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Sun Tracking Schemes for Photovoltaic Panels

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Abstract:

Solar energy systems have emerged as a viable source of renewable energy over the past two or three decades, and are now widely used for a variety of industrial and domestic applications. Such systems are based on a solar collector, designed to collect the sun's energy and to convert it into either electrical power or thermal energy. In general, the power developed in such applications depends fundamentally upon the amount of solar energy captured by the collector, and thus the problem of developing tracking schemes capable of following the trajectory of the sun throughout the course of the day on a year-round basis has received significant coverage in this project.

In Aden city (Yemen), the improvement in the performance of a solar cooker during summer was found to be as much as 40% for higher elevation angle and 70% for lower elevation angle, based on the developed tracking algorithms. Moreover, it was shown that the amount of solar energy captured by a tilted collector could beincreased by more than 40% by adjusting the tilt angle on a seasonal basis.This project is designed with ARM Depending upon the light falls on LDR the data will be read by the Microcontroller and the direction of the motor will be changed. With this direction the Solar plates which are fixed to the stand will also rotates to gain the maximum sun rays.

I.Introduction:

A solar tracker is a generic term used to describe devices that orient various payloads toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices.In flat-panel photovoltaic (PV) applications trackers are used to minimize the angle of incidence between the incoming light and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity.

In standard photovoltaic applications, it is estimated that trackers are used in at least 85% of commercial installations greater than 1MW from 2009 to 2012. In concentrated photovoltaic (CPV) and concentrated solar thermal (CSP) applications trackers are used to enable the optical components in the CPV and CSP systems.

The optics in concentrated solar applications accept the direct component of sunlight light and therefore must be oriented appropriately to collect energy. Tracking systems are found in all concentrator applications because such systems do not produce energy unless oriented closely toward the sun

II.Tracking mechanism literature survey:

This will be varied in three types

- Fixed array mounting
- Adjustable array
- Automatic tracking

Firstly we shall discuss about fixed array mounting.The name itself describes that the panel will be fixed in one direction and no movement of the panel will be possible in any season or time. If the light falls on it then the production takes place if not there will be no such thing.Second thing we can go with adjustable array. In this one need to go there and physically adjust the panel in the direction of sunlight. To gain more power for our purpose.

The next one is our project to track the light automatically using LDR sensors. Automatically the panel should move as per the direction of sun. In this no need for the presence of a person. Our controller will monitor the entire thing and move the panel accordingly.

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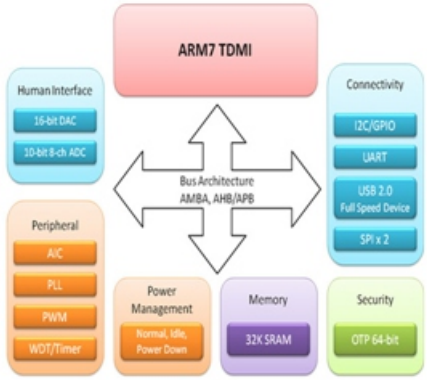
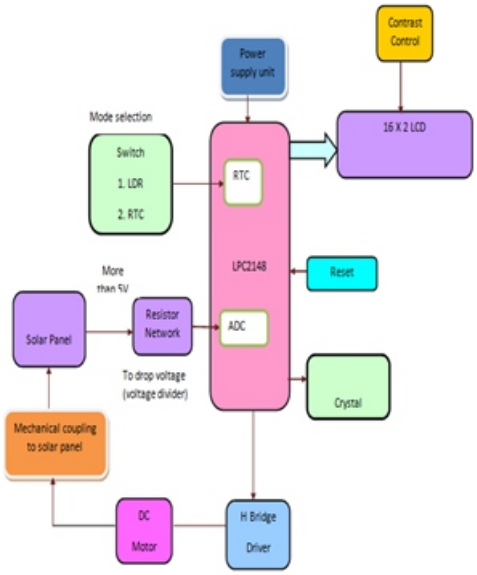
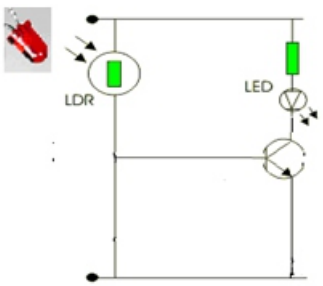


Block Diagram:



III.Hardware requirements

LDR Sensor



LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically.Thus in this project, LDR plays an important role in controlling the electrical appliances based on the intensity of light i.e., if the intensity of light is more (during daytime) the loads will be in off condition. And if the intensity of light is less (during nights), the loads will be switched ON.LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.

