in contemporary electric power systems, digital instruments still serve as defensive relays for these purposes.

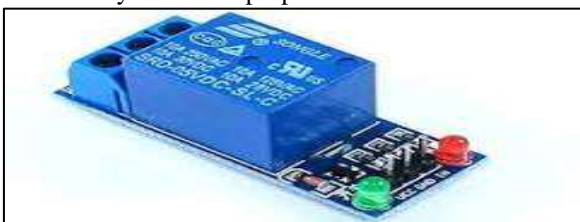


Fig. 5: Relay

4) LCD

The TV screen is further energy effective and can be disposed of further safely than a CRT. Its low electrical power consumption enables it to be used in battery- powered electronic outfit. It's an electronically modulated optic device made up of any number of parts filled with liquid chargers and disposed in front of a light source(backlight) or glass to produce images in color or snap. Liquid chargers were first discovered in 1888. By 2008, worldwide deals of boxes with TV defenses exceeded periodic deals of CRT units; the CRT came obsolete for utmost purposes.



Fig. 6: Display

On a 16x2 TV, there are 2 lines that can each display 16 characters. Each character on this TV is presented using a 5x7 pixel matrix. The Command and Data registers on this TV are its two registers. The command instructions transferred to the TV are stored in the command register. A command is a directive issued to an TV device to carry out a certain operation, similar as initialising it, clearing its screen, conforming the cursor, managing the display, etc. The data that will be shown on the TV is kept in the data register. The character's ASCII value, which will be shown on the TV, is the data. Click to find out further about an TV's internal construction.

5) MAX232

Microcontrollers and PCs constantly communicate serially using the MAX232 IC. This intertwined circuit's primary job is to convert TTL/ CMOS sense values to RS232 during the periodical communication process. A computer generally functions at RS232 norms like-25 to 25V, but a microcontroller generally operates at TTL of roughly 0 to 5V. Hence, it isn't doable to affiliate a computer with a microcontroller without a MAX232 IC. For case, MAX232IC must be included if you wish to link a snap microcontroller to a laptop's periodical connector.



Fig. 7: MAX232 IC

6) GSM

In Europe and other areas of the world, numerous mobile phone guests use the GSM (Global System for Mobile communication) digital mobile network. The most popular of the three digital wireless telephony technologies TDMA, GSM, and CDMA — GSM employs an interpretation of time division multiple access (TDMA) (CDMA). GSM converts data to an electronic form, compresses it, and delivers it together with two other aqueducts of stoner data, each in its

own time niche, down a channel. Either the 900 MHz or, 800 MHz frequency band are where it works. The development of wireless mobile telecommunications covers GSM as well as fresh technologies including High-Speed Circuit-Switched Data (HSCSD), General Packet Radio Service (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS).

7) *Voltage Sensor*

Voltage detector that's able of measuring DC voltages in the 0 to 25 Volt range. The topmost DC voltage this can measure is 25V. As you're all apprehensive, Arduino and a select many other microcontrollers can measure up to 5V straight from the analogue legs, but it isn't doable to cover voltages advanced than 5V, and indeed if you connect voltages advanced than 5V, the chip may be burned or damaged. So, we can measure up to 25V from the Arduino Analog legs with the backing of this voltage detector.

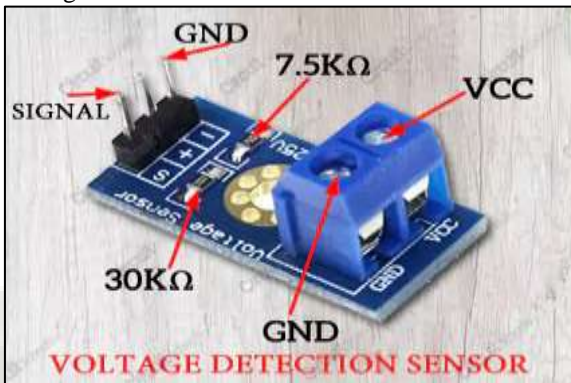


Fig. 8: Voltage Detection Sensor

8) *Current Sensor*

For operations involving power control and calculation, a current detector is pivotal. It calculates the circuit's current consumption and produces the necessary signal. The affair of this detector produces an analogue voltage. Both AC and DC may be measured using this detector (Alternating Current). It contains an intertwined low-resistance current capacitor and 2.1 kVRMS voltage insulation.

