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"Modeling of Development of IOT Based Smart Metering Infrastructure of E-Vehicle Charging Station"

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ABSTRACT
Solar power is the fastest growing means of renewable energy. The project is designed and implemented using simple dual axis solar tracker system. In order to maximize energy generation from sun, it is necessary to introduce solar tracking systems into solar power systems. A dual-axis tracker can increase energy by tracking sun rays from switching solar panel in various directions. This solar panel can rotate in all directions. This dual axis solar tracker project can also be used to sense weather, and it will be displayed on LCD. This system is powered by Arduino, consists of servo motor, stepper motor, rain drop sensor, temperature and humidity sensor and LCD. A solar tracker is a generic term used to describe devices that orient solar panel toward the sun. In flat-panel photovoltaic applications trackers are used to minimize the angle of incidence between the incoming light and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity of a photovoltaic panel.

The purpose of this Solar Tracking System is to maximize the power generation from the photovoltaic panel. The hardware designs are of solar panel, motor controller circuit to control the servo and circuit converter comprised the voltage output from the solar panel is stabilized by circuit converter before to be used by application. Benefit of Solar power is pollution-free during use. Production end-wastes and emissions are manageable using existing pollution controls. PV installations can operate for many years with little maintenance or intervention after their initial set-up, so after the initial capital cost of building any solar power plant, operating costs are extremely low compared to existing power technologies.

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I. INTRODUCTION

Now days world facing the problem of fuel. The fossil energy exhausted. This is because the demand for electrical energy nowadays is very high due to the increasingly rapid development. So the non renewable energy like fuel and coal will run out if this energy continuous using by users. Because of these matters, the world wide scientist now is busy searching for renewable energy like solar, hydro and wind. This energy are the best solution for the problem that world facing now a days. Solar power is the fastest growing means of renewable energy production with grid connected solar capacity increasing on average by

60% annually from 2004 to 2009 according to the National Center for Policy Analysis. Yet solar energy contributes to only The current situation of the more mature segment of solar energy production, the Photovoltaic (PV) solar cell technology, is one in which energy production is improving from energy capacity value.

Solar energy is the energy that is obtained from the sun. This energy helps and supports all life and Earth. Heat and light from the sun, along with solar based resources such as wind and wave power, hydroelectricity and biomass, account for most the available flow of renewable energy. Solar power is becoming popular, as a friendly environment renewable energy sources that produces no pollution, requires minimal maintenance and free energy from the sun. Solar energy has a wide variety of technologies and is flexible for different application. One types of solar energy is solar photovoltaic power. For example are the residential, commercial, industrial, agricultural, and transportation sectors.

Photovoltaic's (PV) is a method that to generate electrical power by converting solar radiation or solar energy into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic

power generation employs solar panels comprising a number of cells containing a photovoltaic material. Materials that are used for photovoltaic's include mono crystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium solenoid/sulfide.

These solar photovoltaic systems are friendly to environment and can also be used to improve power quality and increase the reliability of the electric power system.

The August 2010 White House report on the other hand predicted that PV solar power will reach grid parity by 2015. Regardless of the diverging predicted time period for grid parity equivalence with current price, it is unequivocal that for solar photovoltaic energy production to become a reality it has to compete with other available sources of energy.

Subsequently, it is believed that Solar tracking will contribute significantly in increasing the efficiency of energy collection from the PV panels. Novel Dual-Axis solar systems allow for precise control of the elevation and azimuth angle of the panel relative to the sun. Tracking is reported to potentially double the energy output of a fixed PV Solar system. The French Development Enterprises (FDE) are currently developing a patented Dual-Axis Solar system that in addition to tracking the sun via sensitive sensors (add more attributes), it can be rapidly deployable and transportable with an automatic. default position in extreme weather conditions. Among the benefits of this remotely articulated solar tracker include a maximum tilting angle of 80 degrees with the horizontal axis to remove accumulated snow and sensitivity speed from one extreme position to the other. During the three months of tracking the sun with their commercial Single-Axis solar system, they have been obtaining a positive power efficiency of (estimate from website they gave us) which (state good or bad estimate for future dual axis STS).

II. LITERATURE REVIEW

Hossein Mousazadeh et Al.,[(2011), Journal of Solar Energy Engineering,Vol.133]

In this paper authorinvestigated and discussed the maximization of collected energy from an on-board PV array, on a solar assist plug-in hybrid electric tractor (SAPHT). Using four light dependent resistive sensors a suntracking system on a mobile structure was constructed and evaluated. The experimental tests using the sun-tracking system showed that 30% more energy was collected in comparison to that of the horizontally fixed mode.

Cemil Sungur (2008) The multi-axes sun tracking system with PLC control.

The authour studied on azimuth and altitude angles of the sun are calculated for a period of 1 year at 37.6o latitude where Turkey is located. According to these angles, an electromechanical system which tracks the sun according to azimuth and altitude angle is designed and implemented.

A.chaib et al (2013) have presented the heliostatorientation system based on PLC robot manipulator.

