A Fully Automated Solar Tracking System

Bonamsetti Madhu, Karri Vinay Sudheer, S. Rajasekhar

ABSTRACT---This is dual axis tracking system, the path of the sun is been tracked by the system is been determined in this procedure. The optimization goal is to increase the amount of generation energy with the help photovoltaic system considering the tracking system consumption. Determination of the tilt angle and azimuth angle trajectories is described as a nonlinear and bounded optimization problem, in future there will be drastic amount of shortage of non-renewable energy resources, we have to replace these resources ,For collection of solar energy we need to improve of efficiency we used sensors (LDR) for tracking of suns path to make sure that the panel should be placed in MPPT-(maximum power point tracking) to observe more efficiency to make sure that the panel should be placed in MPPT point.

Index Terms: High altitude wind control (HAWC), Power electronic converter (PEC), and cost of power (COE).

I. INTRODUCTION

Energy we know that "energy is non been created or not been destroyed " this is a universal law said by newton which has been proved by science. this is applicable for all things in energy sector the various forms of energy is converted into electrical energy in the process of transformation of various energy into electrical energy non-renewable resources, after some time these resources are run out or replenished in human life we need to focused on renewable energy which are given by nature and don't' make harm to the same nature so many energy have been identified ,from that solar energy is one of the best energy from renewable energy this energy is not replenished until the sun existed.[1][2][3]

II. SOLAR RADIATION

The estimated temperature 5778k this energy is been emitted in the form of radiation .[5]

- The sun light which reaches earth is divided in to 2 types
- Direct beam
- Diffuse beam
- Direct beam means which hits directly with out any deviation in the traveling is called direst beam .

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- Diffuse beam which is been deviated by some other things in the way of traveling like clouds ..etc, is called diffuse beam'
- Direct beam carries around 90% of solar energy from sun ,Diffuse beam carries remaining 10%of solar energy from sun .
- The diffuse beam less at blue sky on a clear day and increases at cloudy days.
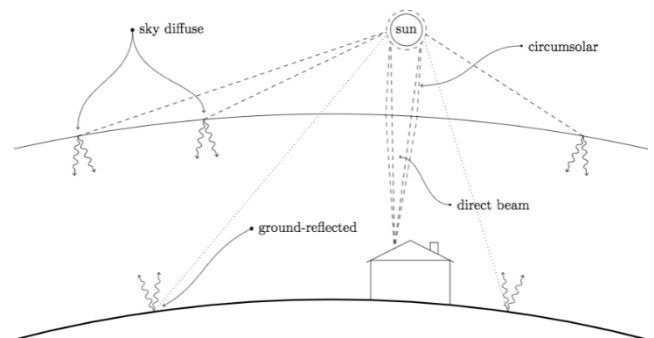- The sum of beams, diffuse and reflected radiation is called as global radiation.

Fig1.direct beam and diffuse beam

III. SOLAR ALTITUDE ANGLE (ΘZ)

Solar altitude is the angle between the line connecting to the sun and horizontal at sunset / sunrise the altitude is zero(0degrees) and nighty degrees (90degrees)the altitude related to the latitude of the site, and the declination angle and the hour angle .[6][1][2]
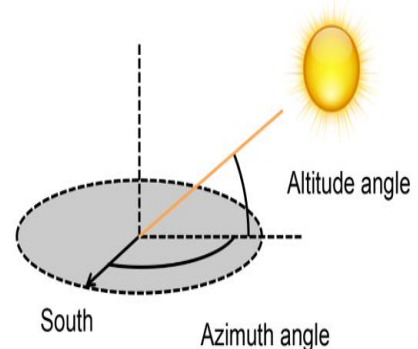

Fig .2 altitude and azimuth angle

IV. SOLAR AZUMITH ANGLE(ΘA)

Solar azimuth angle is quit opposite to the altitude angle with in the horizon plane measured from true south or north ,it has been measured in clock wise direction from zero angle θA for example if you are southern hemisphere the azimuth angle of zero is towards north in the same way it is quit opposite to

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- Northern hemisphere the zero azimuth angle is towards the south .the azimuth angle is negative before solar noon ,after solar noon it will be positive ,at noon it will be equal to zero[19].
- The azimuth angle is clearly seen in the above figure ,azimuth angle is denoted with θA in technical terms.
- KINAMATICS

Earth receives energy of around 1000w/m2 that means we can generate 1000 watts of energy in 1m2 area. If we assume 10% total efficiency of the photovoltaic panels, the predicted output power from the panel will be 100 Watt. Although, it is known that there are panels with higher efficiency but it is preferable to calculate for the least case[7]. Earth will complete its one rotation around its axis it will take 24 hours which means full completion of 360 degrees in 24 hour or one day. Therefore one hour cover 360 degrees /24=15 degrees, which means one hour angle =15 degrees. The system is been designed to move discretely to cover the total daily track of the sun in desired steps to reduce the operating time. After sunset, the panel can be designed is been designed to return back pointing towards the east to collect the sun radiation next morning.