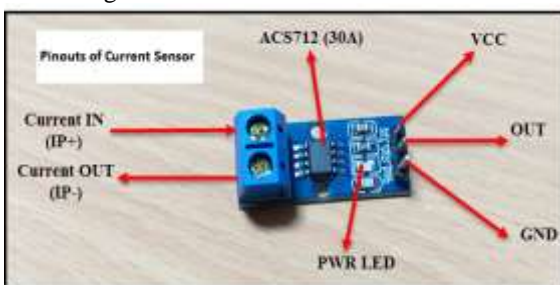


Fig. 9: Current Sensor

9) *Arduino Uno R3 Microcontroller*

A microcontroller board called the Arduino Uno R3 is grounded on the ATmega328. It contains a 16 MHz demitasse oscillator, 6 analogue inputs, 14 digital input/ affair legs (of which 6 may be used as PWM labors), a USB harborage, a power connector, an ICSP title, and a reset button. It comes with everything demanded to support the microcontroller; to get started, just plug in a USB string, an AC- to- DC motor, or a battery. The FTDI USB- to- periodical motorist chip isn't used by the Uno, which is how it differentiates from all earlier boards. In its place, a USB- to- periodical motor erected using the Atmega16U2 (or Atmega8U2 up to interpretation R2) is

included. The Uno board in modification 2(A000046) features a resistor that pulls the 8U2 HWB line to base to make entering DFU mode simpler.

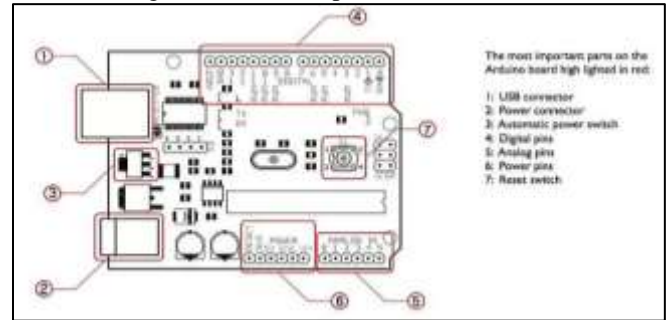


Fig. 10: Arduino Board Diagram

- a) SOFTWAREUSED
- EMBEDDED C
- PHP
- MYSQL

IV. RESULT AND DISCUSSION

A. *Result & Discussion*



Fig. 11: Proposed Kit

The proposed system initially operates on an AC power supply. When it uses a given amount of power, message is delivered to the user through GSM. Afterwards, we may choose whether to use the electricity produced by the Photo Voltaic panel or to continue using the AC supply. Using an application, this procedure is carried out. Hence, by switching to grid electricity whenever it is appropriate, we may reduce the cost of our electricity bill.

V. CONCLUSION

As domestic Home have installed renewable energy sources to save the energy cost, it's important that both energy consumption and generation are contemporaneously considered in ends. This paper proposes the smart ends armature that considers both consumption and generation. In the energy consumption, the EMCUs are installed in outlets and lights to measure the energy exercises of Home appliances and lights grounded on ZigBee; they transfer the gathered data to the Home ramify. With this scheme, the Home garçon figures out the Home energy operation pattern. In the energy generation, PLC modems are installed in each solar panel to cover its status. The REG gathers the status data of the solar panels grounded on PLC and the generation data from inverters grounded on RS- 485; it transfers the gathered data to the home garçon. This PLC monitoring technology

can cover each solar panel for conservation. The home garçon can estimate the energy generation grounded on a rainfall cast. Using the attained energy information, the home garçon can control the home energy use schedule to minimize the energy cost. druggies can pierce the home energy information through smart bias. The ends provides the comparison and analysis of each home energy operation. By considering both consumption and generation, the proposed armature is anticipated to enhance home energy operation and to save the energy cost.

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