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TO DESIGN DUAL AXIS SOLAR TRACKING WITH WEATHER MONITORING

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Abstract : This project presents a performance analysis of the dual axis solar tracking using Arduino, LDR and servo motors. It incorporates mainly with the 3 sensors namely DHT11, LDR and Rain drop sensor. Initially the 4 LDR sensors are placed at the edges of the solar panel as a tracking mechanism for the sun radiations and DC motors are connected vertically and horizontally to direct the position of the solar panel such that the panel will maintain perpendicular to the sunlight. The voltage from the panel is calculated from time to time in an interval of 1hr and this voltage is used to sense the weather conditions and climatic temperatures. Initially DHT11 and Rain drop sensors will collaborate to find out the environment conditions based on temperature, humidity and moisture content respectively and it displays on the LCD screen.

On the other half, the software part is written by using embedded C programming language which head towards the Arduino UNO controller.

Keywords: DHT11, LDR, Rain drop sensor, Arduino UNO.

1 INTRODUCTION

With the unavoidable shortage of fossil fuel sources in the future, renewable types of energy have become a topic of interest for researchers, technicians, investors and decision makers all around the world. New types of energy that are getting attention include hydroelectricity, bioenergy, solar, wind and geothermal energy, tidal power and wave power. Because of their renewability, they are considered as favourable replacements for fossil fuel sources. Among those types of energy, solar photovoltaic (PV) energy is one of the most available resources. This technology has been adopted more widely for residential use nowadays, thanks to research and development activities to improve solar cells' performance and lower the cost. According to International Energy Agency (IEA), worldwide PV capacity has grown at 49% per year on average since early 2000s. Solar PV energy is highly expected to become a major source of power in the future.

While the modern tracker tracks east west and north south movement of the sun. In this project we are integrating dual axis solar tracking system with weather sensor. It detects temperature, raindrop and humidity by using sensors and the output of these sensors can be seen in liquid crystal display(LCD).Light detecting resistors(LDR's) which can sense the maximum intensity of light and the arduino which guides the rotation of servomotors towards the maximum intensity of light is used. Servomotors are used to rotate the solar panel. Sensors are used to sense the weather conditions. From the past million years man has needed and used Energy at an increasing rate for his existence and well-being. Solar energy promises of becoming reliable energy source without any polluting effects. Hence obtaining of maximum energy with this method is more efficient and beneficial.

2 NEED OF THE STUDY.

The demand for reliable source of energy has been increasing day by day. So, government improved the usage of renewable energy sources there by curtailing the usage of conventional source of energy. By using photovoltaic cell we can harness solar energy and later photovoltaic effect can be used to convert solar energy into electrical energy and this energy can be used in wide applications like solar thermal energy, solar heating, photovoltaic, solar architecture etc. The output of photovoltaic cell directly depends on the intensity of light and sun's positions changes continuously in a day. In general, during the day the single axis tracker moves from east to west with one degree of freedom. While the modern tracker tracks east west and north south movement of the sun. In this project we are integrating dual axis solar tracking. 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.

2.1 PROBLEMS IN THE EXISTING SYSTEM

In past we don't have any automatic technologies for rotating the solar panel. It was not provide sufficient output continuously. It is difficult to rotate solar panel every time on the day manually at plant. So power is not sufficient for all the time.

Although single axis trackers can move to absorb sunlight from East - West, they cannot move from North To South, unlike dual axis solar trackers. Efficiency of solar tracking in single axis solar tracking is less compared to dual axis trackers.

2.2 OBJECTIVES OF THE PROPOSED SYSTEM

The main objective of the dual-axis tracker is **to follow the position of the sun for maximum energy efficiency**. Given that the sun moves at 15 degrees per hour and assuming, the tracker would make position changes every . 01 seconds, the change in angular velocity is calculated and to increase the efficiency of the solar panel by 30-45% when compared to the static and single axis solar tracker. The energy which is stored is used in monitoring the humidity in nature and to find the humidity in forms.And also It can track seasonal variations in the height of the sun in addition to normal daily motion.