In this paper author presented that by mounting certain no. ofheliostats and facing them towards central power tower water can be heated and turbines can be driven forenergy conversion purpose. By applying MATLAB program for determining the sun's position forheliostat orientation and by using PLC robot manipulator it is presented that maximum amount of energygets converted from solar to electricity. Concentrated Solar Power (CSP) is used in this experiment.

Authors Tao Yu and Guo Wencheng (2010) Automatic sun tracking control system based on CPV.

In this paper author have introduced automatic sun-tracking control system basedon Concentrated Photo Voltaic (CPV) generation. CPV generation works effectively when light panelstrace the sun accurately. Stepper tracking control technology is used. This control relies on control circuitwith ARM and camera which can provide powerful computational capability

III. PROBLEM STATEMENT

- An optimal control on two axis and design for solar tracker which called altitude and azimuth is challenge.
- The problem is the solar panel that is use only in fixed installation. Because of this problem, the power that can be generated is low. The other problem is the price for the solar tracking system is very expensive for the family that use more power than usual because its need to install more than one solar panel to produce enough power. So this project is to fix the problem that occurs. This solar tracking system can detect a 180 degree of rotation. So the solar panel that can be generating here is very high compare to when the solar panel can only stay in one direction.

- The other problem is related with the solar energy. The fixed solar panels do not aim directly to the sun due to the constant motion of earth. As the result the power produce by this device is not the maximum it should produce. The better solution for this system to get the maximum output power is solar tracking system. This is the main reason the project solar tracker is made. The solar tracker will follow the sunlight to get more output

power. Indirectly it will reduce the cost of buying more solar panels. These systems also reduce the time for users to change the position of solar panel to face the sun.

IV. OBJECTIVE & SCOPE

Objectives:

This research study intends to plug the research gap and will demonstrate the development of the techniques to get maximum solar energy parameter by:

1. To develop a tracking system that maximize the solar panel power generation.
2. The tracking system is based on LDR.
3. To develop a tracking system that control and monitor the movement of solar panel based on the intensity of light.
4. Panel is should be able to tilt a maximum of 80 degrees with the horizontal axis.
5. The panel should be able to rotate a full 360 degrees around the vertical axisso thatthe tracking system that constantly tracking the sun during daytime so that maximum energy is prodced.
6. The model should be able to demonstrate snow removal simulation, solar tracking up to ±5 degree accuracy, and bracing in windy conditions to reduce drag forces.

Scope:

Solar tracking system offers a prototype for implementing a large array type solar tracker. Following additions can be made to the prototype to maximize the power conversion:

1.By connecting the solar panels in an array more energy can be extracted.

2.Using aluminum type of material for the assembly setup the weight upon the motorcan be reduced which will automatically reduce the power consumption of the system.

3. With the monocrystalline PV panel in use the efficiency of the project can be increased. Monocrystalline PV panels have also more lifetime than polycrystalline panels.

V. NEED OF THE PROJECT

- It is beneficial to generate a greater amount of electricity during peak times of the day. Using a tracking system helps maximize the energy gains during these peak time periods.
- To solve the electricity problem in rural area.
- To overcome the problem of darkness on roads .so using solar tracking street lighting system will be done.
- Losses free energy transformation and pollution free energy generation is need of the now days
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- .

VI. PROPOSED SYSTEM

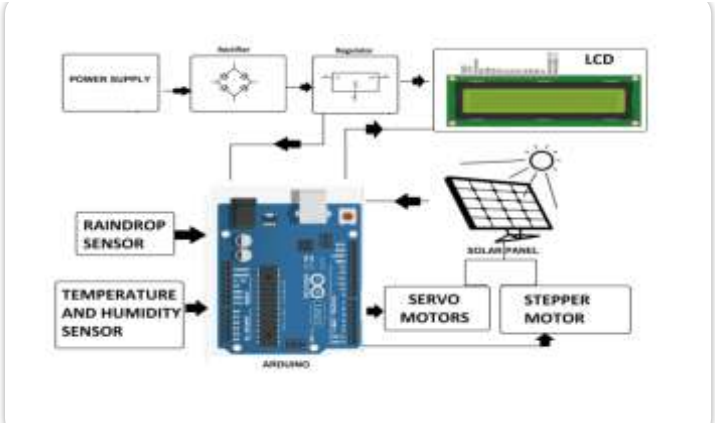

Fig 6.1: Project Block Diagram

VII. COMPONENT REQUIRED

- **Hardware Specification**
- Atmega Microcontroller
- Solar Panel
- Servo Motor

- DC Motor
- Rain Sensor
- Humidity Sensor
- Temperature Sensor
- Resistor
- Capacitors
- Transistors
- Cables and Connectors
- Diodes
- PCB and Breadboards
- LED
- Transformer/Adapter
- Push Buttons
- Switch
- IC
- IC Sockets
-

