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DESIGN AND IMPLEMENTATION OF SUN TRACKER SOLAR PANEL USING AT89C52 MICROCONTROLLER

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ABSTRACT: *Solar energy is very important means of expanding renewable energy resources. In this paper is described the design and construction of a microcontroller based solar panel tracking system. Solar is an on conventional source of energy, considering this we have developed solar panels so that we can full fill our electricity need. But due to revolution of the earth, solar source i.e. sun does not face the panel continuously hence less electricity is produced. The energy panel should face the SUN till it is present in a day. The problem above can be solved by our system by automatic tracking the solar energy. The block diagram below shows system architecture it consist of a LDR sensor senses max solar power which is being given to the Microcontroller through the ADC which digitizes the LDR output. Controller then takes the decision according to then algorithm and tilts the panel towards the direction of the max energy given by LDR with the help of DC Motor. The Motor is used to rotate the LDR to sense the max solar power. A Solar Tracker is basically a device onto which solar panels are fitted which tracks the motion of the sun across the sky ensuring that the maximum amount of sunlight strikes the panels throughout the day. The system is able to track and follow the Sunlight intensity in order to get maximum solar power at the output regardless motor speed.*

KEYWORDS: IC555, LDR, suntrackingsystem, micro controller, LCD, DC motor

INTRODUCTION

This proposed system gives the Main objective of the project is to control the solar panel movement according to the movement of sun [1]. It is useful to produce the maximum energy from the solar panel according to the tangential light rays focused on the solar cell. For the purpose of practical demonstration, we have constructed solar panel by using LDR's sun is nothing but the laser light [2]. The project is designed with Micro Controller 8051 and motor, motor driven circuits, LDR's and voltage comparators. The solar panel attached to the linear motor rotating towards the forward directions and reverse directions. There are two limit switches attached to the motor to restrict the rotation for 270°.Initially the program written in micro controller scans for the maximum light intensity focused on the solar panel then stop's rotation. When the light intensity is decreased again it looks for maximum [3] light intensity and moving in incrementing direction. Again, it stops rotation at maximum value. The rotating direction may be clockwise or anticlockwise. All LDR's, limit switches are connected to the input port, motor is connected to output port of Micro Controller. It is a useful project for the general public to rotate the solar panel in the direction of sun.

Commercial purpose of solar tracking system:

- Increase Solar Panel Output.
- Maximum efficiency of the panel.
- Maximize Power per unit area.
- Able to grab the energy throughout the day.

HARDWARE DESCRIPTION

A. POWER SUPPLY: -

The Power Supply is a Primary requirement for the project work. There required DC power supply for the base unit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V-012V transformer is used. From this transformer we getting 5V power supply. In this +5V output is a regulated output and it is designed using 7805 positive voltage regulator. This is a 3 Pin voltage regulator, can deliver current up to 800milliamps. Rectification is a process of rendering an alternating current or voltage into a unidirectional one. The component used for rectification is called 'Rectifier'. A rectifier permits current to flow only during positive half cycles of the applied AC voltage. Thus, pulsating DC is obtained to obtain smooth DC power additional filter circuits required.

RESISTORS: -

Resistors limit current. In a typical application, a resistor is connected in series with an LED: Enough current flows to make the LED light up, but not so much that the LED is damaged. The symbol for a fixed resistor is popular in the UK and Europe. A zig-zag symbol is used in America and Japan:

CAPACITOR: -

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors. An ideal capacitor is characterized by a single constant value, capacitance which is measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them.

LIGHT DEPENDENT RESISTOR

A photoresistor 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 as a photoconductor. A photoresistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the conductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, here by 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 bandgap. Extrinsic devices have impurities, also called dopants, 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.

DC MOTORS: -

The electrical motor is simple device in principle.it converts to electrical energy into mechanical energy. The dc motor is used to rotate the solar panel.