3 METHODOLOGY

The entire set up is divided into 3 parts the light detecting unit, monitoring unit and the movement controlling unit. The detailsare as follows;

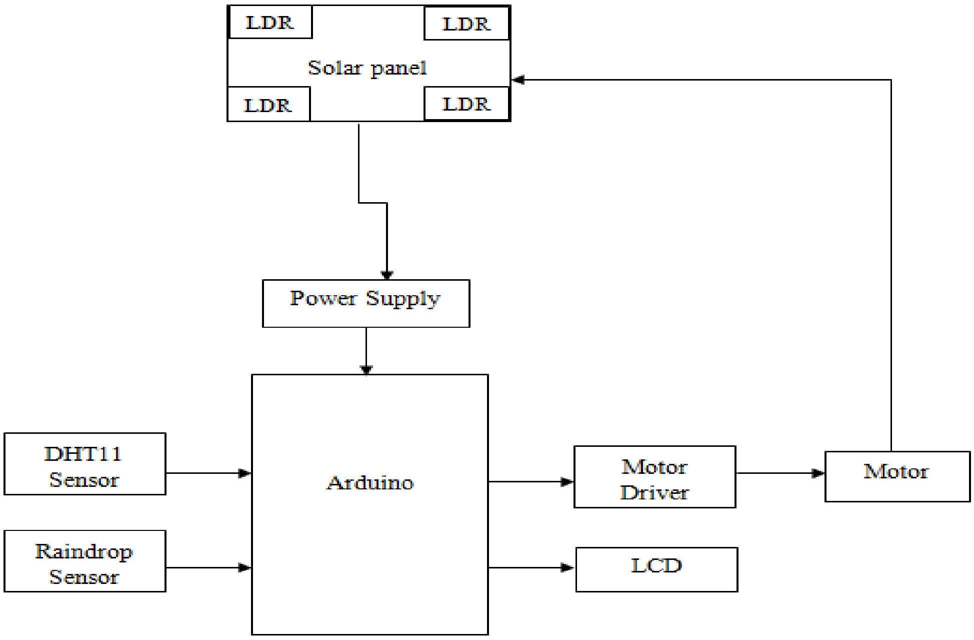

Fig 1: block diagram

3.1 LIGHT DETECTING UNIT

It consists of four light detecting resistors each forming a pair of two. It measures the light intensity and converts it into analog voltage and gives the input to the controller. One pair of LDR trace the location of sun in east- west direction and the other pair senses in the north-south direction. Resistance is inversely proportional to intensity of light and hence it decreases with increase in light intensity. The relationship between light intensity and resistance is given in the equation below.

$$RL = 500/LUX.$$

3.2 MONITORING UNIT

Arduino is the main monitoring unit of the entire apparatus as showed in fig.1..LDR is connected to the first four pins of Arduino i.e. A0- A4.Arduino takes the input from the LDR and based on that it gives instructions to servomotors to rotate either in horizontal or vertical directions.

3.3 MOVEMENT CONTROLLING UNIT

The movement controlling unit comprises of two servo motors. The Arduino gives an output of 5v which is used to drive the servo motor which can be driven by an input of about 4.5 volts. One of the motor controls the horizontal rotation while the other controls the vertical rotation. Only one motor functions at a time so as to reduce the power consumption.

3.4 WEATHER SENSORS

It comprise of a weather sensing unit in which arduino is used as an interfacing device and indicates the surrounding temperature conditions and humidity which is displayed on LCD display device.

4 RESULTS AND DISCUSSION

Thus, Experiment outcomes of the system were performed by placing it in the rooftop. This output voltage is collected from 8:00 AM to 6:00PM.

