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SOLAR PANEL WITH SOLAR TRACKING DEVICE WITHOUT POWER CONSUMPTION

P.Deepthi Reddy*1, MP. Achsah Pearl*2, R. Thanuja*3, Dr. Shruti Bhargava Choubey*4

*1 Student, Sreenidhi Institute of Science and Technology (SNIST), Affiliated to JNTUH, ECEDepartment, Ghatkesar, Telangana, India
*2 Student, Sreenidhi Institute of Science and Technology (SNIST), Affiliated to JNTUH, ECEDepartment, Ghatkesar, Telangana, India
*3 Student, Sreenidhi Institute of Science and Technology (SNIST), Affiliated to JNTUH, ECEDepartment, Ghatkesar, Telangana, India
*4 Dean-Innovation, Associate Professor, Sreenidhi Institute of Science and Technology (SNIST),Affiliated to JNTUH, ECE Department, Ghatkesar, Telangana, India.

ABSTRACT

The purpose of this project is to design and construct a solar tracker system that follows the sun direction for producing maximum out for solar powered applications using arduino.
Achieving balance between power consumption and power production is a bigger challenge today. The best way to solve this imbalanced equation is to use solar energy as efficiently as possible. The problem in the usage of solar energy is with solar cell panel should be exposed maximum to the sun light. If the solar panel is fixed in a particular direction, then the sun light intensity varies from morning to evening. Moving the solar cell panel in the direction of sun can increase the solar energy generated from the solar cell.
This project consists of few sun light sensors and a motorized mechanism for rotating the panel in the direction of sun. Arduino based control system takes care of sensing sunlight and controlling the motorized mechanism. This system works continuously without any interruption.
The main controlling device of the project is Arduino uno microcontroller which LDR’s and servo motor with panel setup is interfaced. The Microcontroller gets input from LDR sensors regarding the direction of sun and controller process this information and controls the movement of solar panel attached to servo motor. This solar energy is stored into the battery. This system runs with battery power. The Microcontroller is programmed using powerful Embedded C language.

Keywords: solar energy, Microcontroller, Arduino uno, LDR

I. INTRODUCTION

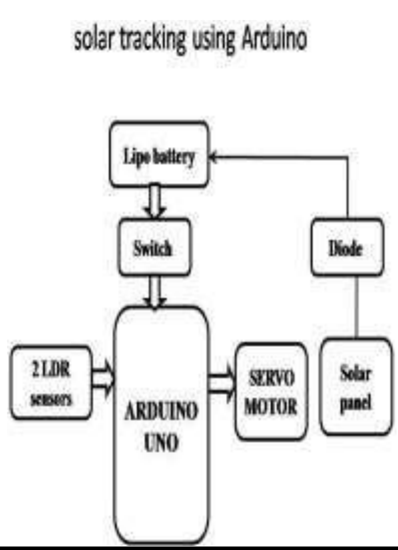
The purpose of this project is to design and construct a solar tracker system that follows the sun direction for producing maximum out for solar powered applications using arduino. Achieving balance between power consumption and power production is a bigger challenge today. The best way to solve this imbalanced equation is to use solar energy as efficiently as possible. The problem in the usage of solar energy is with solar cell panel should be exposed maximum to the sun light. If the solar panel is fixed in a particular direction, then the sun light intensity varies from morning to evening. Moving the solar cell panel in the direction of sun can increase the solar energy generated from the solar cell.This project consists of few sun light sensors and a motorized mechanism for rotating the panel in the direction of sun. Arduino based control system takes care of sensing sunlight and controlling the motorized mechanism. This system works continuously without any interruption.The main controlling device of the project is Arduino uno microcontroller which LDR's and servo motor with panel setup is interfaced. The Microcontroller gets input from LDR sensors regarding the direction of sun and controller process this information and controls the movement of solar panel attached to servo motor. This solar energy is stored into the battery. This system runs with battery power. The Microcontroller is programmed using powerful Embedded C language.

