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Automatic Solar Tracking System for Air Cooler

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ABSTRACT: Solar energy is a promising technology that can have huge long-term benefits. Solar cells convert the solar energy into electrical energy. Solar tracking system is the most suited technology to improve the efficiency and enhance the performance by utilizing maximum solar energy through the solar cell. In hardware development we utilize LDR's as sensors and two servo motors to direct the position of the solar panel. The variation in the solar energy occurs daily due to variation in day night cycle and also because of seasonal variations throughout the year. Population of the world is increasing very rapidly. From past decade of years, the non-renewable energy sources like coal and oil are extinguishing and so it become serious problem for providing he reliable energy to the world. But solar energy plays an important source of primary energy. In this project we propose a dual axis solar tracking system by which it is possible to catch the maximum amount of solar energy by using Arduino as the main processing unit. Air-conditioning is one of the major consumers of electrical energy in many parts of the world today and already today air-conditioning causes energy shortages in for example China. The demand can be expected to increase because of changing working times, increased comfort expectations and global warming. Air-conditioning systems in use are most often built around a vapor compression system driven by grid electricity. However, most ways of generating the electricity today, as well as the refrigerants being used in traditional vapor compression systems, have a negative impact on the environment.

KEYWORDS: Solar panel, Arduino, LDR, DC Motor, Exhaust Fan.

INTRODUCTION

Bustling civilization is the vein through which modern civilization is operated. Energy day by day is put to use at its best to fulfill the desires and ambition of the peoples at large. Each and every corner of our life is caged with various layers of impediment and in this response, energy is becoming an indispensable factor. Therefore, the source of energy needs to be endless/ perpetual in order to carry this colossal population ahead. Human beings being evolutionary in nature are perhaps the best ever creation of nature is always in the race of envisaging the probable and available comforts and benefits in every possible angle in this perilous world. The evidential matrix manifests that in a dichotomy of various opinions what options best expedite the scarcity of energy in an immensely heterogeneous society like ours. Our motto is to end forwarding such a noble goal of energy conservation.

Nowadays, climate change on the globe is at a critical level. Global warming or climate changes can be seen through some of them natural phenomena like the effect on crops and extreme weather conditions around the world. Renewable-energy is an energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). Solar energy is rapidly advancing as an important means of renewable energy resource in many applications like thermal energy storage systems and electric power generation systems. As the demand for electricity keeps increasing over the years, solar energy is the alternative for those electricity problems. Solar energy is the energy derived from the sun through the form of solar radiation. The sun is the most inexhaustible, renewable source of energy known to man. Solar energy provides light, heat and energy



to all living things. There is no price and also no air pollution created by solar energy, environmentally friendly and the solar energies are interminable supplies.

This concept is driven by solar energy. Components involved in this concept are solar panel, battery, charge controller, battery, inverter, blower, ceramic slabs and cooling pads. Solar panels are employed to convert sunlight into electrical energy by means of photovoltaic effect. The generated electrical energy is supplied to the battery for storage purposes through a charge controller which prevents power fluctuations. When the blower is switched on, the blower sucks atmospheric air into the cabin through the cooling pads, meanwhile heat transfer occurs between water and air, so the cool air enters into the room thus providing required thermal comfort conditions.

Solar Energy Conversion

Solar energy conversion is done by using a battery, inverter and charge controller. As sunlight falls on the solar panel, which converts into electrical energy by photoelectric effect. This electrical energy is stored in batteries in the form of chemical energy. Charge controller is employed in between the solar panel and battery which prevents overcharging solar energy conversion process and may protect against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. The stored energy directly can be used for DC loads or else need to be converted to AC (alternate current) by the help of an inverter.

Cool Air Generation by Centrifugal Fan

The converted energy is used to run the centrifugal fan. This fan is covered with cooling pads, through which water is passed at a specific rate. As the fan sucks the hot air through cooling pads, heat transfer occurs between air and water thus generated cool air enters into the room.

II. BLOCK DIAGRAM

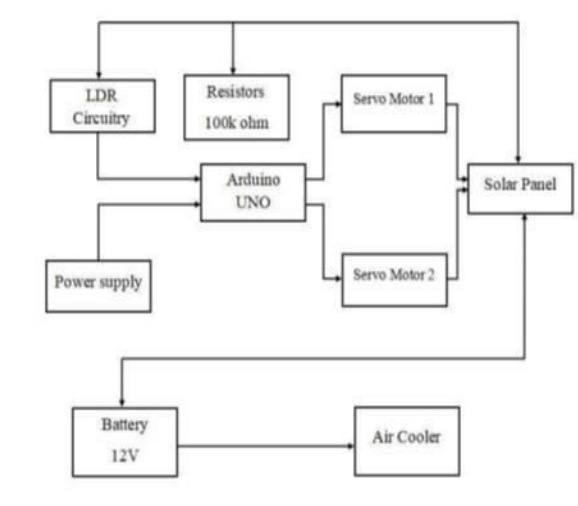


Fig 1: Block Diagram

On each four sides of the solar panel a LDR is placed. Along with that a Servo motor used to rotate the panel is placed. With the help of a motor, the solar panel towards the LDR whose resistance apparently will be low, means towards the LDR on which light is falling, that way it will keep following the light. LDR's does the function of light detectors. First let us understand how the LDR's work. LDR (Light Dependent Resistor) also known as photoresistor is the light sensitive device. When the light falls on it the resistance decreases and vice versa and. This is the reason why it is frequently used in dark or light detector circuits, and the servo is not going to rotate in the

presence of the same amount of light falling on both the LDR.

