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DUAL AXIS SOLAR TRACKING AND AUTOMATIC STREET LIGHT USING PIR SENSOR

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Abstract —The proposed Dual axis solar tracker devices ensures the optimization of the conversion of solar energy into electricity by properly place the PV panel in accordance with the real position of the sun. In this system used servo motor to controlled by a dedicated drive unit that moves a PV panel according to the signals received from two simple but efficient light sensors. In this proposed system the solar panels exactly in front of sun.PIR SENSOR used in system with purpose of activation of led street light only when on object is passing through subjected peripheral of street light so we can store energy for further usage and will be useful to prolong the utilization time of street light.

Keywords: PIR Sensor , servo motor ,LDR, MAX232, Microcontroller ,Solar panel.

I. INTRODUCTION

The existing sources of fossil fuels are continuously reduced and the growing demand of energy, increasing environment pollution is also a concern, we have to explore new technology for the production of electrical energy using non conventional energy source such as solar energy . Solar energy systems have emerged as a viable source of renewable energy over the past two or three decades. Now widely used electrical power for industrial and domestic application ,solar energy affords more potential for conversion into electric power. The conversion of solar light into electrical energy represents one of the most challenging but promising energetic technologies , in continuous development ,more reliable ,with low maintenance costs and minimal ecological impact .The conversion of solar energy into electrical energy is called as Photovoltaic or PV conversion panel. This paper refers to the design of a Dual axis solar tracking system that automatically controlled by the solar panel is always able to maintain a perpendicular to the sun's rays. As the sun moves across the sky during the day, it is advantageous to have the solar panels track the location of the sun, such that the panel are always perpendicular to the solar energy radiated by the sun. It has been estimated if we use the tracking system instead of fixed system it can increase the power upto 30%-60%

1.1. Motivation

In this system we have used microcontroller because microcontroller based system are easily transferable and also less bulky. It is cheap because it requires less power. It requires less space, easy to install, so can fitted easily in the system. Energy efficient: Most of the energy is converted into electricity. Eco friendly: As this system uses microcontroller, it operates on less power as well as less space also it is user friendly and cost effective.

1.2. Problem definition

Previously, due to stationary position of solar panel we were enable to get maximum solar energy. Due to which it was difficult to meet the increasing demand of electricity. To try to solve the problems previously identified, recent years has witnessed the appearance of several other technological solutions for assistance.

1.3. Objective

The objective of this system is to control the position of a solar panel in accordance with the motion of sun. The proposed system is designed with solar panels, LDR, ADC, Microcontroller, Servo Motor and its driving circuit. In this project four LDRs are fixed on the solar panel at four distinct points. Working of LDR (Light Dependant Resistor) is such that it varies the resistance which depends on the light fall. The varied resistance is then converted into an analog signal or you can call it analog volatage signal. The analog voltage signal is then fed to an ADC. ADC is analog to digital Converter which receives the four LDR voltage signals and converts them to respective digital signal. These digital signal is then given as the input of the microcontroller. Microcontroller receives the two digital signals from the ADC and compares them. The LDR signals are not equal except for normal incidence of sunlight. When there is a difference between LDR voltage levels the microcontroller program drives the servo motor towards normal incidence of sunlight.

II. LITERATURE SURVEY

2.1. Existing system

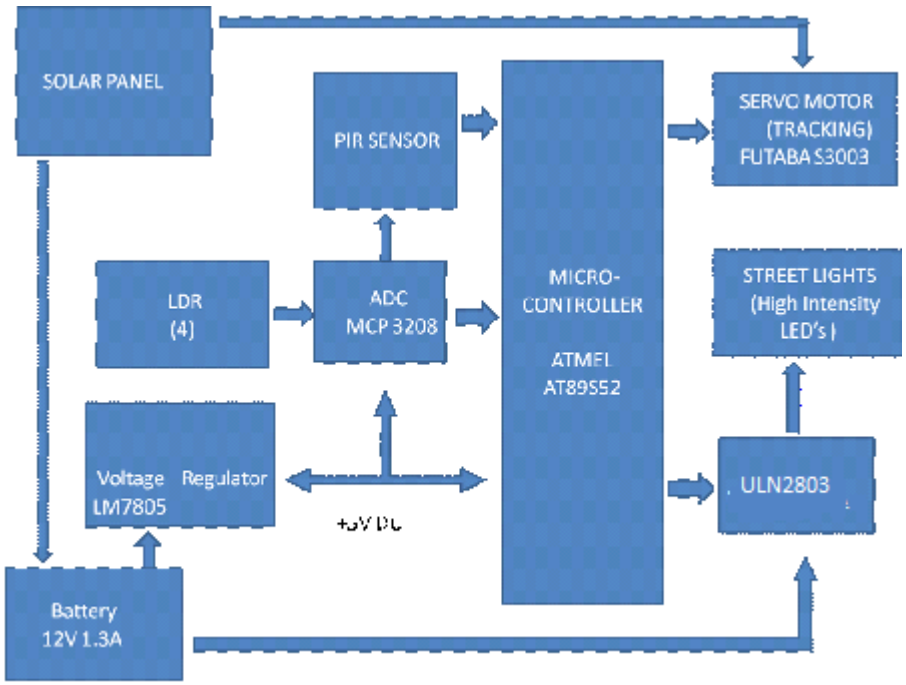
The existing system has a single axis solar tracking system device. It has a low energy output during sunny conditions when compared to dual axis conditions and it has only fewer technology advancements. Single axis trackers tend to be better for companies having low budget or for areas with frequent cloud cover. Depending on the budgetrary restrictions of the client the required facilities get limited in the existing system.

