PROJECTS OF PIC MICROCONTROLLER

PIC Microcontroller based projects

Solar Street Light(Inverter) PIC based

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Project Cost:

Project Code: 3110

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You will get a CD with this project

CD contains following things with fully assembled project:

1. Project report
2. Circuit diagram of the project
3. PCB layout of the project
4. PIC Microcontroller program in embedded C language
5. Datasheets of all ICs used in the project

1.1 AIM OF PROJECT:

Our aim is to design and implement Solar Street Light system to drive a load using solar energy.

1.2 RECENT TRENDS AND DEVELOPMENTS IN FIELD:

Existing techniques for solar based inverter and charger systems rely typically on one of the following methods:

1. One of the methods makes use of comparator to provide automation for inverting and charging process. This reduces the battery life and it affects efficiency of system.
2. Another problem with existing system is, CFL lamps used as load suffers from the starting problem in winter season.
3. Existing systems does not include sufficient protection circuitry.
4. Provide Locking Period to inverter. Locking period means once battery becoms low load i.e. CFL should be turn off when load is reduced from battery voltage of battery gets slight increased so controller will again sense battery vtg and turn on load at this time battery vtg is again become low so load will again turn off this again and again turn on and turn off of CFL will cause cfl damage and so decrease life of cfl.

But in our project we are using Microcontroller instead of comparators for automation purpose, which will improve accuracy and efficiency of system.

To deal with starting problem of CFL lamp, we are going to use pre-heating condition.

Our system is well equipped with protection circuitry such as,

1. Over voltage/ current protection.
2. Reverse voltage protection.

Project list

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Categories

- Automation System
- Energy saver
- GPS projects
- GSM projects
- Power Saving
- RFID based projects
- Security System
- Solar energy
- Uncategorized
- Wireless Communication

3. Reverse polarity protection.

1.3 LITERATURE SURVEY:

Criteria for choosing Micro controller:

1. The first & foremost criterion in choosing a Micro controller is that it must meet the task at hand efficiently & cost effectively. In analyzing the needs of a Micro controller based project, we must first see whether an 8-bit, or 16-bit, or 32-bit Micro controller can best handle the computing needs of the task most effectively. Among other considerations in the category are:

- Speed: What is the highest speed that the Micro controller supports?
- Packaging: Does it comes in 40-pin DIP (dual in line package) or 28-pin DIP or a QFP (quad flat package) or some other packaging format? This is important in terms of space, assembling & prototyping the end product.
- Power consumption: This is especially critical for battery-powered products.
- The amount of RAM & ROM on chip.
- The number of I/O pins & the timer on the chip.
- Cost per unit: This is important in terms of the final cost of the product in which a Micro controller is used.
- How many inbuilt function it has?

2. The second criterion in choosing a micro controller is how easy it is to develop products around it. Key considerations include the availability of an assembler, debugger, a code – efficient c language compiler, emulator, technical support, and both in-house and outside expertise.

PIC Micro-controller of Micro-chip Corporation:

This popular PIC chip has inbuilt ADC and on-chip ROM in the form of program and data memory. This is ideal for development since flash memory can be erased in seconds compared to the twenty minutes or more needed for the 8751 for this reason the PIC is used in place of the 8751 to eliminate the waiting time needed to erase the chip & thereby speed up the development time. To use the PIC to develop a micro controller based system requires a ROM burner that supports flash memory; however, a ROM eraser is not needed. Notice that in flash memory you must erase the entire contents of ROM in order to program it again. PROM burner itself does this erasing of flash & this is why a separate eraser is not needed.

Voltage Regulator 7805:

We need the regulated 5 V output for the most of the IC's used in our system. Now the output of bridge rectifier is unregulated DC. To get 5V regulated DC output from it we have used regulator IC 7805. The 7805 is designed with adequate heat sinking and can deliver output currents in excess of 1A. It has internal thermal overload protection and internal short circuit current limiting. For proper operation a common ground is required between input and output voltages.

CHAPTER 2: THEORETICAL DETAILS OF TOPIC

2.1 NEED OF PROJECT:

As whole world is facing a problem of global warming and energy crisis, our project will help to reduce these problems by using solar energy to generate electricity. Solar energy is a infinite source of energy.

Main motto of our project is to promote use of renewable energy sources.

2.2 NEED OF A SOLAR SYSTEM:

Photovoltaic's is the field of technology and research related to the application of solar cells as solar energy. Solar cells have many applications. Individual cells are used for powering small devices such as electronic calculators. Photovoltaic arrays generate a form of renewable electricity, particularly useful in situations where electrical power from the grid is unavailable such as in remote area power systems, Earth-orbiting satellites and space probes, remote radiotelephones and water pumping applications. Photovoltaic

electricity is also increasingly deployed in grid-tied electrical systems.