The principle behind the solar tracking system is Light Dependent Resistor (LDR). Four LDR's which acts as in-puts are connected to Arduino analog pins AO to A4. The built-in Analog-to-Digital Converter will convert the LDR's analog value to digital. The analog value of LDR is taken as inputs. Arduino is the controller part and the DC motor provides us with the output value. Two LDRS are taken as pairs, LDR1 and LDR2, LDR3 and LDR4 respectively. If any one of the LDR in a pair gets more light intensity than the other, there will be difference on node voltages sent to the respective Arduino channel if anyone LDR in each pair gets more light intensity than other then it initiates to take necessary action. The motor tries to move the solar panel such that both the LDRs have equal resistance. In this sense both the resistors are going to receive the same amount of sunlight. The panel moves towards the lower resistance LDR if resistance of any LDR is reduced. So, the maximum energy produced by the solar panel is stored in the 12V battery. Then the air cooler consumes the energy which is stored in the battery at the time of when it's required.

A. Solar Panel

A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel is used as a component in a larger photovoltaic system to offer electricity for commercial and residential applications. Because a single solar panel can only produce a limited amount of power, many installations contain several panels. This is known as a photovoltaic array.



Fig 2: Solar Panel

B. Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. It rotates an object at some specific angles or distance. A servo motor shown in Figure is just made up of a simple motor which runs through servo mechanism. It can reach a very high torque in a small and lightweight package. Due to these features, they are being used in many applications like Robotics, machines, cars etc. A servo motor can usually only turn 90 in either direction for a total of 180 movement. Servo motors are rated in Kg/cm (kilogram per centimeter). This Kg/cm tells how much weight the servo motor can lift at a particular distance. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.



Fig 3: Servo Motor

C. Arduino UNO

Microcontroller is a computer on a chip. Micro suggests that the device is small, and the controller tells you that the device' might be used to control objects, processes, or events. Another term to describe a microcontroller is embedded controller, because the microcontroller and its support circuits are often built into, or embedded in, the devices they control. It is a temporary storage unit. Arduino is an open-source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Arduino uses a hardware known as Arduino development board and software for developing code known as IDE. The micro controller board used in our design is Arduino Uno, it is an open source platform used for building the electronic projects, it has both physical board and has own unique simplified programming language and has the endless possibilities such as can interface several sensors, actuators like motors, here we did not required any dumper kit to dump the program in to the board Coming to the specification of Arduino Uno microcontroller board, it uses Atmega328p-pu as the main microcontroller, the operating voltage of the board is 5v, the recommended input voltage and limit input voltage is 7v-12v and 6v-20v. It consists of 14 digital input/output pins, 6 PWM digital input/output pins and 6 analog input pins, the dc current obtained from input/output pins is 20ma, and from 3.3v pin is 50ma.



Fig 4: ARDUINO UNO

D. Exhaust Fan

Air cooling systems in Coolers most commonly rely on forced air. Forced air is passed through cooling elements and circulated to the desired locations. Exhaust Fan provides this air movement. Blower Fan efficiency is the ratio between the power transferred to the air stream and the power delivered by the motor to the fan. The power of the airflow is the product of the pressure and the flow, corrected for unit consistency. Another term for efficiency that is often used with fans is static efficiency, which uses static pressure instead of total pressure in estimating the efficiency. When evaluating fan performance, it is important to know which efficiency term is being used. The fan efficiency depends on the type of fan and impeller. As the flow rate increases, the efficiency increases to a certain height.

III. HARDWARE IMPLEMENTATION



Fig 5: Hardware Implementation



The solar panel is converting sun rays to the Electricity by “Photo-Voltaic Effect”. This electrical power is stored in a 12- Volt battery. Battery D.C power is used to run the D.C motor and D.C water pump. Block diagram, Photo-voltaic Effect and major components of our project are already discussed above chapters. The D.C motor is coupled with impeller blades. The D.C motor runs during the air cooler button ON, the impeller blades start rotating. The water pump is used to circulate the water to the blower unit. The forced air is flow through the water which is sprayed by water pump, so that the cold air produced. This project would be fruitful in both domestic & industrial backgrounds. We also know about nonconventional energy sources and utilization.

IV. CONCLUSION

In this project, we designed and implemented an Automatic solar tracking system for air cooler. These experiments show that the solar based air cooler is considered to be solution for a small and portable air cooler business or consumer product. The innovative design of the sun tracking solar panel have increased the development of many solar thermal and PV systems. It has been showed that the sun trackers can be classified into two that is single axis and dual axis or active or passive trackers. The proposed dual axis solar tracker automatically tracks position of sun and maximize the solar power with help of Arduino. As compared to single axis, dual-axis system provides high abundant electrical energy output when compared to the fixed mount system. The Dual axis tracker is having more efficiency. The main aim of this work is to develop two axis solar tracker system that uses four sensors (ldr s) to predict the sun position.

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