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Designing of Solar Tracking System using AT89C51 Microcontroller

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ABSTRACT

Solar panel have been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a stand-alone system or as a large solar system that is connected to the electricity grids. The earth receives 84 Terawatts of power and our world consumes about 12Terawattsof power supply per day. We are trying to consume more energy from the sun using solar panel. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of the sun's location and positioned of the solar panel are important. This paper aim is to design a tracking system, which can locate the position of the sun. The Tracking system will move the solar panel so that it is positioned perpendicular to the sun for maximum energy conversion at all time. Photo resistors will be used as sensors in this system. The system will consist of light sensing system, microcontroller, gear motor system, and a solar panel. Our system will output up to 40%more energy than solar panels without tracking systems.

Keywords: Terawatts, microcontroller, Photo resistors, Sensors.

I. INTRODUCTION

Our project deals with a photo sensor circuit, which is used, in conjunction with stepper motor to control the movement of a solar panel. For this purpose a Phototransistor is mounted on the solar panel. The stepper motor has been programmed using an AT89C51Microcontroller. Due to the rotation of the stepper motor, the solar panel mounted on it moves in a direction so as to search the maximum light intensity. When the LDR receives maximum light, the stepper motor circuit is switched off. Hence, with varying light intensity, the position of the solar panel also changes.

A Solar Tracker is 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. In terms of Cost per Watt of the completed solar system, it is usually cheaper (for all but the smallest solar installations) to use a Solar Tracker and less solar panels where space and planning laws permit. A good Solar Tracker can typically lead to an increase in electricity generation capacity of 30-A microcontroller (also MCU or µC) is a computer-on-a-chip. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). In addition to all arithmetic and logic elements of a general purpose microprocessor, the microcontroller usually also integrates additional elements such as read-only and read-write memory, and input/output interfaces[1].Microcontrollers are frequently used in automatically controlled products and devices, such as automobile engine control systems, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes.Despite it's relatively old age, the 8051 is one of the most popular microcontrollers in use today. Many derivative microcontrollers have since been developed that are based on and compatible with the 8051. In our

projectwe have used AT89C51 microcontroller manufactured by ATMEL [2].

A. Necessity:Solar energy in India:

In general, India has relatively1 long sunny day for more than ten months and partly cloudy sky for most of the days for the rest two months. This makes our country, especially the desert sides in the west, involving Rajasthan, Gujarat, Madhya Pradesh etc. very rich in solar energy. Many projects have been done by using photovoltaic cells in collecting solar radiations and converting them to electrical energy. But most of these don't take into account the difference of sun's angle of incidence by installing the panels in a fixed orientation, which highly influences the solar energy collected by the panel. The proposed model of Dual Axis Solar Tracker is most compatible for obtaining maximum efficiency. Figure 1 shows global energy usage by region.

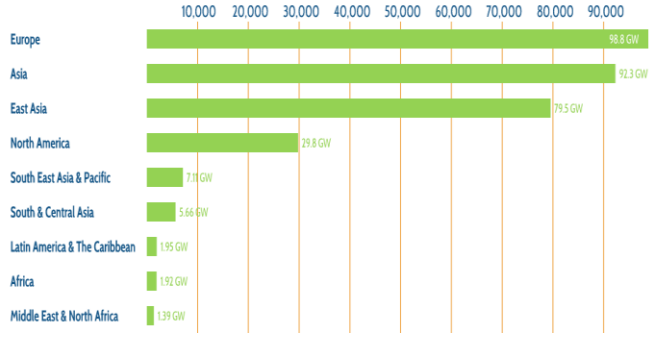

Figure 1. Global usage of Solar energy

II. LITERATURE REVIEW

With the impending scarcity of non-renewable resources, people are considering using alternate sources of energy. From all other available resources sun energy is the most abundant and it's comparatively easy to convert it to electrical energy. Use of solar panel to convert sun's energy to electrical popular, but due to transition of the Sun from east to west the fixed solar panel may be able to generate optimum energy. The proposed system solves the problem by an arrangement for the solar panel to track the Sun.[3]

The design of a solar tracking system driven by a mnicrochip PIC 18F452 micro controller. The system is based on two mechanisms. The first one is the search mechanism (PILOT) which locates the position of the sun. The second mechanism(intelligent PANELS) aligns itself with the PILOT only if maximum energy possible could be extracted. On top of that the main advantage of the technique is that the rotation only takes place, if the energy obtained in the new position is higher then that consumed by the panels during the transition. So there are two mechanisms, one for the search which is mounted on a miniature motor and consumes only small amount of energy. Its role is to locate the best position for maximum energy extraction. The second one is the panels mechanism which rotates to the position when energy extraction is optimal [4].

