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DUAL AXIS SOLAR TRACKER

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Abstract- *The goal of this thesis was to develop a workroom model of a solar tracking system, which is able to enrich the show of the photovoltaic modules in a solar energy system. The operating principle of the method is to retain the photovoltaic modules constantly associated with the sunbeams, which exploits the coverage of solar panel to the Sun's radiation. As outcome, additional output power can be formed by the solar panel.*

The work of the project encompassed hardware project and employment, collected with software programming for the microcontroller unit of the solar tracker. The system utilized an ATmega328P microcontroller to control motion of two servo motors, which rotate solar panel in two axes. The quantity of rotation was resolute by the microcontroller, based on inputs retrieved from four photo sensors located next to solar panel.

Key Words*: *Microcontroller, Solar Panel

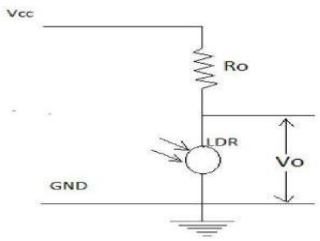
1. Introduction

The solar project was instigated using two servo motors. The choice was informed by the fact that the motor is fast, can stand high torque, has precise rotation within restricted angle and does not yield any noise. The Arduino IDE was used for the coding.

2. Working Principle

Resistance of LDR is contingent on intensity of the light and it differs according to it. The higher is the intensity of light, lower will be the LDR resistance and owed to this the output voltage lowers and when the light intensity is low, higher will be the LDR resistance and thus higher output voltage is achieved.

Fig -1: Potential Divider Circuit



3. Block Diagram

An overview of the requisite circuit for the Dual-axes solar tracker is shown here. The 5V supply is fed from an USB 5V dc voltage source through Arduino Board.

Servo X: Rotates solar panel along X direction

Servo Y: Rotates solar panel along Y direction

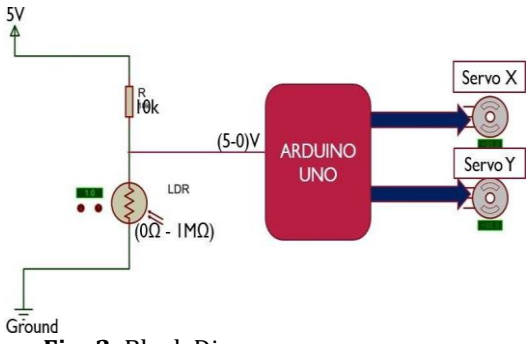


Fig -2: Block Diagram

As we see in the block diagram, there are three Light Dependent Resistors (LDRs) which are employed on a common plate with solar panel. Light from a source strikes on them by different amounts. Due to their inherent property of decreasing resistance with increasing incident light intensity, i.e. photoconductivity, the value of resistances of all the LDRs is not always same.

Each LDR refers equivalent signal of their respective resistance value to the Microcontroller which is configured by required programming logic. The values are compared with each other by considering a particular LDR value as reference.

One of the two dc servo motors is mechanically attached with the driving axle of the other one so that the former will move with rotation of the axle of latter one. The axle of the former servo motor is used to drive a solar panel. These two-servo motors are arranged in such a way that the solar panel can move along X-axis as well as Y-axis.

The microcontroller sends appropriate signals to the servo motors based on the input signals received from the LDRs. One servo motor is used for tracking along x-axis and the other is for y-axis tracking.

In this way the solar tracking system is planned.

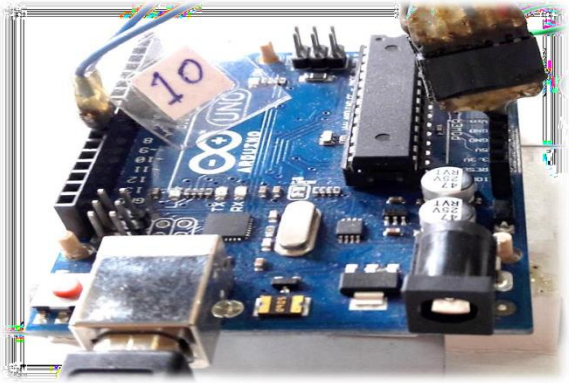
4. ARDUINO UNO

The **Arduino Uno** is a microcontroller board based on the ATmega328. Arduino is an open- source, prototyping stage and its simplicity makes it model for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to- DC adapter or battery to get started.

The Arduino Uno differs from all preceding boards in that it does not use the FTDI USB-to- serial driver chip. In its place, it constructions the Atmega8U2 microcontroller chip programmed as a USB-to-serial converter.

"Uno" possessions one in Italian and is named to mark the forthcoming release of Arduino 1.0. The Arduino Uno and version 1.0 will be the reference versions of Arduino, moving forward.

Fig -3: ARDUINO UNO



5. AVR CPU Core Architecture

The main determination of the CPU core is to defense correct program execution. The CPU must therefore be able to access memories, perform calculations, control peripherals, and handle interrupts.

Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most applications. Some devices have a parallel external bus option to permit adding additional data memory or memory-mapped devices. Almost all devices (except the smallest Tiny AVR chips) have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

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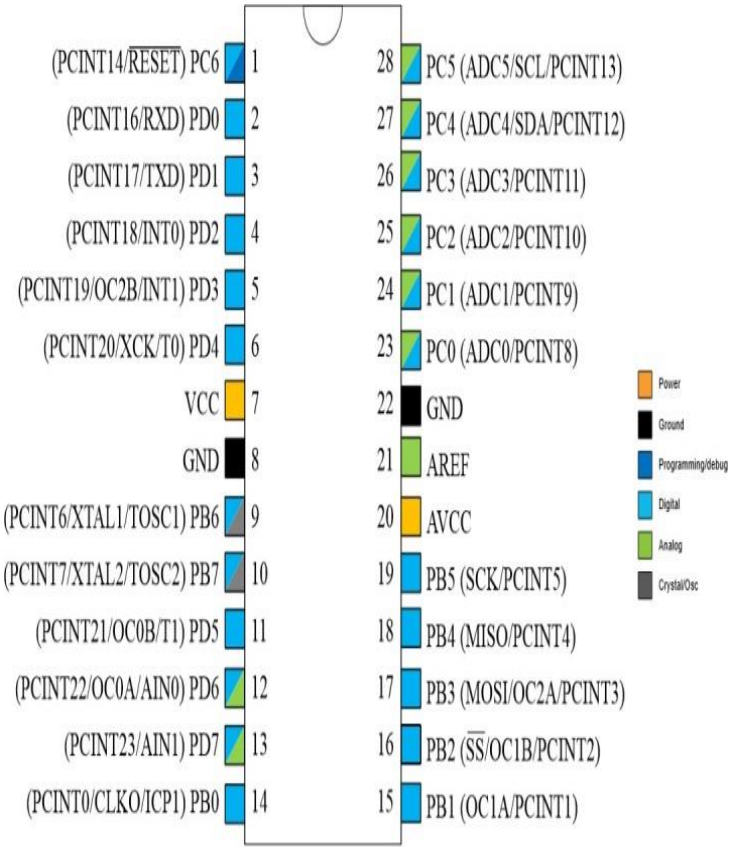
6. Pin layout of ATmega328p

The Atmel®picoPower®ATmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture.

Fig-4: Pin layout of ATmega328p



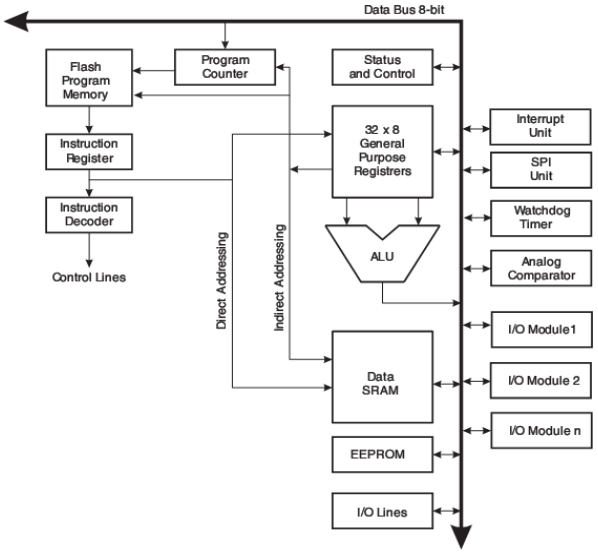


Fig-5: AVR CPU Core Architecture

The main purpose of the CPU core is to ensure correct program execution. The CPU must therefore be able to access memories, perform calculations, control peripherals, and handle interrupts.
Flash, EEPROM, and SRAM are all integrated onto a single chip, eliminating the need for external memory in most uses. Some procedures have a parallel external bus option to allow adding additional data memory or memory-mapped devices. Almost all devices (except the tiniest Tiny AVR chips) have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

CPU

The CPU of the AVR microcontroller is similar but so modest like the one in a computer. The main purpose of the CPU is to confirm correct program presentation. Therefore, the CPU must be able to admittance perform calculations, memories, control peripherals & handle interrupts.The CPUs of Atmel's 8-bit and 32-bit AVR are based on an innovative "Harvard architecture" thus every IC has two buses namely one instruction bus and data bus. The CPU reads executable instructions in instruction bus, wherein the data bus, is to read or write the corresponding data. The CPU core of the AVR contains ALU, General Purpose Registers, Program Counter, Instruction Register, Instruction Decoder, Status Register and Stack Pointer.

8. Benefits and Demerits of Solar Energy

Benefits

- Solar energy is a clean and renewable energy source.
- Once a solar panel is installed, the energy is produced at reduced costs.
- Whereas the reserves of oil of the world are estimated to be depleted in future, solar energy will last forever.
- It is pollution free.
- Solar cells are free of any noise. On the other hand, various machines used for pumping oil or for power generation are noisy.
- Once solar cells have been installed and running, minimal maintenance is required. Some solar panels have no moving parts, making them to last even longer with no maintenance.

Demerits

- Solar panels can be costly to install resulting in a time lag of many years for funds on energy bills to match initial funds.
- Generation of electricity from solar is dependent on the country's exposure to sunlight. That means some countries are slightly disadvantaged.
- Solar power stations do not challenge the power output of conventional power stations of related size. Furthermore, they may be lavish to build.
- Solar power is used for charging large batteries so that solar powered devices can be used in the night. The batteries used can be huge and weighty, taking up sufficiently of space and demanding frequent replacement.

9. Conclusion

In this 21st century, as we form up our technology, populace & progress, the energy consumption per capita rises exponentially, as well as our energy resources (e.g. fossils fuels) decrease rapidly. So, for viable development, we have to think substitute methods (utilization of renewable energy sources) in order to fulfill our energy demand.
In this project, Dual Axis Solar Tracker, we've developed a demo model of solar tracker to track the maximum intensity point of light source so that the voltage given at that point by the solar panel is extreme.