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Energy Management for Large Society by Using Renewable Energy Sources

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Abstract: *For very long-time power outage, power interrupt and also unexpected routine of power line maintenance is of the major problem faced in industries, hospitals, office and residential areas whole over the world. For that case, this project provides an automatic operation of electrical power distribution system; the rapid and reliable transfer of the system from one power source to another during specific event such as power outage, power interrupt, routine power line maintenance to achieve the reliability of such system. And also, sudden fluctuation in voltage is very big and serious problem in industries and home appliances and it causes losses in electrical circuits. These losses cause low power factor in the supply and by much amount of power is going to be wasted. These fluctuations may significantly impact the power quality as well as the reliability of other voltage controlling devices. Therefore, due to this fluctuation; much costly & precious equipment may get damaged. To avoid all over problems we design system for under over voltage protection, auto power switch between mains and solar power inverter. Here we are using different sensors like voltage sensor, current sensor, PIR and LDR sensor, fire sensor to give input to microcontroller. In this project we will use PIC 18f4520 microcontroller. All parameter will display on LCD display. To control switching between power sources as well as light, sprinkler, load we will use different relays*

Keywords: Renewable Energy, Microcontroller, 3-Phase Sensing, Solar supply

I. INTRODUCTION

Energy usage index indicates the country's state of economy, growth and standard of living. But the rate at which the energy demands and prices are increasing, it may be difficult to get the correct rate of development. The result of the same is to enforce retarding action on the growth and industrialization programs of developing countries like India for the want of sufficient energy reserves. Energy management refers to efforts made to reduce energy consumption. Smart homes hold the potential for increasing energy efficiency, decreasing costs of energy use, decreasing the carbon footprint by including renewable resources. This article presents a discussion of state of the art in electricity management and conserving the renewable energy sources.

Power failure or outage has been a major challenge to national development as economic activities are at most times brought to stand still. In addition, there are processes that need not be interrupted because of their importance, such as surgery operation in hospitals, transfer of money between banks and lots more. Most industrial and commercial processes are dependent on electrical power. As industrial processes and IT applications diversify, power consumers have adopted another means of power supply so as to compensate for the inconsistence of the power supply from the power providers, thus the use of Generators since there is need to alternatively supply power from another source as a result the need to combine the use of power supplied by the national Power Supply/Distribution Sector and Generator, leads to the introduction of change-over switch between nations power supply and Generator. The introduction of change over switch proffers the means to change from national power supply to Generator or vice versa but it was manually done. hence this system often results in waste of time and energy. It was faced with a lot of limitations which includes:

i. The stress of turning the metal gear to affect the changeover manually.
ii. Inability to detect the level of the voltage and the sequence of the three phases.

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iii. Inability to select between the phases as in the single-phase consumers

The aim of every electricity supply authority is to affect a continuous, efficient and reliable supply of power to the consumers.

Where this aim is not achieved, there are usually erratic supplies of power which are evident in underdeveloped and developing countries like Nigeria. These regions experience fluctuation in power, phase interruption and sometimes total power failure which adversely affects the economic development. Most times, commercial and domestic houses experience damages in electrical appliances and downtimes as a result of the epileptic nature of power supply.

1.1 Objective

Objective of this project is the reliability and continuity in utility power supply, there is increased need for automation of phase switch (during phase failure) between the utility power supply and the alternative channels (power failure) to back up the utility power supply.

The aim of every electricity supply authority is to affect a continuous, efficient and reliable supply of power to the consumers costly.

II. LITERATURE SURVEY

Raugei and Frankl (2009) proposed three alternative scenarios for the future development of PV systems from the current time to year 2050, and they argued that these scenarios are likely to play an important role in the future energy mix. Fthenakis et al. (2009) used hourly load data for the entire US, as well as 45-years of solar irradiation data, and proposed a plan based on PV and CSP technologies.