Energy crisis is the most important issue in today's world. Conventional energy resources are not only limited but also the prime culprit for environmental pollution. Renewable energy resources are getting priorities in the whole world to lessen the dependency on conventional resources. Solar energy is rapidly gaining the focus as an important means of expanding renewable energy uses. Solar cells those convert sun's energy into electrical energy are costly and inefficient. Different mechanisms are applied to increase the efficiency of the solar cell to reduce the cost. Solar tracking system is the most appropriate technology to enhance the efficiency of the solar cells by tracking the sun. A microcontroller based design methodology of an automatic solar tracker is presented in this paper. Light dependent resistors are used as the sensors of the solar tracker. The designed tracker has precise control mechanism which will provide three ways of controlling system. A small prototype of solar tracking system is also constructed to implement the design methodology presented here[5].

"Solar Tracking System" is a power generating method from sunlight. This method of power generation is simple and is taken from natural resource. This needs only maximum sunlight to generate power. This paper helps for power generation by setting the equipment to get maximum sunlight automatically. This system is tracking for maximum intensity of light. When there is decrease in intensity of light, this system automatically changes its direction to get maximum intensity of light. [6].

The efficiency of solar cell with and without tracking system. It also includes a proposed plan of simple dual axis tracking devicewhich is based on servo motors which are in turn interfaced using arduino microcontroller kit. The instructions to the servo motor comes from highly efficient light dependent resistors

which are responsible for moment of PV panels towards maximum light intensity.[7]

III. METHODOLOGY

A. COMPONENTS USED

The various components used in our project are:

1. Microcontroller AT89C51
2. Stepper Motor
3. Regulated Power Supply
4. Phototransistor LTR4206
5. Hex Inverter 74LS04
6. Darlington Array ULN2803
7. Crystal Oscillator(12 MHz)
8. Light Emitting Diodes
9. Diodes
10. Capacitors(Electrolytic and Ceramic)
11. Resistors
12. Push Button Reset Switch
13. Potentiometer

B. Working Of Solar Tracking System

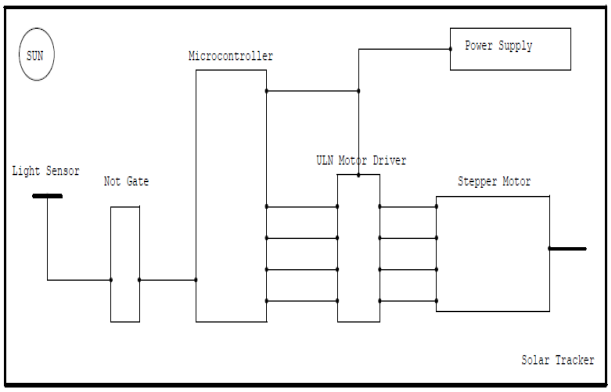

Figure 2. Block diagram of solar tracking system

1. Light Sensor: It is used to sense the presence of light coming from the sun.
2. Not Gate: It will invert the incoming signal and will fed this signal to the controller.
3. Microcontroller: It will do the programming of the circuit.
4. Motor Driver: The signal so received is of very small amplitude and is not able to drive the motor. Thus current amplifier as motor driver is used to increase the amplitude of the incoming signal.
5. Stepper Motor: A Stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements.
6. Power Supply: It comprises of battery and a charger. A 12v, 4 Amp battery is used to operate the circuit. Charger is connected to restore the Power of the battery.