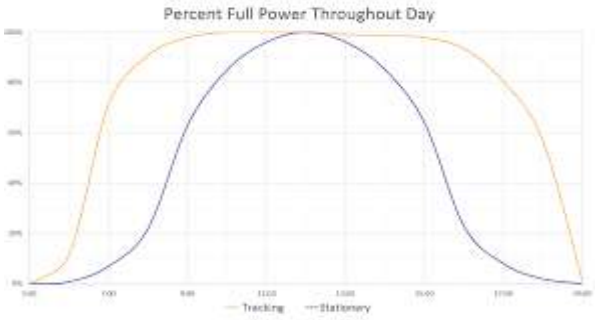


Fig 1: solar energy availability of power throughout the day

WORKING: Microcontroller works by using power supply which sends the signal in analog form by using rectifier with 5v dc. when the light falls on the LDRs it sends the signal to microcontroller through A-D converter the output of the controller is send to D-A converter to dc motor it rotates based up on the light falls on LDRs which is connected to solar panel. The LDRs values are display in the liquid crystal display (LCD) as shown in the fig 2.

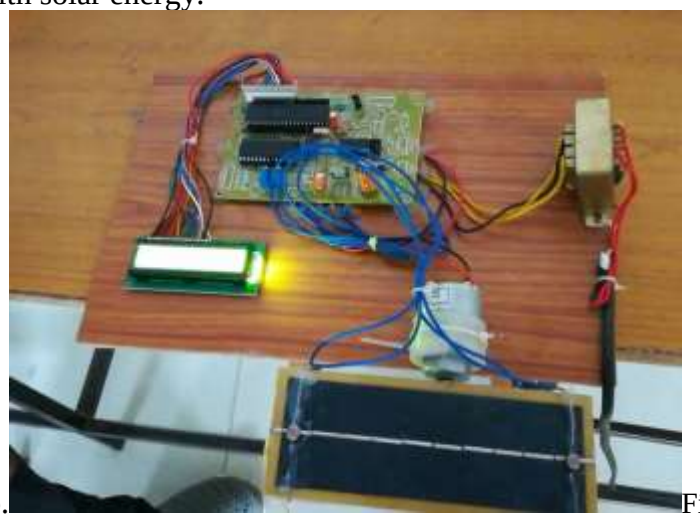
ADVANTAGES: -

- It is economical
- Life time is more
- Electricity is generated through the day by using rotating panel
- More efficient in production of electricity

APPLICATIONS: -

- Solar electric power system
- This are used in household, factories etc.
- Solar power cars and trains
- Latest automobiles

We can replace the present generation stations with solar energy.



We can control this sun tracker using Arduino. Fig 2: Implementation of solar tracker with AT89C52 kit

Advantages of Sun Tracking Solar Panel

- The solar energy can be reused as it is non-renewable resource.
- This also saves money as there is no need to pay for energy used (excluding the initial setup cost)

- Helps in maximizing the solar energy absorption by continuously tracking the sun.

Sun Tracking Solar Panel Applications

- These panels can be used to power the traffic lights and streetlights
- These can be used in home to power the appliances using solar power.
- These can be used in industries as more energy can be saved by rotating the panel.

Limitations of Sun Tracking Solar Panel Circuit

1. Though solar energy can be utilized to maximum extent this may create problems in rainy season.
2. Although solar energy can be saved to batteries, they are heavy and occupy more space and required to change time to time.
3. They are expensive.

I. MICRO CONTROLLER

DESCRIPTION OF AT89C52 MICRO CONTROLLER: Microprocessors and microcontrollers stem from the basic idea. The contrast between a microcontroller [4] and a microprocessor is best exemplified by the fact that most microprocessors have many operational codes (opcodes) for moving data from external memory to the CPU; microcontrollers have one or two. Microprocessors have one or two types of bit handling instructions; microcontrollers will have many. The microprocessor is concerned with rapid movement of code and data from external addresses to the chip; the microcontroller is concerned with rapid movement of bits within the chip. The microcontroller can function as a computer with the addition of no external digital parts; the microprocessor must have additional parts to be operational. The AT89C52 is a low power, high performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory [5]. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pinout [6].