When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. The LED lights.Here in our project to avoid the light from led to fall on to LDR we place a box in which we will keep our jewelry. If any one removes the box the light from led falls directly on to the LDR and then the transistor will be on which is monitored by the microcontroller.

Solar panel :

A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.Because a single solar panel can only produce a limited amount of power, many installations contain several panels. A photovoltaic system typically includes an array of solar panels, an inverter, may contain a battery and interconnection wiring.Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer or the back layer. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The conducting wires that take the current off the panels may contain silver, copper or other conductive (but generally not magnetic) transition metals.

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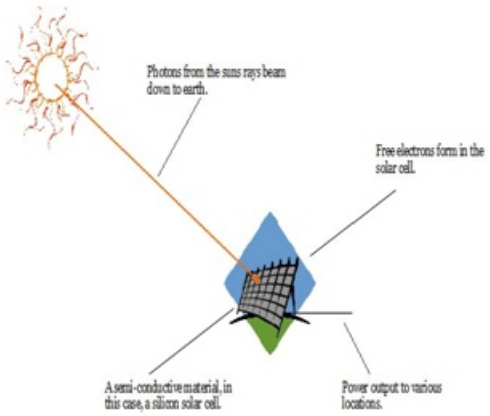
The cells must be connected electrically to one another and to the rest of the system. Cells must also be protected from mechanical damage and moisture. Most solar panels are rigid, but semi-flexible ones are available, based on thin-film cells.Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. Separate diodes may be needed to avoid reverse currents, in case of partial or total shading, and at night. The p-n junctions of mono-crystalline silicon cells may have adequate reverse current characteristics that these are not necessary. Reverse currents waste power and can also lead to overheating of shaded cells. Solar cells become less efficient at higher temperaturesand installers try to provide good ventilation behind solar panels.The solar panel diagram below shows how solar energy is converted into electricity through the use of a silicon cell.

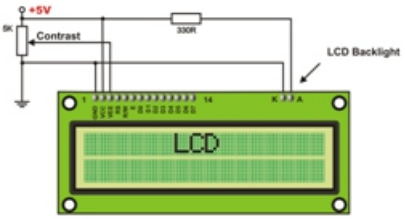


below image is not a solar panel wiring diagram, if you need access to a wiring plan, you could consult a specialist electrician, or solar installer.In the diagram below, you can see how a solar panel converts sunlight into energy to provide electricity for a range of appliances.This energy can be used for heating, through the use of solar hot water panels, or electricity through the use of regular solar cells.

LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1.The declining prices of LCDs.
2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4.Ease of programming for characters and graphics.
These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.



SOFTWARE DETAILS:

A.Keil compiler:

Keil compiler is a software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

B.Proload:

Proload is a software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed.

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IV.ADVANTAGES:

- Highly sensitive
- Works according to the sun direction
- Fit and Forget system
- Night – Day mode sensing
- Low cost and reliable circuit
- Complete elimination of manpower

V.APPLICATIONS:

- Street lights
- Garden Lights
- Solar water heater
- Hotels, hostels and house hold applications
- Offices
- Industries

VI.Conclusion:

This project presents a solar tracking power generation system. The tracking controller based on the closed loop algorithm is designed and implemented with LPC2148 MCU in embedded system domain. Set up on the solar tracking system, the light sensitivity resistors are used to determine the night – day vision. The proposed solar tracking power generation system can track the sun light automatically. Thus, the efficiency of solar energy generation can be increased. Experimental work has been carried out carefully. The result shows that higher generating power efficiency is indeed achieved using the solar tracking system. The proposed method is verified to be highly beneficial for the solar power generation.

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