Automatic Angle Alignment Based Efficient Solar Harnessing System

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Abstract: This article put forward an automatic angle alignment robotic arm for harnessing maximum solar energy that could be used in many useful ways for household, agriculture, hospitals and many more. The Robotic arm is designed to work as a sensor that detects the maximum solar beam and moves its position accordingly to harness the energy.

Index Terms – Arduino Uno, Solar Panel, robotic Arm.

I. INTRODUCTION

Solar energy is the most abundantly available renewable natural resource. Solar powered vitality is brilliant light and warmth from the Sun that is saddled utilizing a scope of consistently advancing innovations, for example, sun based warming, photovoltaics, sun oriented warm vitality, sun based design, molten salt power plants and artificial photosynthesis.[1][2]

It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favourable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

The Earth receives 174 petawatts (PW) of incoming solar radiation (insulation) at the upper atmosphere [5]. Approximately 30% is reflected to space while the rest is absorbed by clouds, oceans and land masses. The range of solar oriented light at the Earth's surface is for the most part spread over the obvious and close infrared extents with a little part in the close bright [6]. Most of the the world's population live in areas with insulation levels of 150–300 watts/m², or 3.5–7.0 kWh/m² per day. India utilizes about 7 percent of the solar energy.

The present architecture of solar panel installations are:
I. Flat roof installation
II. Pitched roof installation
III. Ground-mount installation

The Automatic Angle correction bot Based solar energy harnessing system consists of a robotic arm controlled by a microcontroller which consists of Photo resistors which works as the photo detector and the solar panel to harness the ultimate energy. The photo resistors aligned with the robotic arm works as a sensor detecting the maximum solar beam and where the solar beam is intense the arm aligns its position to harness maximum energy.

Hence harnessing 30 percent more efficient than the presently available installation methods.

II. COMPONENTS USED

i. Solar Panel
ii. Arduino
iii. Light Detecting Resistors
iv. Robotic Arm

i. SOLAR PANEL

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. Most modules use wafer-based crystalline silicon cells or thin-film cells. The auxiliary (load conveying) individual from a module can either be the top layer or the back layer. Cells should likewise be shielded from mechanical harm and dampness. Most modules are unbending, yet semi-adaptable ones dependent on dainty film cells are likewise accessible. The phones must be associated electrically in arrangement, to each other.

A PV intersection box is joined to the back of the sunlight based board and it is its yield interface. Externally, most of photovoltaic modules use MC4 connectors type to facilitate easy weatherproof connections to the rest of the system. Also, USB power interface can be used.

Module electrical associations are made in arrangement to accomplish an ideal yield voltage or in parallel to give an ideal flow ability (amperes). The conducting wires that take the current off the modules may contain silver, copper or other non- magnetic conductive transition metals. Sidestep diodes might be fused or utilized remotely, in the event of incomplete module shading, to amplify the yield of module areas still lit up.

Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This empowers the utilization of cells with a staggering expense for each unit zone, (for example, gallium arsenide) in a savvy way. Solar panels also use metal frames consisting of racking components, brackets, reflector shapes, and troughs to better support the panel structure [2].

![Figure 2: Pitched Roof Installation.](image1)

![Figure 3: Flat Roof Installation](image2)
ii. **Arduino**  
Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its items are authorized under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] allowing the production of Arduino sheets and programming dissemination by anybody. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards highlight sequential correspondences interfaces, including Universal Serial Bus (USB) on certain models, which are likewise utilized for stacking programs from PCs. The microcontrollers are commonly customized utilizing a tongue of highlights from the programming dialects C and C++. Notwithstanding utilizing conventional compiler toolchains, the Arduino venture gives an incorporated improvement condition (IDE) in view of the Processing language venture.

iii. **LIGHT DETECTING RESISTORS**

light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be connected in light-touchy finder circuits, and light-enacted and dim actuated exchanging circuits.

A photoresistor is made of a high resistance semiconductor. In obscurity, a photoresistor can have an obstruction as high as a few megohms (MΩ), while in the light, a photoresistor can have an opposition as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The subsequent free electrons (and their opening accomplices) lead power, along these lines bringing down opposition. The opposition range and affectability of a photoresistor can generously vary among different gadgets. Besides, one of a kind photoresistors may respond generously contrastingly to photons inside certain wavelength groups.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy [2], aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Normal instances of such gadgets expected for novice specialists incorporate straightforward robots, indoor regulators and movement locators.

The name Arduino originates from a bar in Ivrea, Italy, where a portion of the organizers of the venture used to meet. The bar was named after Arduino of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014 [3].

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**Figure 4: Ground-Mount Installation**

**Figure 5: Arduino.**
iv. **ROBOTIC ARM**
The Robotic Arm consists of a 3D printed tilt model which bears the Servo motors and the Photo resistors which are controlled by the microcontroller. The microcontroller is programmed such that the servo motor rotates to the side of the LDR (LIGHT DETECTING RESISTOR) which is directly exposed to the light. Hence absorbs maximum light energy.

**III RESULTS:**
The sun’s rays are sharp beam of rays, which falls angles on the earth’s surface. Thus, to harness maximum energy the solar panels must be frequently moved to align the solar beam angle, this manual movement is automatically performed the Automatic position correcting bot and maximum energy is harnessed. The Robotic arm is designed to work as a sensor that detects the maximum solar beam and moves its position accordingly to harness the energy. The Automatic Angle correction bot Based solar energy harnessing system consists of a robotic arm controlled by a microcontroller which consists of Photo resistors which works as the photo detector and the solar panel to harness the ultimate energy. The photo resistors aligned with the robotic arm works as a sensor detecting the maximum solar beam and where the solar beam is intense the arm aligns its position to harness maximum energy. The Robotic Arm consists of a 3D printed tilt model which bears the Servo motors and the Photo resistors which are controlled by the microcontroller. The microcontroller is programmed such that the servo motor rotates to the side of the LDR (LIGHT DETECTING RESISTOR) which is directly exposed to the light. Hence absorbs maximum light energy. Hence harnessing 30 percent more efficient than the presently available installation methods.
Figure 8: Circuit Diagram of the complete system

Figure 9: Automatic Angle correction bot

References:
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