The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer shown in Fig 3. which provides a highly flexible and cost-effective solution to many embedded control applications.

Block Diagram:

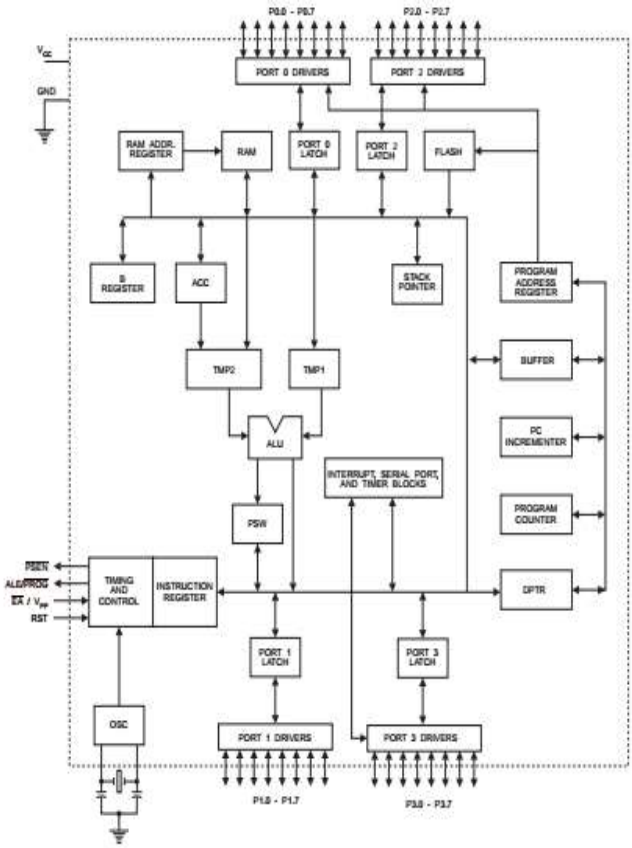


Fig 3: Block Diagram of Micro Controller AT89C52

The AT89C52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning [6]. The Power Down Mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset.

Programming Algorithm: Before programming the AT89C52, the address, data and control signals should be set up according to the Flash programming mode table [8]. To program the AT89C52, take the following steps.

1. Input the desired memory location on the address lines.
2. Input the appropriate data byte on the data lines.
3. Activate the correct combination of control signals.
4. Raise EA/VPP to 12V for the high-voltage programming mode.
5. Pulse ALE/PROG once to program a byte in the Flash array or the lock bits. The byte-write cycle is self-timed and typically takes no more than 1.5ms. Repeat steps 1 through 5, changing the address and data for the entire array or until the end of the object file is reached.

Programming Interface

Every code byte in the Flash array can be written, and the entire array can be erased, by using the appropriate combination of control signals [9]. The write operation cycle is self-timed and once initiated, will automatically time itself to completion. All major programming vendors offer worldwide support for the Atmel microcontroller series. Please contact your local programming vendor for the appropriate software revision

CONCLUSION

The main objective of the project is to control the solar panel movement according to the movement of sun. It is useful to produce the maximum energy from the solar panel according to the tangential light rays focused on the solar cell. For the purpose of practical demonstration we have constructed solar panel by using LDR's sun is nothing but the laser light The project is designed with Micro Controller 8051 and motor, motor driven circuits, LDR's and voltage comparators. The solar panel attached to the 14 linear motor rotating towards the forward directions and reverse directions. There are two limit switches attached to the motor to restrict the rotation for 270°. Initially the program written in micro controller scans for the maximum light intensity focused on the solar panel then stop's rotation. When the light intensity is decreased again it looks for maximum light intensity and moving in incrementing direction. Again, it stops rotation at maximum value. The rotating direction may be clockwise or anticlockwise. All LDR's, limit switches are connected to the input port, motor is connected to output port of Micro Controller. It is a useful project for the general public to rotate the solar panel in the direction of sun.

FUTURE SCOPE

Based up on this technique we can construct electric power generation station.

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