Objectives:

- Design a single axis solar tracker.
- Conservation of Non-Renewable energy sources.
- Maximum output can be obtained.
- Using of arduino to archive this task.

MOTIVATION

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accept the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. The "SOLAR PANEL WITH SOLAR TRACKING DEVICE WITHOUTPOWER CONSUMPTION" using ARDUINO microcontroller is an exclusive project which is used to move the solar cell panel in the direction of sun and can increase the solar energy generated from the solar cell which is stored into the battery.



The main blocks of this project are:

1. Power supply.
2. Arduino uno.
3. Sun light Sensor to sense the sun direction.
4. Motorized mechanism to control the position of solar panel.
5. Servo motor.

Advantages

- It does not cause any environmental pollution like the fossil fuels and nuclear power.
- Solar cells last a longer time and have low running costs
- Low power consumption.
- Conservation of Non-Renewable energy sources.
- Maximum output can be obtained.
- Efficient and low-cost design.
- Low power consumption.
- Fast response.

Disadvantages

- Monitoring and Maintenance is required.
- A drastic environmental change cannot be tolerated by the equipment.

Applications

- This energy can be utilized for simple house hold appliances.
- This energy can be stored and utilized as backup power supply mainly in industry

Methadology

Features:

- High Performance, Low Power AVR® 8- Bit Microcontroller
- Advanced RISC Architecture
- 131 Powerful Instructions – Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20 MHz
- On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
- 4/8/16/32K Bytes of In-System Self- Programmable Flash progam memory

(ATmega48PA/88PA/168PA/328P)

▪ 256/512/512/1K Bytes EEPROM (ATmega48PA/88PA/168PA/328P)

- 512/1K/1K/2K Bytes Internal SRAM (ATmega48PA/88PA/168PA/328P)
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- Data retention: 20 years at 85°C/100 years at 25°C(1)
- Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot

Program

- True Read-While-Write Operation
- Programming Lock for Software Security

Peripheral Features

- Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 8-channel 10-bit ADC in TQFP and QFN/MLF package Temperature Measurement
- 6-channel 10-bit ADC in PDIP Package Temperature Measurement
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Byte-oriented 2-wire Serial Interface (Philips I2C compatible)
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- –Interrupt and Wake-up on Pin Change

Special Microcontroller Features

- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator

- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- I/O and Packages
- 23 Programmable I/O Lines
- 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

•Operating Voltage:

1.8-5.5V for ATmega48PA/88PA/168PA/328P

Temperature Range:

- -40°C to 85°C
- Speed Grade: 0 - 20 MHz @ 1.8 - 5.5V
- Low Power Consumption at 1 MHz, 1.8V, 25°C for

ATmega48PA/88PA/168PA/328P:

- Active Mode: 0.2 mA
- Power-down Mode: 0.1 µA
- Power-save Mode: 0.75 µA (Including 32 kHz RTC)

- Implementation

The project "SOLAR PANEL WITH SOLAR TRACKING DEVICE WITHOUT POWER CONSUMPTION" is designed such that it used to construct a solar tracker system that follows the sun direction for producing maximum output of solar energy which can be used to charge the battery.

A photo resistor or light dependent resistor or cadmium sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referenced asa photoconductor.

A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called dopants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.
The schematic symbol of a solar cell 1. Photons in sunlight hit the solar panel and are absorbed by semi conducting materials, suchas silicon.

2.Electrons (negatively charged) are knocked loose from their atoms, allowing them to flow through the material to produce electricity. Due to the special composition of solar cells, only allow the electrons to move in a single direction. The complementary positive charges that are also created (like bubbles) are called holes and flow in the direction opposite of the electrons in a silicon solar panel.

3.An array of solar panels converts solar energy into a usable amount of direct current (DC)electricity.

Conclusion:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced ICs with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

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