PROJECTS OF PIC MICROCONTROLLER

PIC Microcontroller based projects

Solar Based Home Automation System

Project Cost: Rs.15000

Project Code: 3*

Available in: 12 Days

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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

INTRODUCTION :

1.0 Introduction

This chapter describes about the project's introduction. It consists of overview of the project, the project aim, objectives and scopes of the project.

1.1 Project Overview

This project is about to develop and fabricate the circuit that can charge the lead acid battery when in day by using solar as the source. To control the circuit of the charging, we used the circuit charging that can implement the condition of the charging whether it's in charging condition of in float condition. When charging condition, red LED will turn on until the battery reach the full charge that is in floating condition, when floating, green LED will turn on. For the switching to the load, I used PIC16F72 to switch on the lamp, by using the sensing circuit, the PIC16F72 will determine whether is in daylight or in night by determination of ADC in that come from the sensing circuit. The value to determine the intensity of the light we had set up it into the coding of the PIC.

When PIC gets the input from ADC, PIC gives the output to the relay to switch on the light. When night change to day, sensing circuit sense the panel voltage and ADC will convert to digital form which is required for PIC, PIC will give the output to switch off the lamp and the charging circuit will continue charge the battery for the day.

1.3 AIM OF PROJECT:

Our aim is to design the systems, which will Provide Light facility in home. we are designing cheapest battery charger and inverter using the set of solar cells.

1.4 Scope Of The Project:

The scope of the project includes construct the circuit in order to charge the 12V lead acid battery. The acid battery will supply power to switch the lamp when there is no light or night condition. Integration between sensor and wave sensor was also concentrated in development of this system. In order to control the circuit for

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switching the PIC16F72 was developed. Finally, the system will combined together to complete the development of the system

LITERATURE REVIEW :

2.1 Solar energy

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Solar radiation is secondary resources like as wind and wave power, hydroelectricity and biomass account for most of the available flow of renewable energy on Earth.

Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes.

Solar energy refers primarily to the use of solar radiation for practical ends. All other renewable energies other than geothermal derive their energy from energy received from the sun.

Solar technologies are broadly characterized as either passive or active depending on the way they capture, convert and distribute sunlight. Active solar techniques use photovoltaic panels, pumps, and fans to convert sunlight into useful outputs. Passive solar techniques include selecting materials with favorable thermal properties, designing spaces that naturally circulate air, and referencing the position of a building to the Sun. Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the need for alternate resources and are generally considered demand side technologies.

2.2 Photovoltaic Cell:

Photovoltaic energy is the conversion of sunlight into electricity. A photovoltaic cell, commonly called a solar cell or PV, is the technology used to convert solar energy directly into electrical power. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity.

When enough sunlight energy is absorbed by the material that is a semiconductor, electrons are come out from the material's atoms. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface. When the electrons leave their position, holes are formed. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery.

When the two surfaces are connected through an external load, electricity flows.

2.3 Battery Charger:

A battery charger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it.

The charge current depends upon the technology and capacity of the battery being charged. For example, the current that should be applied to recharge a 12 V car battery will be very different from the current for a mobile phone battery.

A simple charger works by connecting a constant DC power source to the battery being charged. The simple charger does not modify its output based on time or the charge on the battery. This simplicity means that a simple charger is inexpensive, but there is a tradeoff in quality. Typically, a simple charger takes longer to charge a battery to prevent severe over-charging. Even so, a battery left in a simple charger for too long will be weakened or destroyed due to over-charging. These chargers can supply either a constant voltage or a constant current to the battery.

Pulse Width Modulation (PWM) is the most effective means to achieve constant voltage battery charging by

switching the solar system controller's power devices. When in PWM regulation, the current from the solar array tapers according to the battery's condition and recharging needs.

PWM solar chargers use technology similar to other modern high quality battery chargers. When a battery voltage reaches the regulation set point, the PWM algorithm slowly reduces the charging current to avoid heating and gassing of the battery, yet the charging continues to return the maximum amount of energy to the battery in the shortest time. The result is a higher charging efficiency, rapid recharging, and a healthy battery at full capacity.

2.4 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 is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Programmable Interface Controller", but shortly thereafter was renamed "Programmable Intelligent Computer".

PIC are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability .

PIC16F72 is a small piece of semiconductor integrated circuits. The package type of these integrated circuits is DIP package. DIP stand for Dual Inline Package for semiconductor IC. This package is very easy to be soldered onto the strip board. However using a DIP socket is much easier so that this chip can be plugged.