2.2. Proposed system

The output power produced by the solar thermal and photovoltaic systems depends on the amount of solar energy acquired by the system, and so for high degree of accuracy it is important to track sun's position. Accordingly, this paper provides a high level overview of the sun tracking system field and then describes some of the more significant proposals for closed-loop and open-loop types of sun tracking systems.

III. SYSTEM DESIGN

3.1. Block diagram



IV. COMPONENTS USED

4.1. SERVO MOTOR

A **servomotor** is a Rotary actuator that allows for the precise control of angular or linear position, velocity and acceleration. For positive feedback it consist of a motor coupled with a sensor. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor but the term *servomotor* is usually used to refer to a motor suitable for use in a closed-loop control system. Applications of servo motor are robotics, CNC machinery or automated manufacturing.

4.2 MCP3204

The Microchip Technology Inc. MCP3204/3208devices are successive approximation 12-bit Analog to-Digital (A/D) Converters with on-board sample and hold circuitry. The MCP3204 is programmable to provide two pseudo-differential input pairs or four single end inputs. The MCP3204 is programmable to provide four pseudo-differential input pairs or eight single ended inputs. Differential Nonlinearity (DNL) is specified at ±1 LSB, while Integral Nonlinearity (INL) is offered in ±1 LSB (MCP3204/3208-B) and ±2 LSB(MCP3204/3208-C) versions .Communication with the devices is accomplished using a simple serial interface compatible with the SPI protocol. The devices are capable of conversion rates of up to 100 ksps. The MCP3204 devices operate over a broad voltage range (2.7V - 5.5V). Low current design permits operation with typical standby and active currents of only 500 nA and 320 μA, respectively.The MCP3204 is offered in 14- pin PDIP, 150 mil SOIC and TSSOP packages.

4.3. SENSOR

The system consists of two Types of sensors, LDR and PIR. One unit is made up of four LDRs. These are situated at the four corner ends of the solar panel. The intensity of sunlight is sensed by the LDR and the output is sent to the controller via ADC which converts the variation in voltage into digital code. LDR along with the fixed resister forms a potential divider network. Now variation in light varies the LDR resistance which will reflect the variation in voltage in the potential divider network. The control unit analyses it and decides the direction in which the panel has to be rotated, for maximum intensity of light. The other unit of sensor is PIR which is meant for the control of a lighting load. PIR sensor gives the digital output hence, can be directly interfaced to the microcontroller.

4.4. Power supply

Power supply gives a 5V to the controller. 5V is received from an IC voltage regulator. Inside the power supply a rectifier is present.

4.5. Microcontroller (AT89s52)

The microcontroller used here is AT89S52. It is a low-power, high-performance CMOS. It is an 8-bit microcontroller with 8Kb of programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is backward compatible. The Atmel AT89S52 is a very powerful microcontroller that provides a high flexibility and is a cost-effective solution to many embedded control applications. The AT89S52 has the following standard features: (1)8K bytes of Flash, (2) 256 bytes of RAM, (3) 32 I/O lines, (4)Watchdog timer, (5)two data pointers, (6)three 16-bit timer/counters, (7)a six-vector two-level interrupt architecture, (8)a full duplex serial port, (9)on-chip oscillator, (10)clock circuitry. Also the AT89S52 has a static logic designed for operation down to zero frequency. It 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. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

4.6. MAX 232

MAX 232 is an integrated circuit that is created by Maxim Integrated Products that convers signals from a RS 232 serial port to signals suitable for use in TTL compatible circuits. The max 232 is a dual driver/receiver and typically converts

the RX, TX, CTS and RTS signals. The divers provide a voltage level outputs of about 7V or -7V supply from a single 5V supply. The receiver reduce the RS 232 inputs which may be as high as 25V or -25V.

4.7.ULN 2803

These are line driver chips which amplifies the signal to drive high power loads.

4.8.VOLTAGE REGULATOR

The KA78XX/KA78XXA series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

4.9.SOLAR PANEL

Solar panel is used for the conversion of solar energy directly into electricity. It is composed of photo voltaic cells, which convert solar energy into electrical energy.

4.10 BATTERY

It is for the storage of energy received from the panel. A rechargeable battery is normally for this purpose. we used 12V,1.3A battery.

V. SYMBOLS AND ABBREVIATIONS

Below is a list of abbreviations used in this report. The abbreviation, the description of the abbreviation and first mention page in the report are listed in the respective columns:

SR NO•	ABBREVIATION	ACRONYOMS
1	PIR	Passive infrared sensor
2	MPPT	Maximum Power Point Tracking
3	LDR	Light Dependent Resistor
4	MPOP	Maximum Power Operation Point
5	ISO	Indian Standard of Organization
6	INCCOND	Incremental Conductance
7	CUBESAT	Concentrating Solar Panel For Use In a Satellite
8	PCB	Printed Circuit Board

VI. CONCLUSION

In recent years, the use solar energy for the generation of electricity has increased tremendously because of the economic ease and easy operation of the solar panels. Even though the initial costs are high, but operation costs and maintenance are cheap. Solar tracking system today offer an innovative method to track the solar energy and provide economic compatibility of the generation of electric power where grid connections are difficult to setup and costly. The proposed system is based on microcontroller with effective systematic operation and the solar panel is rotated by the servo motor effectively.

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