Solar Energy has been the power supply of choice for Industrial applications, where power is required at remote locations. Most systems in individual uses require a few kilowatts of power. The examples are powering repeater stations for microwave, TV and radio, telemetry and radio telephones. Solar energy is also frequently used on transportation signaling e.g. lighthouses and increasingly in road traffic warning signals. Solar's great benefit here is that it is highly reliable and requires little maintenance so it's ideal in places that are hard to get to.

CHAPTER 3: SYSTEM DESIGN

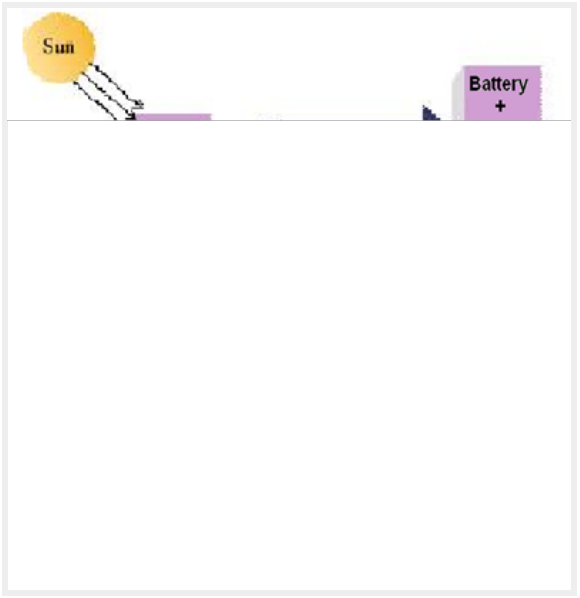

Fig 1: Block diagram of solar system

3.2 BLOCK DIAGRAM DESCRIPTION:

From block diagram we can see that PIC microcontroller is heart of system. Microcontroller automates whole system.

Block diagram mainly includes five major blocks as follows:

1. Solar panel
2. PIC microcontroller
3. Charger
4. Inverter
5. Battery

As shown in the block diagram, solar panel converts solar energy into electrical energy. It is DC signal which is directly given to the charger circuit. Charger circuit charges battery by providing PWM pulses. Battery output is given to Inverter circuit. Inverter circuit is used to convert DC signal into AC signal. This AC signal is used for driving a load.

Feedbacks of all the blocks are given to microcontroller to automate the working of the system.

3.3 BLOCK DESCRIPTION:

The system comprises of following sections:

3.3.1 Solar Cell:

A solar cell, sometimes called a photovoltaic cell, is a device that converts light energy into electrical energy. A

single solar cell creates a very small amount of energy (about .6 volts DC) so they are usually grouped together in an integrated electrical panel called a solar panel. Sunlight is a somewhat diffuse form of energy and only a portion of the light captured by a solar cell is converted into electricity

When the sun rays fall on the solar cell in some particular direction then only we get maximum output .The output of solar cells depends on the intensity of sunlight and the angle of incidence. To get the maximum output the solar panels must remain in front of sun during the whole day. Hence the solar cells are rotated in the direction of sun's position where we get maximum efficiency; the solar cell captures the sun's rays and gives the analog output to the ADC.

Sunlight is made up of packets of energy called photons. When the photons strike the semi-conductor layer (usually silicon) of a solar cell a portion of the photons are absorbed by the material rather than bouncing off of it or going through the material.

When a photon is absorbed the energy of that photon is transferred to an electron in an atom of the cell causing the electron to escape from its normal position. This creates, in essence, a hole in the atom. This hole will attract another electron from a nearby atom now creating yet another whole, which in turn is again filled by an electron from another atom. This hole filling process is repeated a few zillion times and voila, an electric current is formed.

3.3.2 PIC Controller:

This is the heart of the project, as we know the processor is the heart of any project. Here PIC controller takes that job. The chip used is Atme. There are two memory blocks in each of these PIC controllers. The program Memory and Data Memory have separate buses so that concurrent access can occur. The program memory can be read internally using Special Function Resistors in PIC. PIC devices have a 13 bit program counter capable of addressing an 8K word x 14 bit program memory space. The PIC devices have 8K x 14words of FLASH program memory.

Features:

- 28 pin, 8 bit CMOS flash MCU with 8 bit ADC.
- Only 35 instructions (only single word).
- Operating speed: DC-20MHz clock input

DC-200 nsec instruction cycle.

- Interrupt capability.
- High sink/source current: 25mA.
- Capture, Compare, PWM module.
- Synchronous serial port with SPI and I2C.
- Brown out reset (BOR), Power on reset (POR).
- Watchdog timer.
- Low power consumption.
- Programmable code protection.
- In-circuit Serial Programming (ICSP).
- Inbuilt Debugger.

