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DUAL AXIS SOLAR TRACKER

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Abstract- *The goal of this thesis was to develop a laboratory prototype of a solar tracking system, which is able to enhance the performance of the photovoltaic modules in a solar energy system. The operating principle of the device is to keep the photovoltaic modules constantly aligned with the sunbeams, which maximizes the exposure of solar panel to the Sun's radiation. As a result, more output power can be produced by the solar panel.*

The work of the project included hardware design and implementation, together 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 amount of rotation was determined by the microcontroller, based on inputs retrieved from four photo sensors located next to solar panel.

***KeyWords*:Microcontroller, Solar Panel**

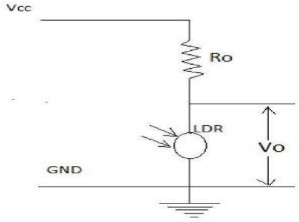
1. Introduction

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

2. Working Principle

Resistance of LDR depends on intensity of the light and it varies according to it. The higher is the intensity of light, lower will be the LDR resistance and due to this the output voltage lowers and when the light intensity is low, higher will be the LDR resistance and thus higher output voltage isobtained.

Fig-1:Potential Divider Circuit



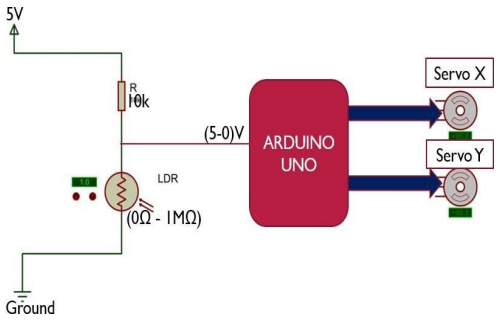
3. Block Diagram

An overview of the requisite circuit for the Dual-axes solar tracker is shown at this point. The 5V supply is nursed from an USB 5V dc voltage source through ArduinoBoard.

Servo X: Rotates solar panel along X direction

Servo Y: Rotates solar panel along Y direction

Fig -2: Block Diagram



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

EveryLDRshowsequal signal of their corresponding resistance value to the Microcontroller which is constructed by requisite programming logic. The values are linked with eachother by considering a particular LDR value asreference.

Oneofthetwodcservo motorsismechanicallyinvolvedwiththedrivingaxleoftheo therone sothattheformerwillmovewithrotationoftheaxleoflattero ne.Theaxleoftheformerservo motor is recycled to drive a solar panel. These two-servo motors position arranged in such a way that the solar panel can move along X-axis as well asY-axis.

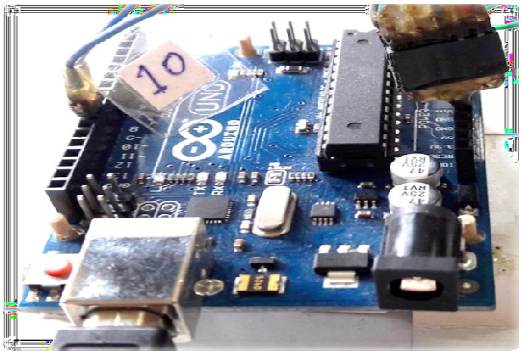
The microcontroller sends proper signals to the servo motors constructed on the input signals acknowledgedfromthe LDRs.Oneservomotorisrecycledfortrackingalongx-

axisandtheotherisfor y-axistracking.
In this manner the solar tracking system is designed.

4. ARDUINO UNO

The **Arduino Uno** is a microcontroller board constructed on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity creates it perfect for hobbyists to practice as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 container be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB joining, a power jack, an ICSP header, then a reset button. It contains everything desirable to support the microcontroller; simply connect it to a computer with a USB cable or power it through an AC-to- DC adapter or battery to get started.
The Arduino Uno varies from all preceding boards in that it does not use the FTDI USB-to- serial driver chip. Instead, it structures the Atmega8U2 microcontroller chip programmed as a USB-to-serial converter.
"Uno" resources 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 position versions of Arduino, moving forward.

Fig -3:ARDUINO UNO



5. AVR CPU Core Architecture

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

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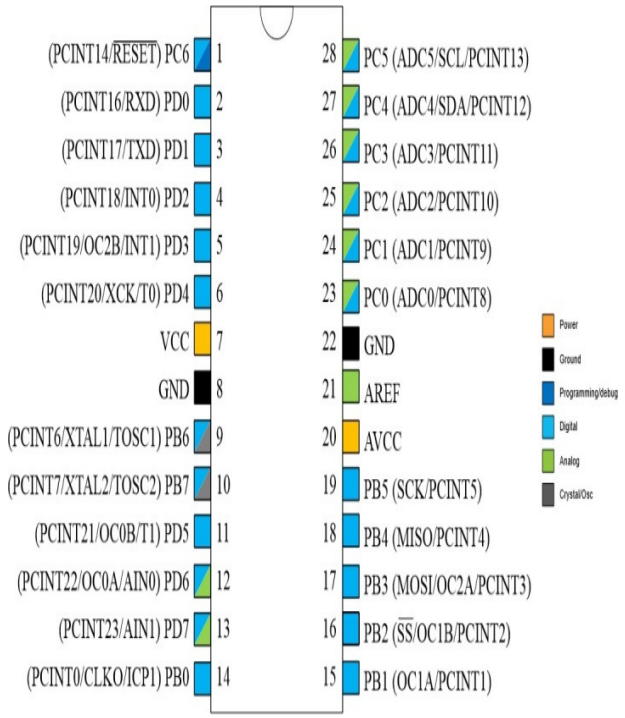
6. Pin layout of ATmega328p