- LDR-(LIGHT DEPENDENT RESISTOR)

Light dependent resistor is also known as photo resistor or it also called as cadmium sulfide (cds) cell it also called as photo conductor it basically a photo cell which works depends on the principle of photo conductivity the passive component is basically a resistor which is been inversely proportional to light [8].when the light intensity increases or the lux(units of light) increases the resistance decreases if the light intensity decreases or the lux decreases the resistance valve been increased
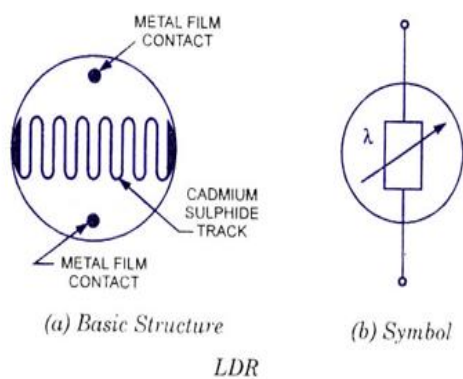

Fig .3 light dependent resistor -LDR
Light is inversely proportional to resistance

V. MPPT-MAXIMUM POWER POINT TRACKING

This the point where we can get more power and more more radiation simply the point where we can get max amount of power at this   particular[9] weather condition however this is the point where we can provide maximum power for fixed position solar panel .Due to this pont it leads to development of solar tracking system to get more efficiency and one more thing it is an renewable energy resource [10]
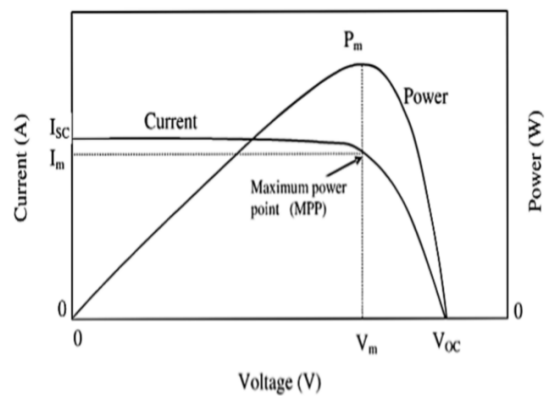

Fig.4 MPPT POINT

VI. MPPT TRACKING SYSTEM (OR) DUAL AXIS SOLAR TRACKING SYSTEM& RESULTS

- This is one of the finest method which are been introduced until right now compare to other technique this is a unique one[11].
- The name it self justify about it self it is a two axis tracking system.
- It was more better than one way tracking system.
- It can used for closed loop or open loop control system .
- The motion of sun is calculated from time to time by its position and its angle with the help of LDR sensor the position of sun is been tracked.
- With the help of sensors the we make sure that the panel should be placed in MPPT-point to get more efficiency .
- MPPT-(maximum power point tracking) in this point will maximum amount of energy or to observe maximum amount of light from sun ,the amount of energy generation was more at this point.[12][2][13][4]
- At initial the cost of installing was more but the comeback period of returns in less time can be seen in this method.
- There are 2 angle like tilt angle and azimuth angle which are most important things in this method.
- 20-30% of efficiency increases in this method .
- In this method the degrees of freedom was two.

VII. DESIGN OF PROTOTYPE

It is the design which is used to track the sun radiation or make sure that the panel is placed in MPPT point through out the day it has 2 movement one was[14] vertical and another was horizontal hear we used servo to rotate on both side to have 2 degree of freedom and it allows the solar panel to direct beam or direct ray radiation (which is shown in the above figure no 1) [17]to generate more power ,to ensure that the panel always produce maximum out put with the help of LDR(figure no 3)the feed back from the sensor is forwarded to Arduino Uno board to generate pulse and the servo starts rotating to place the panel in MPPT point ,before this we need to verify the circuit with the help of

proteus 8 is used for simulation when we compared with both technical and practical valves there is a some part of deviation in practical valves .