3.3.3 CHARGER:

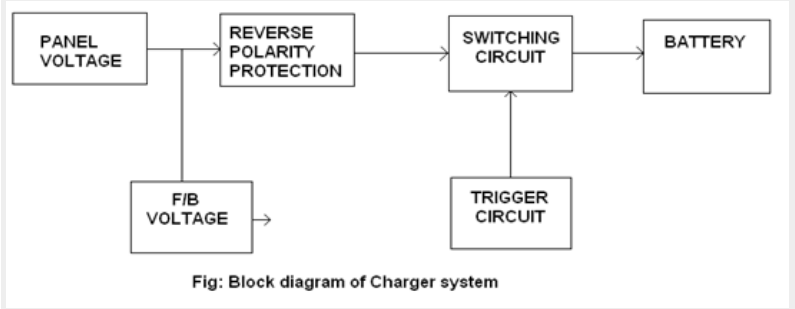

Fig: Block diagram of Charger system

Panel output voltage is given to charger system. Charger provides PWM pulses to battery to get charged.

Working:

We get DC voltage from panel. It is then converted into pulses by using switching circuit which gets triggering pulses from triggering circuit. These pulses are used to charge battery. The panel feedback voltage is given to the micro-controller for automation purpose. Charger system mainly includes following blocks:

Reverse polarity protection: It is used to protect panel from reverse voltage when panel voltage is zero and battery voltage is high. Schottky diode is used for reverse polarity protection.

Switching circuitry: It is used to convert constant DC voltage obtained from panel into pulses. Power MOSFET is used for switching purpose.

Driver / Trigger circuit: It is mainly used for making Power MOSFET ON/OFF. Power transistor is used for triggering purpose.

Charging methods:

Our project provides advance charging methods to improve overall performance of battery. These methods are as follows.

Trickle charging:

This method is used to charge the battery in slow and steady rate. This method is provided when battery voltage is near about maximum voltage. It provides PWM charging pulses having large OFF period.

Boost charging:

This method is used to charge battery at rapid speed. In rainy season when there is insufficient sunlight, battery voltage is dropped at very low level due to less charging and high utilization. Boost charging provides PWM charging pulses having large ON period.

3.3.4 INVERTER:

Inverter circuit is mainly designed to convert DC signal into AC. We are going to use push-pull amplifier and pulse transformer to design the inverter.

3.3.5 BATTERY AND LOAD:

We are using lead acid rechargeable battery of capacity 12v/7Ahr. OSARAM Company's CFL lamp is used as a load.

4.1 OVERALL WORKING OF SYSTEM:

Maximum solar panel voltage (16 volt) is set as reference voltage. During day time when panel voltage exceeds 3.7 volt, it will be the indication for charger to start charging battery. If panel voltage falls below 3.4 volt that is during night condition or rainy season when sunlight is not sufficient, it is the time to switch OFF the charger and inverter will be turn ON to drive load.

As soon as battery voltage reaches to maximum capacity of 14.8 volt, charging is to be stopped to protect battery from over charging and hence battery life is secured. If battery voltage falls below 13.5 volt micro-controller gives signal for charger to start charging process.

During rainy season intensity of sunlight could not be consistent to charge the battery. And inverter could be on for long period. In this condition utilization of battery is more than charging. So when battery voltage is lower than 10.8 volt micro-controller gives indication to stop the inverter. This will improve the battery efficiency.

In the winter season CFL lamps suffers from starting problem because of decrease in temperature. To overcome this problem pre-heating condition is provided in winter season. In this process high frequency of 42 kHz low current is supplied to CFL lamp to get heated before start working. This improves life of CFL lamp.

6.1 ADVANTAGES:

As whole system runs on solar energy there is no need of electricity.

- System does not contribute to pollution due to use of renewable energy source.
- Maintenance cost of the system is very low.
- Accuracy and efficiency is very high due to micro-controller based automation.
- System is reliable than existing system.
- The operator interference is minimal since the system is automated this increases efficiency of the stationary solar system.

6.2 DISADVANTAGES:

Initial cost is high.

6.3 APPLICATION:

Industrial applications:-

1. Shop floor lights can be powered by this system; just we have to increase the capacity system.
2. We can provide power supply for small offices; containing pc, ac, tubelights, etc.
3. Now days space shuttles also uses this type of systems for energy fulfillment.

Domestic applications:-

1. We can automate parking light on this system.
2. Home appliances like TV, PC can be powered by this system.
3. Street light system can be automated in villages through this system.

BY ROHITG IN ENERGY SAVER, POWER SAVING, SOLAR ENERGY ON OCTOBER 2, 2012.

← AUTOMATED TOWN WATER MANAGEMENT SYSTEM SOLAR INTELLIGENT CHARGER (AUTOSELECT 12 – 24V) →

5 Comments

anuja REPLY
JANUARY 28, 2013 AT 10:33 AM

send cost of above project

ketki REPLY
FEBRUARY 3, 2013 AT 8:19 AM

plz give the details of the inverter circuit

ketki REPLY
FEBRUARY 3, 2013 AT 8:23 AM

cost prize of project

VIGNESHWARAN REPLY
MARCH 11, 2013 AT 2:27 PM

please give full details about the boost converter and inverter and also cost of that project.

S P Thale REPLY
APRIL 12, 2013 AT 2:57 AM

Pls send cost and also circuit of the same

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