Table 1: Literature Survey

Authors	Subject	Result
Frankl et al. (1997)	Life cycle analysis of PV systems in buildings	They estimated CO_2 yields of 2.6 and 5.4 for conventional PV power plants and building-integrated systems.
Oliver and Jackson (1999)	Market for photovoltaic	Satellites, remote industrial, remote communities, solar home systems, remote houses, and consumer products could be considered niche markets for solar PV.
Nieuwenhout (2001)	Experience with solar home systems in developing countries	Lack of user experience, negative impacts of subsidies, limited choice of size, and insufficient market transparency appear to present difficulties.
Kolhe et al. (2002)	Economic feasibility of solar PV compared with diesel in India	PV systems have the lowest cost up to 15 kWh and can be increased to 68 kWh/day. Break-even point increases if the cost of PV decreases and diesel costs increase.
Waldau (2006)	European PV in worldwide comparison	Reliable political framework is required to ensure returns on investment and need more research to find cost effective materials, device designing, and increase efficiency.
Nawaz and Tiwari (2006)	Energy analysis of PV based on macro- and micro level in India	It is estimated that EPBT is in the range of 7-26 years and CO_2 emission reductions by existed technology are calculated in the range of 18-160 kg/m^2/year.
Fthenakis and Kim (2007)	GHG emissions from solar and nuclear power	GHG emissions (based on CO_2 equivalent) are 22-49 g/kWh (average US) and 17-39 g/kWh (southwest) for solar energy and 16-55 g/kWh for nuclear power.
Ito et al. (2008)	Study on cost and life cycle analysis for very large scale PV	EPBT is 1.5-2.5 years and CO_2 emission rate is 9-16 g/kWh. Generation cost is estimated 11-12(19-20) US Cents/kWh for using 2(4) USD/W PV modules.
Fthenakis et al. (2008)	Emissions from PV life cycle	Thin-film cadmium telluride has the fewest emissions among the four types of technology. The differences in emissions for various PV technologies are too small.
Feltrin and Freundlich (2008)	Material consideration for terawatt level deployment of PV	In spite the availability of silicon, crystalline Si-based solar cells could not be reach the terawatt level easily in a large scale-up of technology.
Raugei and Frankl (2009)	Life cycle impacts and costs of PV systems	If economic incentives are continued for the next two decades, PV systems are likely to play a significant role in the future energy mix.
Fthenakis et al. (2009)	Feasibility for solar energy to supply the energy needs of the US	Solar power has the capability to supply 69% of total electricity and 35% of total energy demands in US by 2050. It could be increased to 90% by 2100.
Huo et al. (2011)	Relationship between PV market and its manufacturing	Growth of market sale affects the innovation scale in the US, Germany and Japan. Feasibility of solar PV system will be increased in the future as it expands geographically.

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In a recent study, Huo et al. (2011) applied the Granger causality relationship between PV market sales and manufacturing development in the US, Germany, China and Japan. The results show that the growth of market sale affects the innovation scale in the US, Germany and Japan. Also, there is a bidirectional relationship between PV market sales and manufacturing development in the US and Germany.

Market interests to expand renewable energy use, including solar power, has increased globally. Oliver and Jackson (1999) proposed certain markets as the main markets for solar PVs. They proposed that satellites, remote industries, remote communities, solar home systems, and remote houses could be considered niche markets for solar PV power. Nieuwenhout (2001) investigated experimental evidence for solar home systems (SHS) in developing countries and found that an adequate level of service infrastructure is required for the viability of solar PV projects.