VIII. PROPOSAL

From this paper we propose that ,we can change the angle ,we can customize the angle according to our instalment place when we are going to install it home application purpose the degree of freedom[15] we can take it max because the panel was in small size when it implemented in a large scale like power generation for grids or for an industrial power purpose the panel size was very huge some parameters will going to act anti to the panel one was the weight of the panel and another thing we need to increase the height of the base when the panel size increases it will touch the fool which out reaching the ma valve and the panel is going to get damage for that we proposes that the angle for home application will be max of 155 degrees when it was going to implement in industrial purpose the max angle will be 135 degrees ,we are not going to use the max valve of motor for the safety purpose[19] ,and another thing we need to consider was degree of freedom in this the degree of freedom was 2 one is horizontal and another thing is vertical the panel is going to track the sun according to its path , we need provide some space which is been called in technical terms as work space-the maximum reach of the panel end from its space is called work space[16].
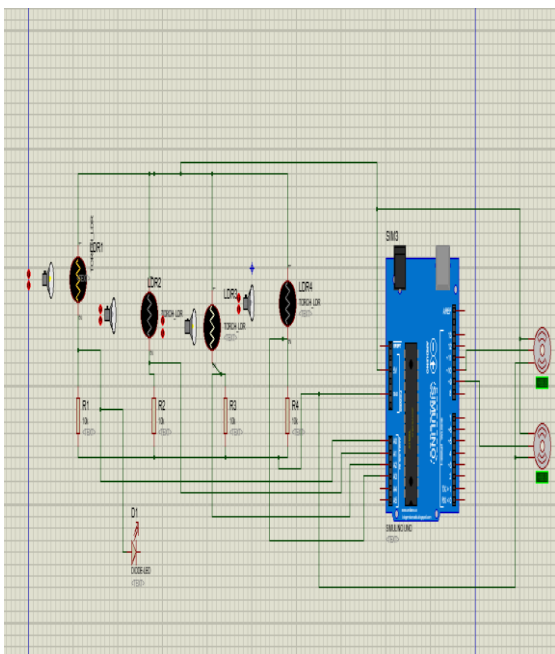
IX. RESULTS

Fig .5 proteus module for circuit verification

Companents when light or lux (units of light)was increases it is inversely proportional to resistance if the light intensity increases the resistance valve decreases if lux was decreases the resistance valve increases this is a basic principle behind LDR (light dependent resistor)which gives feedback to the Arduinouno board.

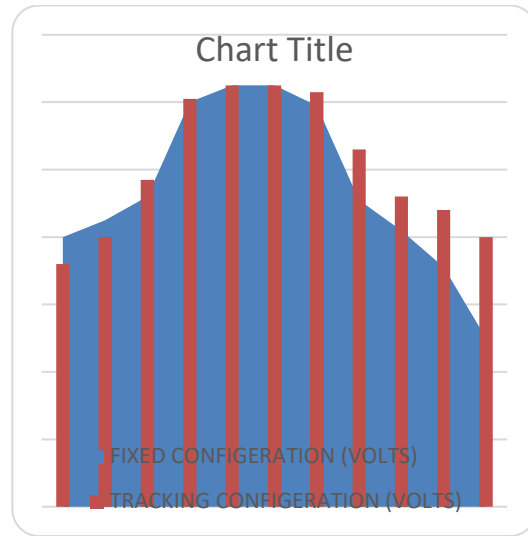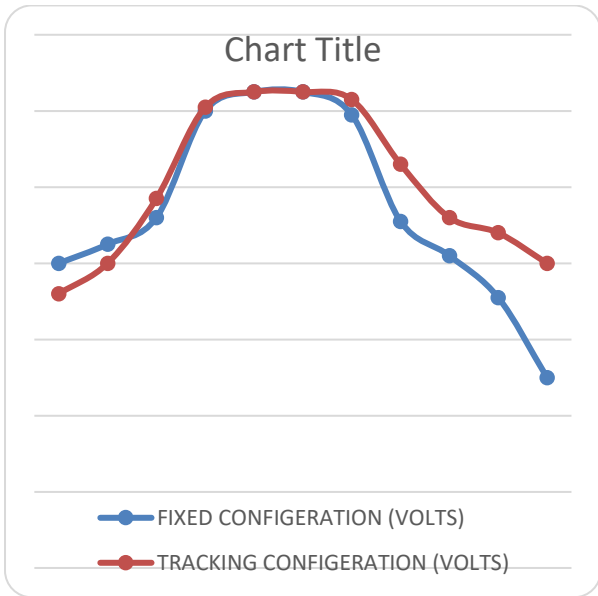| LDR1	LDR2	LDR3	LDR4
798	825	807	816
820	820	829	811
786	816	795	807
816	813	825	804
779	812	788	803
811	811	820	802
785	811	796	801
798	812	808`	802
798	812	811	799

Fig .6sensor response results from hardware

The above screenshots about the hardware valves of LDR and how they are bean responding to light when the light intensity or lux increases the LDR-light dependent resistance where been decreases

| Time (Hour)	FIXED CONFIGERATION (VOLTS)	TRACKING CONFIGERATION (VOLTS)
8AM	8.0	7.2
9AM	8.5	8
10AM	9.2	9.7
11AM	12	12.1
12AM	12.5	12.5
1PM	12.5	12.5
2PM	11.9	12.3
3PM	9.1	10.6
4PM	8.2	9.2
5PM	7.1	8.8
6PM	5	8

X. RESULT ANALYSIS

From the results we can say that the dual axis solar tracker is more effective compared than the fixed solar panel, it is 12% more effective than the fixed solar panel .

