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SOLAR PANEL WITH SOLAR TRACKING DEVICE THAT DOESN'T REQUIRE ELECTRICAL POWER

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ABSTRACT:
The goal of this project is to use Arduino to design and build a solar tracker system that automatically adjusts to the sun's position during the day in order to extract the greatest possible energy for use in solar-powered devices.The difficulty of balancing energy production and consumption has grown in recent years. Optimizing solar energy use is the greatest option for resolving this unbalanced equation. To maximize solar energy production, solar panels must be placed in direct sunlight. With a stationary solar panel, the strength of the sun's rays vary throughout the day. Changing the orientation of the solar panel increases the amount of energy it collects from the sun.A few light sensors and a motorized mechanism to turn the panel toward the sun make up this project. The motor and light detection are handled using an Arduino-based control system. There are no breaks in the operation of this system.The project's primary controller is an Arduino uno microcontroller, to which a series of light-dependent resistors (LDRs) and a servo motor have been connected via a control panel. The microcontroller receives data from the LDR sensors about the direction of the sun, processes the data, and directs the servo motor to move the solar panel. The battery stores this solar power for later use. The system is battery-operated. Embedded C, a very effective programming language, is used to instruct the Microcontroller
Keywords: LED, Light-Dependent Resistor, Solar Panel, and Microcontroller

1. INTRODUCTION.

The goal of this arduino-based project is to build a solar tracker system that tracks the sun's movement to maximize energy harvest for use in solar-powered devices.

The difficulty of balancing energy production and consumption has grown in recent years. Optimizing solar energy use is the greatest option for resolving this unbalanced equation. To maximize solar energy production, solar panels must be placed in direct sunlight. With a stationary solar panel, the strength of the sun's rays vary throughout the day. Changing the orientation of the solar panel increases the amount of energy it collects from the sun.

A few light sensors and a motorized mechanism to turn the panel toward the sun make up this project. The motor and light detection are handled using an Arduino-based control system. This system operates non-stop and without any downtime.The project's primary controller is an Arduino uno microcontroller, to which a series of light-dependent resistors (LDRs) and a servo motor have been connected via a control panel. The microcontroller receives data from the LDR sensors about the direction of the sun, processes the data, and directs the servo motor to move the solar panel. The battery stores this solar power for later use. Systematic Thisuses a battery to operate. Embedded C, a very effective programming language, is used to instruct the Microcontroller.

Objectives:

•Design a single axis solar tracker.

•Conservation of Non-Renewable energysources.

•Maximum output can be obtained.

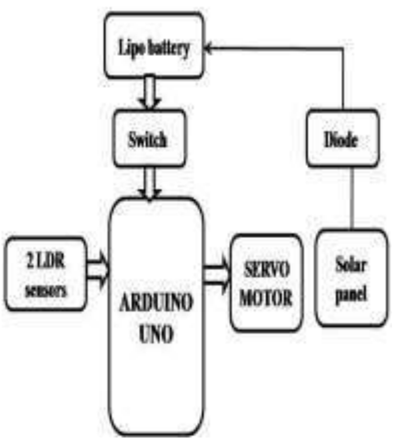
•Using of arduino to archive this task.

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 andMicrocontrollers. Microprocessors arecommonly referred to as generalpurpose processors as they simply accept

The **"SOLAR PANEL WITH SOLAR TRACKING DEVICE WITHOUT POWER 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.

solar tracking using Arduino



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:

- They have no movingparts and hence require little maintenance and work quite satisfactorily without any focusing device.
- It does not cause any environmental pollution like thefossil fuels and nuclear power.
- Solar cells last a longer time andhave low running costs
- Low power consumption.
- Conservation of Non-Renewableenergy 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

Methodology

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 CaptureMode

–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 PackageTemperature 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