2.5 Solar Powered CFL System

With recent advances in compact fluorescent lamps, CFL technology appeared to be a logical choice for consideration in this project. Today's compact fluorescent lamps come in a wide variety of shapes and sizes. The lamps offer enhanced brightness with a greatly reduced input power requirement. For example, a 14W CFL can give the equivalent light output of a 65W incandescent lamp and have an eight-year life. CFLs require a ballast to turn on the lamp (provides a high voltage) and once 'ignited' the current through the lamp drops. Many CFLs available today come with the ballast as an integral part of the lamp, which allows them to be used in standard light fixtures. Unlike LED's though, CFLs require a high voltage of 100 to 120Vrms. Since it was desirable to have a 12V system that allowed the use of a standard 12V solar panel, a high voltage inverter would need to be developed. A large portion of the project was spent developing a high-efficient DC to AC inverter with a low harmonic content. The experimental results of this research have been disseminated through five publications in IEEE International Conferences and Symposiums.

III. 1 CFL Selection

Several types of compact fluorescent lamps were tested in the lab. In choosing the number of lamps, the style of lamp, and the lamp power, the following factors were considered:

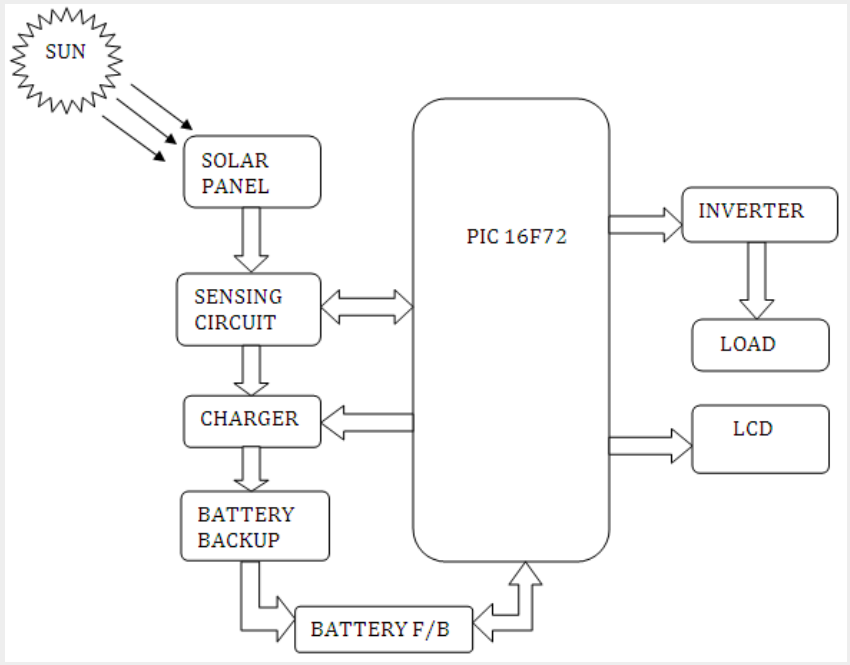
Require sufficient brightness with uniform illumination for the entire 15 ft X 9ft sign.

Desirable that lamp can be mounted in a standard weather proof light fixture.

Use low wattage lamps to keep solar panel size to a minimum.

CFLs in a standard floodlight packaged provided the best uniform coverage of light. The CFL floodlights come with the electronic ballast as an integral part of the lamp, allowing them to be used in a standard screw-in floodlight fixture .

3.1 BLOCK DIAGRAM OF SOLAR HOME LIGHT SYSTEM



3.2 Block Diagram Description:-

Solar Array – The solar array consists of one or more PV modules which convert sunlight into electric energy. The modules are connected in series and/or parallel to provide the voltage and current levels to meet your needs. The array is usually mounted on a metal structure and tilted to face the sun.

PIC16F72 – The aim of the controller is to prevent the battery from overcharge and over discharge. Life of battery is longer if it is saved from overcharging and over discharging. The controller has some inputs and outputs. Photovoltaic cells absorb the sun lights and produce voltages. This voltage value comes to the controller via. sensing circuit. This voltage is converted in digital form by internal ADC which is required for PIC for processing. The voltage of battery is measured every time by the controller. These input values are processed inside the controller. After the inputs are processed, it gives output voltages to electrical load.

Battery Charger

A battery charger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it.

Its function is to regulate the power flowing from a photovoltaic panel into a rechargeable battery.

Boost Charging:

The highest charge current is sent to the batteries until the battery is 80-90% charged.

Trickle Charging:

During ***Trickle*** charge, voltage is maintained to specified level. The purpose of float charge is to keep a charged battery from discharging, thus enhancing battery life.

The result is a higher charging efficiency, rapid recharging, and a healthy battery at full capacity.

