SOLAR BASED SMART HOME SYSTEM

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ABSTRACT

Considering the problem of generation of the ac supply we can design a system which can utilize the solar power. Due to the usage of solar power for home appliances will reduces the usage of ac mains. This system results into the efficient use of renewable energy. This system will be used to overcome the problem of load shedding and reducing the electricity bills. The system consist of solar dc power can be converted into ac power using the solar micro grid inverter. The synchronized output is given to the microcontroller and the source of supply will be selected automatically according to the requirements of load and current status of the sources. Advanced facility like GSM will allow the user to control various appliances just through a message. Daily report of usage of power through individual source will be given to the user by a text message. Various parameters like voltage, current, power consumption will be displayed on a LCD to give the notification of current status of the system.

Keyword: - *Solar, GSM, LPC2138;*

1. INTRODUCTION

The term "smart grid" refers to the use of technologies and tools that help electric utilities better meet consumer's needs reliably and affordably by more effectively monitoring power usage demand and system conditions on a near real-time basis. The smart grid combines digital devices, software applications and two-way communications that allow utilities to track the flow of electricity with great precision, and apply logic to relays according to the situation of input. It can also let utilities record consumer electric use in various time intervals and provide consumers with energy usage data.

Considering the problem of generation of the ac supply, we aim to design a system, which can utilize the solar power. Due to the use of solar power for home appliances requirement the grid's power will be reduced. This system results into the efficient use of renewable energy. This system will be used to overcome the problem of load shedding and reducing the electricity bills.

The system consisting of solar dc power can be converted into ac power using the solar micro grid inverter. The synchronized output is given to the ARM and the source of supply will be selected automatically according to the requirements of load and status of the sources. Advanced facility like GSM will allow the user to control various appliances just through a message. Daily report of usage of power through individual source will be given to the user by a text message. Various parameters like voltage, current, power consumption will be displayed on a LCD to give the notification of status of the system.

1.1 Photovoltaic solar system:

A rooftop photovoltaic power station, or rooftop PV system, is a photovoltaic system that has its electricity-generating solar panels mounted on the rooftop of a residential or commercial building or structure.[1] The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other electrical accessories.

Rooftop mounted systems are small compared to ground-mounted photovoltaic power stations with capacities in the megawatt range. Rooftop PV systems on residential buildings typically feature a capacity of about 5 to 20 kilowatts (kW), while those mounted on commercial buildings often reach 100 kilowatts or more.

2. LITERATURE SURVEY

Existing system:

Modern world demands for more and more energy, but there is a limit for sources to provide it. In order to meet the growing demand for energy, we need to find new resources and allocate them efficiently. Fig 1 shows Traditional analog electricity meter. This electricity meter makes use grid's energy to provide electricity to the consumers.

Fig-1: Traditional analog electricity meter

Proposed system:

Fig-2: Grid tie solar system

As shown in fig.2 Grid tie solar system makes use of both the solar energy and Grid's energy. This system consists of solar panel, which is used to generate the solar energy.

Inverter takes the input from solar panel and Grid to synchronize them. Inverter then forward this sync output to various household appliances. With the smart metering, we can utilize maximum solar energy and measure the consumption from individual sources. Smart grid consists of a power grid with both renewable and non-renewable sources of energy like solar.

Proposed project, smart home system based on GSM technology is capable of load management. This system consists of relays, energy sources and load. Communication between consumer and system is achieved through GSM module.

3. SYSTEM ARCHITECTURE

The implemented system consists of a microcontroller (LPC2138) as a main processing unit for the entire system and all the components are interfaced with the microcontroller.