III. PROPOSED SYSTEM

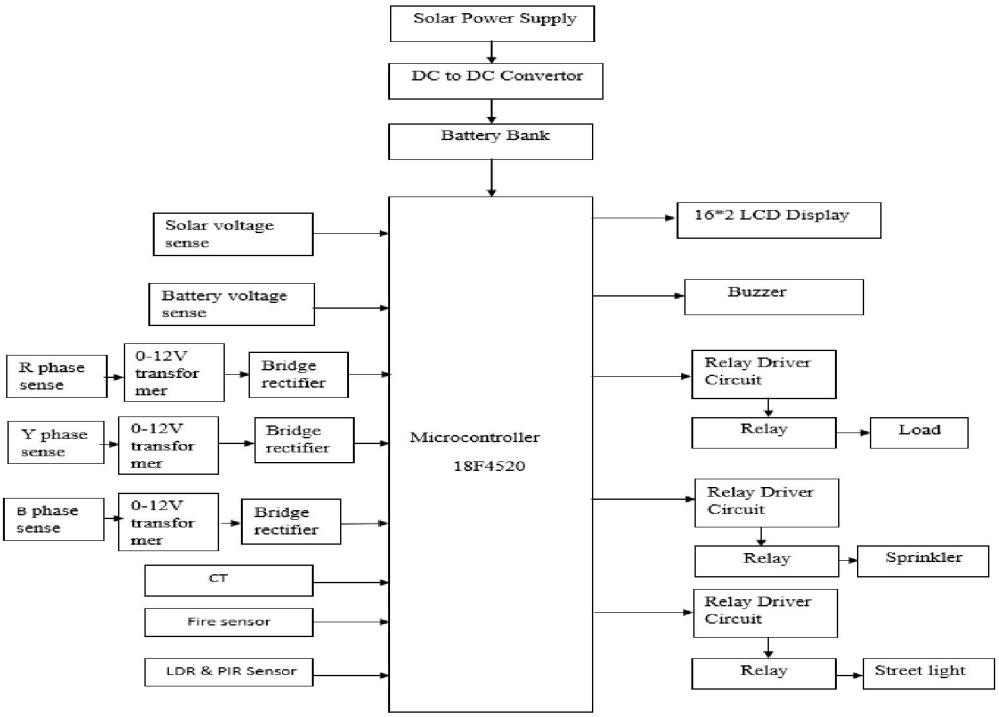

Fig. 1. Block Diagram

3.1 PIC 18f4520 Microcontroller

It is an 8-bit enhanced flash PIC microcontroller that comes with nanoWatt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

- Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF
- Divided into 256-byte banks
- There are total of F banks
- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bit
- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.
- Program memory stores the program and also static data in the system.

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- On-chip External
- On-chip program memory is either PROM or EEPROM.
- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).
- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig. 1. PIC18f4520

3.2 Current Sensor

Here A current sensor is a device that detects and converts current to an easily measurable output voltage, which is proportional to the current through the measured path. There are a wide variety of sensors, and each sensor is suitable for a specific current range and environmental condition. Among these sensors, a current sensing resistor is the most commonly used. It can be considered a current-to-voltage converter, where inserting a resistor into the current path, the current is converted to voltage in a linear way. The technology used by the current sensor is important because different sensors can have different characteristics for a variety of applications.

Current sensors are based on either open or closed loop hall effect technology. A closed-loop sensor has a coil that is actively driven to produce a magnetic field that opposes the field produced by the current being sensed. The hall sensor is used as a null-detecting device, and the output signal is proportional to the current being driven into the coil, which is proportional to the current being measured.

Fig. 3. Current Sensor

3.3 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

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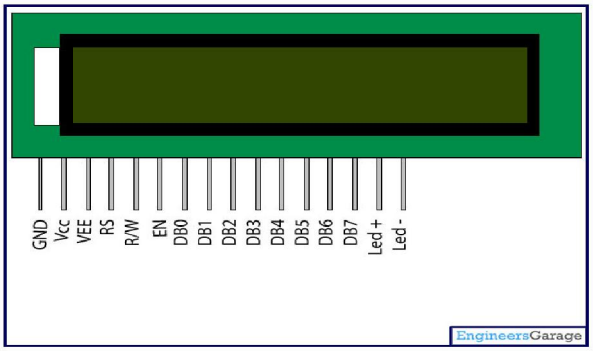

Fig. 4. LCD Display

3.4 Relay

A relay is electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. 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. A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw(changeover) switch contacts as shown in the diagram. Normally Open (NO): Contacts connect the circuit when the relay is activated, the circuit is disconnected when the relay is inactive. Normally Closed (NC): Contacts disconnect the circuit when the relay is activated, the circuit is connected when the relay is inactive. Change Over (CO): It's the common contact. Coil: It's the electromagnet coil inside relay. Coil rating: It's the Voltage at which the coil gets fully activated. Some also have coil resistance mentioned on them. Relay coil voltage rated 6V and 12V are the most commonly available.

Fig. 5. Relay

IV. CONCLUSION

Significant steps should be taken to reduce all kinds of energy losses. In India about 23% of energy is lost during transmission and distribution. This can be curtailed by adopting certain measures. One should use energy knowing that today's wastage will be tomorrow's shortage. Let's nurture the nature so that we can have better future.

V. ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on "Energy Management for large society by using Renewable Energy Sources". We would like to take this opportunity to thank our guide, Prof. Kanawade M.T., Assistant Professor, Department of Electronics and Telecommunication Engineering Department, Amrutvahini Collage of Engg., Sangamner for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful.

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