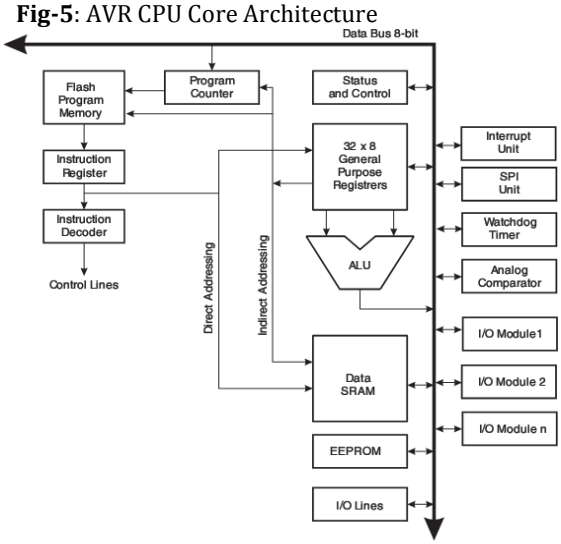


The Atmel®picoPower®ATmega328/P is a low-power CMOS 8-bit microcontroller built on the AVR® enhanced RISC architecture.

Fig-4: Pin layout of ATmega328p

7. AVR CPU Core Architecture

Fig-5: AVR CPU Core Architecture



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Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the essential for external memory in most applications. Some devices have a parallel external bus option to permit adding added data memory or memory-mapped devices. Almost totally devices (except the smallest Tiny AVR chips) have serial interfaces, which can be used to join 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 maindeterminationoftheCPUistosettlecorrectprogra mpresentation.Therefore,theCPUmust be able to access accomplish calculations, memories, control peripherals & handle interrupts.The CPUsofAtmel's8-bitand32-bitAVRarefoundedonaninnovative"Harvardarchitecture"thus every IC has two buses specifically one instruction bus and data bus. The CPU recites executable instructionsininstructionbus,whereinthedatabus,istoreadorwritethecorrespondingdata. The CPU core of the AVR consists of the ALU, General Determination Registers, ProgramCounter, Instruction Register, Instruction Decoder, Status Register and StackPointer

8.Benefits and Demerits of Solar Energy

Benefits

- Solar energy is uncontaminated and renewable energy source.
- Once a solar panel is installed, the energy is produced at cheap costs.
- Whereas the reserves of oil of the world are estimated to be depleted in upcoming, solar energy will last continually.
- This one is pollution free.
- Solar cells are not having any noise. On the other way, several machines castoff for pumping oil or for power generation are noisy.
- Once solar cells have been installed and running, minimal maintenance is essential. Some solar panels have no moving parts, building them to last even longer with no care.

Demerits

- Solar panels can be expensive to install resulting in a gap of many years for savings on energy bills to match initial funds.
- Generation of electricity from solar is in need of on the country's exposure to sunlight. That means some countries are somewhat disadvantaged.
- Solar power stations do not match the power output of conventional power stations of related size. Furthermore, they may be exclusive to build.
- Solar power is used for charging large batteries so that solar powered devices can be castoff in the night. The batteries used can be great and heavy, taking up plenty of space and needing frequent replacement.

9. Conclusion

In this 21st century, as we procedure our technology, population &progress, the energy consumption per capita growths exponentially, as well as our energy resources (e.g. fossils fuels) decrease rapidly. So, for sustainable development, we have to think alternativemethods (utilization of renewable energy sources) in order to fulfill our energydemand.
In this project, Dual Axis Solar Tracker, we've established a demo model of solar tracker to track the extreme intensity point of light source so that the voltage given at that point by the solarpanelisextreme.

Acknowledgement

I would like to acknowledge and extend our deepestgratefulness to all those people who have been related with this Project and have helped us with it thus making it a worthwhile experience.
Firstly I extend our thanks to the many people which include my project Guide Prof. Jayrajesh Vattam, ME. Coordinator & H.O.D who have shared their opinions and experiences through which I received the required information for my report. I am also appreciative to all the staff members of EXTC Dept. for their highly co-operative and encouraging attitudes, which have always boosted me.
I also take this opportunity with great pleasure to thank campus director and Principal whose timely support and encouragement has helped us succeeds in our venture.

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