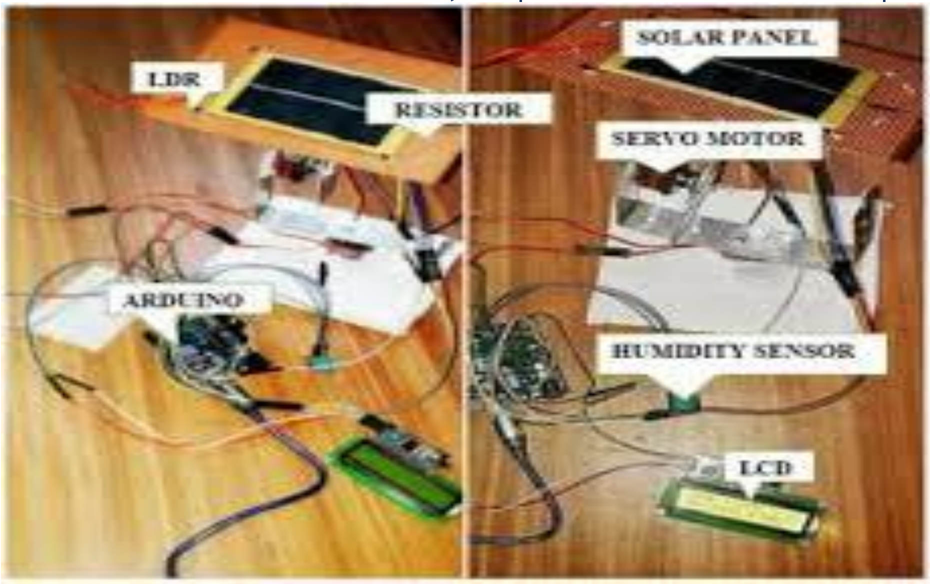

Figure 2: Model

Output of dual axis solar tracker-

Table.1 OBSERVATION OF SOLAR TRACKER

Time(hrs)	Single axis	Dual axis
08:00	04.52	07.88
09:00	06.62	10.51
10:00`	07.15	13.98
11:00	09.33	15.82
12:00	10..42	19.36
13:00	13.77	19.78
14:00	14.79	17.95
15:00	15.56	16.79
16:00	15.22	16.51
17:00	13.55	12.57
18:00	05.83	6.96

The table which is shown above indicates the output values at different time intervals. As we know dual axis solar tracker is more productive than single axis solar tracker, comparison of output voltages of both the tracking methods is done.

Output of weather sensor-

Table.2 OBSERVATION OF WEATHER SENSOR

Time(hrs)	Temperature (°C)	Humidity (%)
16:00	34	60
19:00	30	80

The graphical representation is also seen in the graph mentioned above. Dual axis solar tracker system has high voltage capturing capacity. Graphical representation is undoubtedly showing the improved solar energy conversion when compared to other systems. Other than this there are some other techniques used for efficient tracking of solar radiations such as power towers, parabolic dish concentrator, parabolic trough concentrator, central receiver concentrator etc. but all these are very expensive. So, as dual axis solar system is less expensive, highly efficient it is used more common.

5 FUTURE SCOPE OF THE PROJECT

1. Fabrication of Microcontroller using ASIC concepts: The number of wires can be greatly reduced by directly if a customized PCB is made upon which all the resistors can be directly soldered. This also eliminates the use of a Breadboard which was used to make all the external connections.
2. Design Improvements: With the current design, it can be seen that the controller circuit rotates along with the panel. This was done to avoid tangling of wires. A better design may be realized in which only the panel rotates and all other parts are stationery.
3. Mounting of the panels: In our designs, the panels a mounted on a horizontal shaft supported strongly at both ends. We can mount the panels directly onto a motor placed at the center of the panel-Base in order to provide East-West movement. This reduces the weight and effective cost of the project.

6 CONCLUSION

As solar energy is considered one of the main sources of energy in the near future, In this paper, we give a simple and concise overview of the solar tracking mechanism to improve the solar gain energy, also the costs of the solar tracker operation and cost maintenance is relatively low. In this paper, Design and implementation of solar tracker with four axes that Use in motor satellite dish to track the sun accurately and use LDR sensor to determine the intensity of falling sunlight. We found that the solar tracking system is more effective than the fixed solar panel. The energy gained from the solar panel with the dual tracker exceeds 35% of the energy gained from the fixed solar panel, In analyzing the data, the energy gained from the solar tracker is mostly in the morning and in the evening because at noon time there is little difference and this proves that the fixed solar panel is efficient during noon time only. The dual-axle solar tracking system is efficient as it can be placed anywhere and ensure a high energy gain.

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