Chart Title

FIXED CONFIGERATION (VOLTS)
TRACKING CONFIGERATION (VOLTS)

Graphical representation from the results of fixed and duel tracking configuration

Chart Title

FIXED CONFIGERATION (VOLTS)
TRACKING CONFIGERATION (VOLTS)

Above graph about comparition between fixed and tracking configuration in various types. With the help of graphical representation we can see the clear analyses wile comparing the valves of the both fixed and tracking configuration
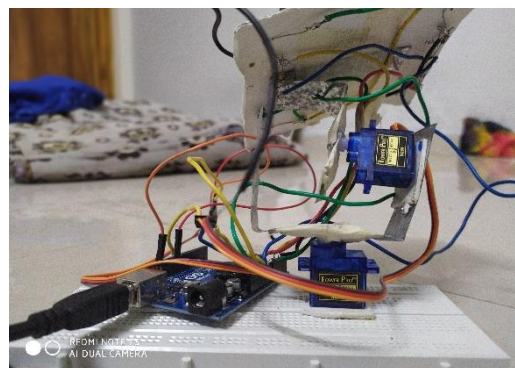

FIXED CONFIGERATION (VOLTS)
TRACKING CONFIGERATION (VOLTS)
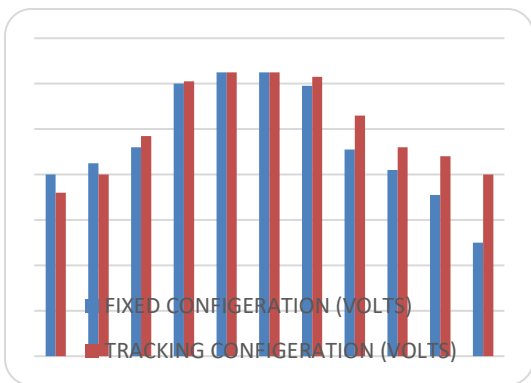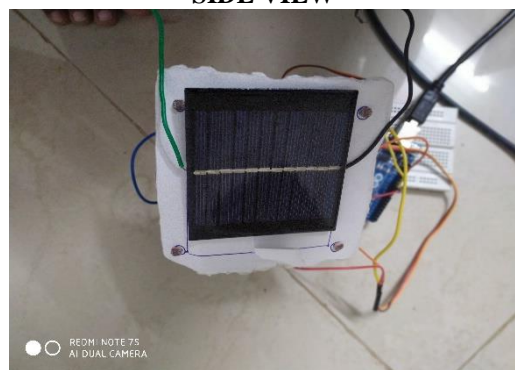
Bar graph analysis for fixed and tracking configuration was shown in the above figure .
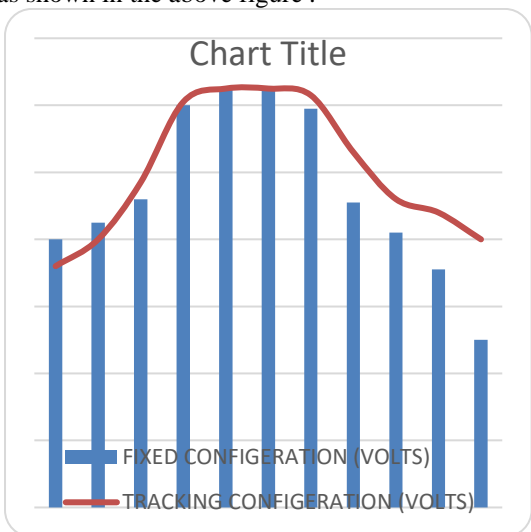
XI. PROJECT PROTO TYPE

SIDE VIEW

Chart Title

FIXED CONFIGERATION (VOLTS)
TRACKING CONFIGERATION (VOLTS)

TOP VIEW

XII. CONCLUSION

The fully automated duel-axis solar tracking system has been implemented with the help of Arduino UNO board .This system can be used more effectively for home applications for household power generation. For an fixed configuration the inclination is around 22.5degrees .from both fixed configuration and tracking configuration ,tracking

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configuration efficiency is 12persent more than the fixed configuration with the help of power modes in taking readings the power conception by the system is reduced .with the help of tracking system we can able to maintain the pH-peak voltage for long duration (or) long period of time as we compared with fixed configuration of solar panel thus more solar energy.

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