Battery Bank: – The battery bank contains one or more deep-cycle batteries, connected in series and/or parallel depending on the voltage and current capacity needed. The batteries store the power produced by the solar array and discharge it when required

Battery provides DC supply to the inverter. DC is converted into 230V AC supply.

Inverter:–

Inverter is a kind of converter which converts DC voltage to AC voltage. It uses the battery voltage for converted AC voltage and also it use as need as energy from the battery. Inverters try to produce an AC voltage as similar to the shape of sinus waveform. Usually some inverters try to be similar to this sinus waveform with alone square waveform. On the other side inverters which uses the method of modify sine wave provide this similarity with increasing number of square waves it seems to be step. Although true-sine inverters exactly simulate sine wave, nearly all-home use devices work with modify-sine wave.

An inverter includes basically;

1. Electronic rectifier
2. Frequency changer
3. Power circuit
4. Automatic control components

AC and DC Loads – These are the appliances (such as lights or radios), and the components (such as water pumps and microwave repeaters), which consume the power generated by your PV array**.**

LCD Display:

In this we are going to monitor battery voltage, panel voltage, battery backup time will be displayed on LCD.

Most of the projects with the any processor/microcontroller CPU (8085/8051/ARM) require some form of display. In market various displays are available like 7-segment, 5*7 matrix LED and LCD, bar graph, LCD, etc. It's important for deciding the required display set for our project. Selection of display depends on various factors like power consumption, ambient light conditions, surrounding temperature, visibility from long distance, total information to be display, cost of display, circuit/lines required for display interfacing, etc.

Working :

Initially during morning session panel voltage is greater than 3.7V. By sensing this voltage charger will going to on. In this when battery voltage is very low we do the charging by boost charging method. When battery voltage reaches at specific level i.e. 14.5V trickle charging will going to on to keep the battery voltage at specific level. In this we are going to monitor battery voltage, panel voltage, battery backup time will be displayed on LCD. Also we are going to operate CFL's on AC voltage generated by inverter circuit. In this inverter circuit we are going to provide pre heating and running condition to maintain the CFL's efficiency.

- The PIC controller receives analog input from panel.
- The maximum voltage which can be obtained from solar cell is set as reference voltage in PIC controller.
- Panel voltage is compared with reference voltage if (panel voltage > 3.7v) then charger must be on for purpose of charging battery.
- Then Panel voltage is compared with reference voltage if (panel voltage < 3.4v) then inverter must be on for purpose of driving load.
- Then Battery voltage is compared with reference voltage if (battery voltage = 14.8v) then charger must be off.
- Then Battery voltage is compared with reference voltage if (battery voltage = 13.5v) then charger must be on.
- In this we are going to monitor battery voltage, panel voltage, battery backup time will be displayed on LCD.

4.2 Voltage divider network(sensing circuit):-

Since the PIC16F72 can only process digital information, A/D conversion is required. Analog signals, either the voltage from the voltage divider network must be converted to binary numbers that is digestible by the PIC16F72

Since the A/D reference voltage is the voltage supplied to PIC16F72 from the panel voltage, hence the maximum voltage that the PIC16F72 is able to sample is 5V.

4.2.3 Diode

Diode choice is a trade off between breakdown voltage, speed, and forward voltage.

The higher the forward voltage, the more power that will be dissipated and lost.

In case of these transients and the possibility of large output voltages if the load is suddenly disconnected, the diode also must have a high breakdown voltage.

4.2.7 Microcontroller

PIC16F873 is chosen as a microcontroller for the design. This microcontroller is

responsible for all tracker functionality, operating the ADCs deal with the analog section, computing what the power point of the array is, and monitoring the state of charge of the battery. The PIC16F873 is a perfect combination of features, performance, and low power consumption for this application. It has 8K x 14 bytes of flash memory, 368 x 8 bytes of data memory (RAM) and five A/D channel. The two D/A converter pins are used to send the analog voltages (PWMs) back out to set the two DC-DC switching converter to the maximum power point voltage of the PV array. For the five A/D converter channels, one are used to monitor the B.V. currents, one are used to monitor the PV array's voltages.

6 Advantages and future enhancement:

6.1 Advantages:

- No noise
- Easy to install
- Simple to operate
- Pollution free working
- Low maintenance cost
- Generating panel has a long life

BY ROHITG IN UNCATEGORIZED ON OCTOBER 2, 2012.

← LIFT AUTOMATION SYSTEM SOLDIER TRACKING AND HEALTH INDICATION SYSTEM →

2 Comments

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OCTOBER 13, 2012 AT 6:27 AM

can i get some more imformation about it?

Nelson REPLY
FEBRUARY 14, 2013 AT 12:24 PM

Hi. Please can u assist me with the code for this project. Am interested in the project

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