VIII. WORKING

The proposed tracking system does tracking of sunlight more effectively by providing PV panel rotation in two different axis. In dual-axis tracking system optimum power is achieved by tracking the sun in four directions. In this way we can capture more sun rays. Movement in two axis is explained with the help of figure which is explaining basic idea behind dual axis tracking. The dual-axis solar tracker follows the angular height position of the sun in the sky in addition to following the sun's east-west movement. The dual-axis working is similar to single axis but it captures the solar energy more effectively by rotating in the horizontal

as well as the vertical axis.. The tracker model is composed of four LDR sensors, two stepper motors and PIC microcontroller. One set of sensors and one motor is used to tilt the tracker in sun's east - west direction and the other set of sensors and the other motor which is fixed at the bottom of the tracker is used to tilt the tracker in the sun's north-south direction. The stepper motors are basically performing function of sun tracking. Upper panel holder stepper motor tracks the sun linearly and base stepper motor tracks the parabolic displacement of sun. These stepper motors and sensors are interfaced with a microcontroller which is controlling

stepper motors on the basis of sensor's input. LDR sensors sense the light and sends signal to microcontroller. Microcontroller is doing comparison of signals received from LDR sensors and on the basis of stronger signal it is deciding rotation direction of stepper motors. Dual Axis tracker control is explained with the help of block diagram shown in figure . The bock diagram is showing that LDR sensors after sensing the light forward the signal to Microcontroller. Microcontroller isintelligent device which is taking actions on the basis of sensor input and activating the motor driver's circuitaccordingly. Now suppose if sunchanges it location and moves from east to west, it will cause light intensity to be different on one sensor as compared to other one. On the basis of lightintensity difference on sensors, controller activates driver circuits and moves stepper motors to new positions where light falling on sensor pairs is same. The same process will keep on with change in sun's location in the sky. As a result this proposed model is able to capture more sun rays andsystem's solar energy conversion capability is greatly enhanced. Controller is performing signal comparison and is the main deciding element. Control algorithm for controller is shown in figure. Algorithm starts with taking data from sensors. Sensors output is analogue which is converter to digital signals. This task is performed using analogue to digital converter (ADC). Digitized signals are forwarded to microcontroller. After collecting digitized signals, it decides about the movement direction and step angle of stepper motors. Controller algorithm is showing that microcontroller drives stepper motors only if sensor light sensing is not equal to each other and if sensor signals are equal. It goes to start of algorithm. This process is repeated until light falling on sensor pairs is equal and PV panel is adjusted in a position for optimum power.

The voltage generated by solar panel is varying and needs to be regulated. A regulator can be used after the solar panel which may regulate the voltage coming from solar panel. Tracker circuitry requires power supply for its working and for this purpose supply is provided by generated solar energy. There is no need to provide external power supply which makes our system economical and cost effective too. The purposed model can also used as a standalone system by introducing battery storage and proper control of storage system. Battery storage is controlled on the basis of generated voltage. Charging and discharging events for storage are decided on the basis of generated voltage.

IX. ADVANTAGES&APPLICATIONS

9.1 ADVANTAGES

- Solar tracking system continually orient photovoltaic panel towards the sun and can help maximize the investment in PV system.
- One time investment ,which produces higher efficiency and flexibility on dependency over the other sources.
- Tracking system can help reducing emission and can contribute against global warming.
- Bulk implementation of tracking system help reduced consumption of power by other sources.
- It enhancesthe clean and emission free power production.
- In certain states, some utilities offer Time of Use (TOU) rate plans for solar power, which means the utility will purchase the power generated during the peak time of the day at a higher rate. In this case, it is beneficial to generate a greater amount of electricity during these peak times of the day. Using a tracking system helps maximize the energy gains during these peak time periods.
- Advancements in technology and reliability in electronics and mechanics have drastically reduced long-term maintenance concerns for tracking systems.

9.2 APPLICATIONS

- Dual axis solar tracker can be used for large and medium scale power generation.
- It can also be used for power generation at remote places where power lines are not accessible .
- It may be used as domestic backup power system.
- It can be used in solar street lighting system.
- It may be used in water treatment technologies and solar heating.

X. CONCLUSION

In this project, Dual Axis Solar Tracker, we've developed a demo model of solar tracker to track the maximum intensity point of light source so that the voltage given at that point by the solar panel is maximum.Dual-axis tracking systems are highly efficient in termsof the electrical energy output when comparedwith the fixed mount system.the dual axis tracking system is more efficient and adds more powerto the solar panel. We cansay that we have shown with design and experiments that the dual axis solar tracking systems can be developed easily and performs better. So,wehavecompletedourobjectiveof developing adual axis solar tracking system with LDR sensor for roof-top solar applications. The basic concept behind the use of solar PV is that it generates electricity by tracking sunlight which is always present in the day time in Indian subcontinent.

So,this projectmay become usefulforall those off-grid areas where solar panels are theonly source to illuminate their homes by generating maximum output in the form of electricity. For further improvements, we may increase the number of panels to be rotated at time, so that in future we might use more than one panel for tracking by joining several panels together.Moreover,anotheropportunity in the tracking system is that solar panels use batteriesto store the generated powerand if,we could use thischarged battery for the extra power needed for tracking purpose, there will be reduction in cost of operation of tracking system.

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