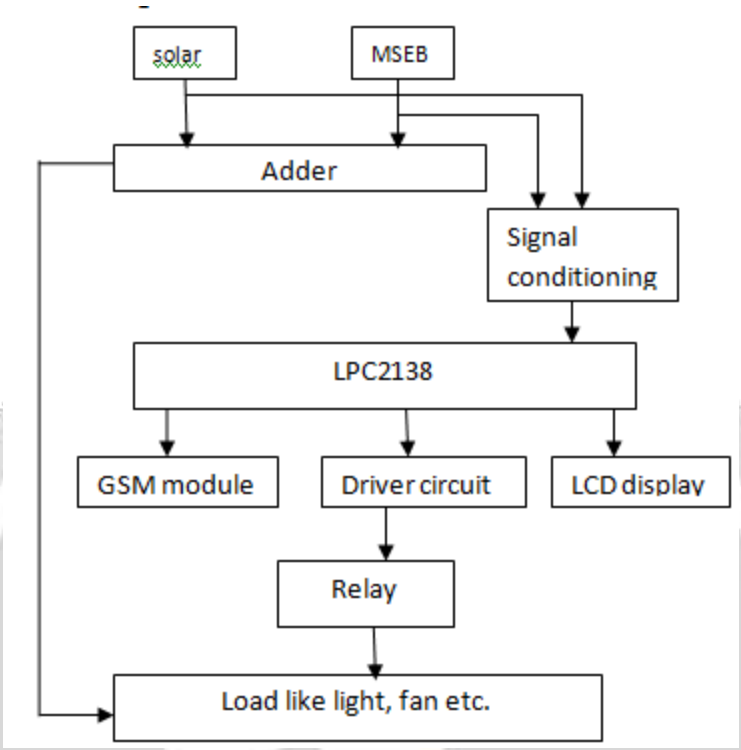

Fig-3: Block diagram of system

First, the LPC2138 checks whether grid is providing supply or not. If grid is on then the synchronizer inverter takes the input from solar panel and grid. Inverter gives a synchronized output of solar and grid. This inverter provides an output, which consists of solar power and power from grid. This output is then step down and provided to the LPC2138 using signal-conditioning circuit. This signal conditioning circuit consists of current and voltage sensing circuit.

With the help of LPC2138 and logic used in the code, input current and voltage are measured and displayed on LCD. The driving circuit is consists of ULN driver, relay. These devices are used to drive the home appliances. GSM module is used to provide the facility of daily report of consumed power. It makes the system smart and user friendly.

When grid (MSEB) fails to provide the power, then LPC2138 switch the source from grid to the solar. The output from these sources is also passed through a signal condition circuit to the LPC2138. The process after this is similar to the working as explained above. In this way, this system provides a smart and cost effective way of electricity supply.

3.1 LPC2138

The LPC2138 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at maximum clock rate.

For critical code size applications, the alternative 16-bit thumb mode reduces code by more than 30% with minimal performance penalty. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

With a wide range of serial communications interfaces and on-chip SRAM options of 8kB,16kB and 32kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit 8-channel ADC(s), 10-bit DAC, PWM channels and 47 GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

Specifications:

- Single 10-bit DAC provides variable analog output.
- Two 32-bit timers/external event counters. and watchdog.
- 32 kHz clock input.
- Two UARTs (16C550), two Fast I2C-bus (400 kbit/s).
- 60 MHz maximum CPU clock available.

3.2 Relay

Relay is an electrically operated switch many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Specifications:

- Operation temperature range –30 °C to +55 °C
- Operation time 10 ms
- Operating voltage 12V
- Max allowable voltage 250V

3.3 LCD 20X4

Most of the basic display unit will indicate empty, half, full with analog display but the market available digital display units were displays the information in terms of percentage but our proposed method will displayed in terms of exact fuel level and these information are preprogrammed according to the sensor positional values.

The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.

3.4 GSM Module

The SIM900A is a complete Quad-band GSM/GPRS solution in a SMT module, which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

SIM900A is designed with a very powerful single-chip processor integrating AMR926EJ-S core Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm SMT type suit for customer application An embedded Powerful TCP/IP protocol stack Based upon mature and field-proven platform, backed up by our support service, from definition to design and production.