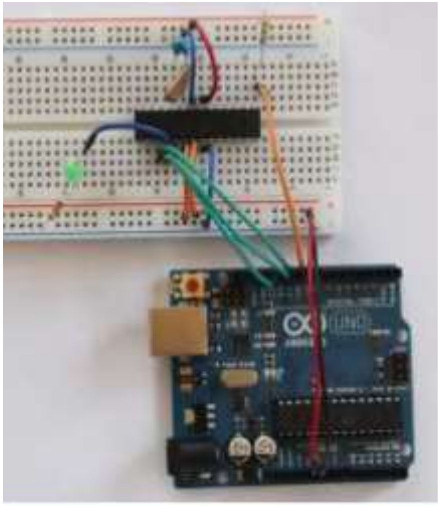
The project "***SOLAR PANEL WITH SOLAR TRACKING DEVICE WITHOUT POWER CONSUMPTION***" is designed such that it used to construct a solar tracker system that follows the sun direction for producing maximum output of solar energy which can be used to charge the battery.

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. Dueto 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 convertssolar energy into a usable amount of direct current (DC)electricity.

Compilation and simulation

steps:Step 1: Parts

Step 1: Parts

1 x Arduino on a Breadboard 1 x ArduinoUNO Connecting Wires Arduino IDE installed on your

PCStep 2: The Approach

We use the Arduino UNO to bootload the ATmega328 that is sitting on the Arduino-on-a- Breadboard. This is fairly straightforward having an ATmega328P-PU,

but needs an extra step for an ATmega328-PU

Step 3: Program your Arduino UNO as anISP

We need to program the Arduino UNO toact as an ISP (In-System Programmer), sothat it can burn the bootloader onto the Breadboard chip.

1. Open the Arduino IDE
2. Open the ArduinoISP sketch (under File, Examples)

3. If you’re using version 1.0 of the IDE:

Search for *void heartbeat* and change the line that reads:

delay(40);

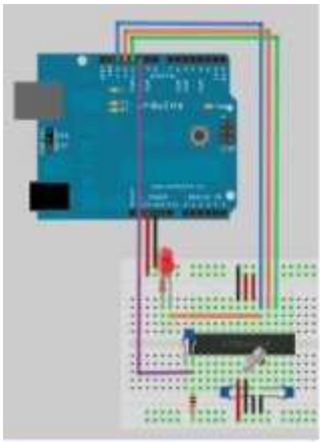
to

delay(20);

Connect your UNO to the PC, making sure it’s not connected to the Arduino on a Breadboard.

Ensure your UNO is selected under the Boards menu option, and upload the sketch.

Step 4: Connect your ATmega328

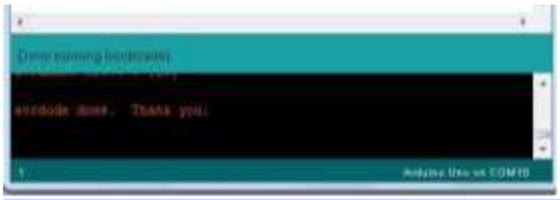


Now connect your ATmega to your UNO asfollows:

- UNO 5v ---> ATmega pin 7 (VCC)
- UNO GND ---> ATmega pin 8(GND)
- UNO pin 10 ---> ATmega pin 1(RESET)
- UNO pin 11 ---> ATmega pin 17(MOSI)
- UNO pin 12 ---> ATmega pin 18(MISO)
- UNO pin 13 ---> ATmega pin 19(SCK)

In your Arduino folder, find the subfolder.*\hardware\tools\avr* *etc*

1. Make a backup copy of the file: *avrdude.conf*
2. Open the file *avrdude.conf* in a texteditor
3. Search for: “*0x1e 0x95 0x0F*” (thisis the ATmega328P signature)
4. Replace it with: “*0x1e 0x95 0x14*”(this is the ATmega328 signature)
5. Save the file
6. Restart the Arduino IDE
7. Continue with the rest of the steps in the instructable, and once bootloading is complete restore thebackup copy you made.



In the Arduino IDE, from the *Tools* menu:

- under the *Board* option choose *Arduino UNO*
- under the *Serial Port* option ensurethe correct port is selected
- under the *Programmer* optionchoose *Arduino as ISP*

To burn the Bootloader, choose *BurnBootloader* from the *Tools* menu

You should see a message *“Burning bootloader to I/O Board (this may take aminute)"*

Once the bootloader has been burned, a message of confirming the success getsdisplayed.

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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