- Pin no 40 of the 89C51 is connected to the positive supply. For this purpose we use 7805 IC (voltage regulator) to provide a 5-volt DC power supply. Pin no 1 of the 7805 IC (voltage regulator) is the input pin, pin no 3 is the output pin and pin no 2 is the ground pin. Output of the 7805 is connected to the pin no 40 of the IC 89C51.
- For the reset action we connect one resistor and capacitor to run an auto reset action.
- Pin no 18 and 19 is connected to the crystal for external oscillator action. Two capacitors are connected to the two terminals of the crystal oscillator and then commonly grounded.
- The collector part of the Phototransistor (LTR-4206) is connected to the pin no 1 of the 74LS04 IC (Hex Converter) and the emitter part is grounded. The LTR-4206 series consist of a NPN silicon phototransistor mounted in a lensed, clear plastic, end looking package. The LTR-4206E is a special dark plastic package that cut the visible light and suitable for the detectors of infrared application.
- Pin no 36, 37, 38, 39 of the 89C51 are connected to the ULN2803 (Darlington Array). Output from the micro controller is a negative voltage. So to convert this negative voltage into positive voltage we use one inverter circuit. ULN2803 is used as an inverter. Pin no. 18, 17, 16, 15 of the IC ULN2803 now connected to the coil of the stepper motor. In the stepper motor there are total four coils. Common point of these coils is connected to the positive supply.
- Pin no. 9 of the 89C51 is connected to the reset switch. And the pin no. 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 and 35 of the 89C51 are left unconnected. Pin no. 20 is connected to the ground.

The microcontroller language is very important part in this project. It is written in assembly language .

C. Features of the Designed Tracker

The attractive feature of the constructed prototype is the software solution of many challenges regarding solar tracking system. The designed prototype requires only two photo resistors to sense the light, which lessens the cost of the system. Power consumption of the system is negligible. The solar PV modules are generally employed in dusty environments which is the case in tropical countries like India. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun. It reduces the power generation capacity of the module. The power output reduces as much as by 50% if the module is not cleaned for a month. To reduce this loss, a brush along with rollers was fixed with the panel. This brush-roller system rolls down twice in 24 hours, when the panel is in vertical position and makes this prototype a self-cleaning system[8].

IV. ADVANTAGES& DISADVANTAGES

A. ADVANTAGES

- ✓ This automatic solar tracker is easy to implement since its construction is simple.
- ✓ With the implementation the proposed system the additional energy generated is around 25% to 30% with very less consumption by the system itself.
- ✓ The solar panel with the sun in order to extract maximum energy falling on it renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate.

B. DISADVANTAGES:

- ✓ This system cannot be used in rainy season.
- ✓ Initial cost is high.

V. CONCLUSION

Solar radiation Tracker has played a vital role in increasing the efficiency of solar panels in recent years, thus proving to be a better technological achievement. The vital importance of a dual axis solar tracker lies in its better efficiency and sustainability to give a better output compared to a fived solar panel or a single axis solar tracker. The tracking system is designed such that it can trap the solar energy in all possible directions. Generally, in a single axis tracker that moves only along a single axis it is not possible to track the maximum solar energy. In case of dual axis trackers, if the solar rays are perpendicular to panel throughout the year. Hence, maximum possible energy is trapped throughout the day as well as throughout the year. Thus, the output increases indicating that the efficiency more than a fixed solar panel (about 30 -40%more) or a single axis solar tracker (about 6-7% more).

VI. FUTURE SCOPE

In future the conventional energy is not sufficient for use so there is need of use non conventional energy sources. This Project is very useful for power supply in rural areas where we can use high sensitive solar panels which can work in mild sun light also and by connecting number of solar tracker assemblies we will able to produce sufficient large quantity of power which will be able to supply power to medium size village. We can make use of solar panels in our day today life for street lighting, in mobile phone chargers, water heaters, etc.

VII. REFERENCES

[1] M.D. Singh and khanchandani, “Power Electronics”, second edition Tata McGraw-Hill Publishing company Limited New Delhi

[2] AsfaqHussain, “Electrical Machines” second edition DhanpatRai and company.

[3] http://www.solar-tracking.com/

[4] Nikesh.D.WataneRakesh.A.Dafde, “Automatic Solar Tracker System” International Journal of Scientific & Engineering Research, Volume 4, Issue 6, June-2013 93 ISSN 2229-5518pg no 93-100.

[5] MsAyushiNitinIngole, “Arduino based solar tracking system”, Satellite Conference ICSTSD 2016 International Conference on Science and Technology for Sustainable Development, Kuala Lumpur, MALAYSIA, May 24-26, 2016, Pg.no 61-66.

[6] AnkitAnurajand Rahul Gandhi, “Solar Tracking System Using Stepper Motor”,International Journal of Electronic and Electrical Engineering. ISSN 0974-2174, Volume 7, Number 6 (2014), pp. 561-566.

[7] MostefaGhassoul, “Design of an Automatic Solar Tracking System to Maximize Energy Extraction”, International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 5, May 2013).

[8] Reshmi Banerjee, “Solar Tracking System” International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015 1 ISSN 2250-3153,Pg no 1-6.