SIM 900A Features:

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Dimensions: 24* 24 * 3 mm
- Weight: 3.4g

4. SYSTEM FUNCTIONALITY

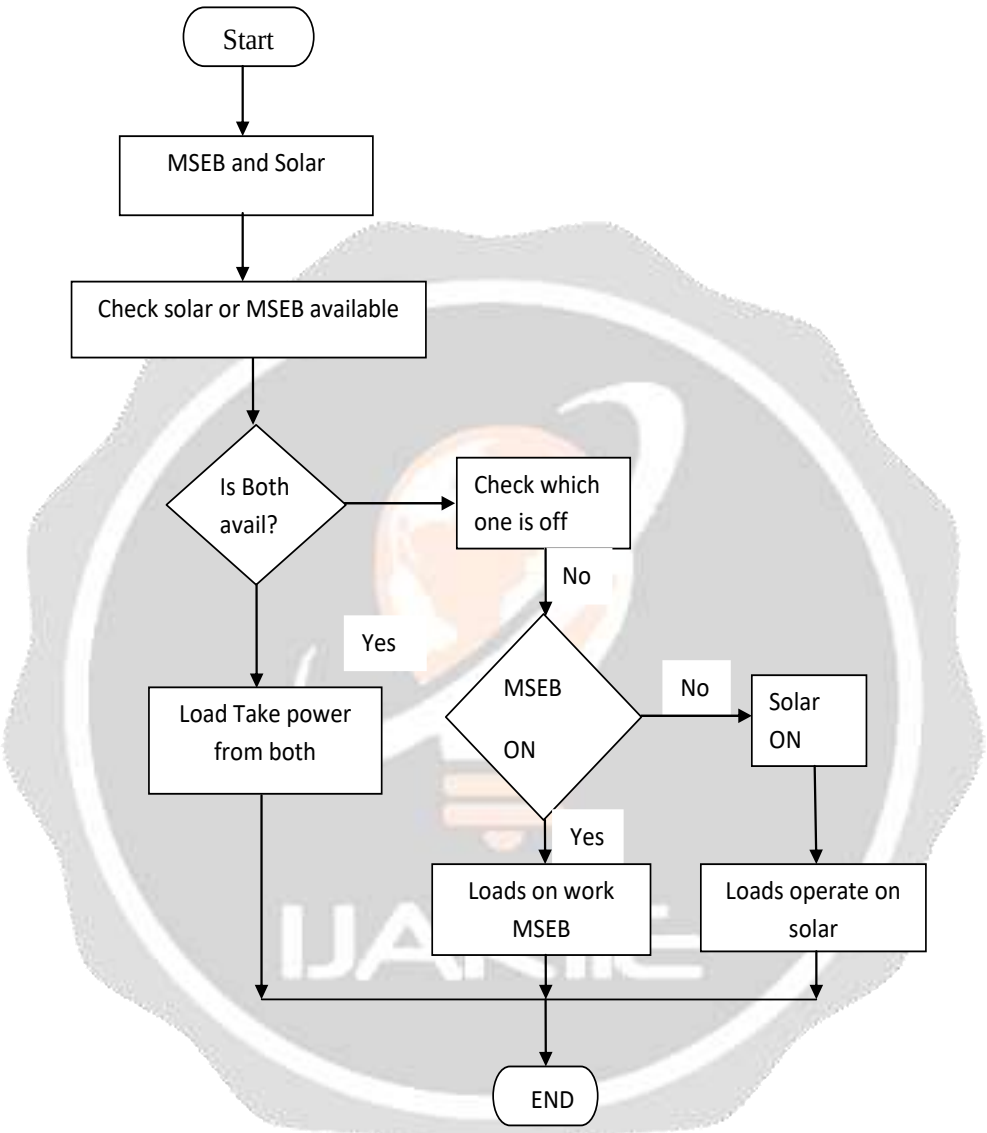

Fig-4: System Flowchart

5. CONCLUSION

This project will provide an economical and smart way of operating electrical power. With the use of solar energy, we have accomplished to make this system more efficient than the traditional systems. The GSM module has helped us providing communication.

This project provides a module, which makes the electrical system cost effective by using a renewable source of energy i.e. solar energy. In addition, it makes this system user friendly by giving the facility of handling various appliances remotely through just a text message.

6. REFERENCES

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