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A PROTOTYPE MODEL OF DUAL AXIS SOLAR TRACKER SYSTEM

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ABSTRACT

As population is increasing globally; we are very concerned for Electricity.There are various ways of electricity generation like Hydro power plant, Nuclear power plant, Windmill plants and also Solar power plants. The former two are Non Renewable source of energy; hence we cannot depend only on such technology. Also Harnessing Energy from Hydro and Nuclear is equally difficult. The latter two are Renewable source of Energy; nowadays we have lots of power plants established on Solar and Wind Technology. Our project aims at Dual axis or Dual direction tracker. The Solar panel used in this system can adjust its direction both in X-Y co-ordinates. This helps better directivity with Sun rays, thus increasing the efficiency of the solar system.Now days it is essential to develop electricity with solar energy, because of low creativity of electricity and high demand of electricity. 12Mega Watt energy was sufficient above 60 years ago, but now days this number is very big (approximately 1.5 million Mega Watt).When absorption and scattering are taken into account, the total solar flux reaching the surface of the earth is estimated to be 1.08×108 GW and the total amount of energy reaching the surface of the earth each year is 3,400,000 EJ.In the best-case scenario, solar panels to receive about four or five hours of direct sunlight. Specifically, that sunlight should reach panels between 10 am and 3 pm. This is when the sun is in its highest position and the rays are the most direct.

Keywords: Solar Panel, Arduino,Sero,DHT11,HC05,Power Supply and LDR.

I. INTRODUCTION

We implement here solar tracker with DC generation system, which follow the sun. To sense the sun position. we used the photo diodes/ LDR. The sensed output controls the motor driving section. DC motor is used in this project to track panel. One direction follows to sun from EAST to WEST. Motors reverse direction is used to take solar panel from WEST to EAST after sun setup. Generated electricity is stored in battery and can be used for further requirement. Electrical energy from solar panels is derived by converting energy from the sun rays into electrical current. The main challenge is to maximize the capture of the sun rays upon the solar panels, which in turn maximizes the output of electricity. There are two possible ways to enhance output power from solar based energy system. Either one can use an efficient material in the manufacturing of the photo voltaic cell or use a solar tracker to follow the sun throughout the year. The axis of rotation is tilted at an angle of 23.45Â° with respect to the plane of the orbit around the Sun. The axis is orientated so that it always points towards the Pole Star .This accounts for the seasons and changes in the length of day rotation is always pointing to the Pole Star the declination angle changes as the Earth orbits the Sun India lies in the Tropic of cancer region .This makes it practically possible for implementing solar panel in our country compared to the countries located beyond23.45Â° The dual-axis solar tracker tracks the angular height position of the sun in addition to following the suns east- west movement.

II. WORKING PRINCIPLE

The proposed tracking system tracks sunlight more effectively by providing PV panel rotation along two different axis. The tracker is composed of four LDR sensors, two stepper motors and PIC microcontroller. A pair of sensors and one motor is used to tilt the tracker in suns east-west direction and the other pair of sensors and the motor which is fixed at the bottom of the tracker is used to tilt the tracker in the suns north-south direction.Two stepper motors are all in use in this system. Upper panel holder stepper motor tracks the sun linearly and base stepper motor tracks the parabolic displacement of the sun. These stepper motors and sensors are interfaced with a microcontroller .The microcontroller gives the command to the motors on the basis of sensors input. LDR sensors sense the light and sends signal to microcontroller.Microcontroller does the comparison of signals received from LDR sensors and

on the basis of stronger signal it is deciding rotation direction of stepper motors. Microcontroller is an intelligent device which functions on the basis of input that it receives from the sensor thus activating motor driver circuit. The controller activates driver circuits and moves stepper motors to new positions where light falling on sensor pairs is same. If difference arises, then the motor moves the panel until the light falling on the sensor is same. Algorithm takes data from the sensors. Analog signals from sensors are converted to digital signals using analog to digital converter (ADC).This ADC module has to be present in the microcontroller or has to be added externally. Digitized signals are forwarded to microcontroller. The step angle and movement direction of stepper motors is calculated once the digitized signal is received. Here circuit requires 5V and 12V regulated DC supply. We used here 12V (10Watt) solar panel. The output energy of solar panel is stored in battery. Now the out of capacitor is DC 12V-13.4V according to solar and battery voltages ratings given to the circuit, which is required to convert in 5V regulated for microcontroller and other devices, here we have used LM7805 regulator for getting 5V regulated DC.12V DC connected with all devices like LED light, charger and it is negative control signal gets from MOSFET and MOSFET triggered via microcontroller. In this ARDUINO board (microcontroller) works with 16MHz frequency used for (timer configuration), the unwanted frequency produced is bypassed by the capacitor of 27pf capacitor. Reset pin is connected to resistor of 10K whenever reset requires the reset switch (2 lead push to ON switch/ micro push to switch) required pressing. LCD data pins (AD4 to AD7) is connected to the pin 10, pin 11, pin12, pin 13 to send the data for the LCD display. The control pins of LCD display is connected to pin 8, pin 9, respectively take action as RS, E. Variable resistor of 10K (or fixed 2.2K) is connected to the adjust contrast of 16X2 LCD display. 10uf capacitor is used to cancel loading effect and 0.1uf is used to bypass the unwanted spikes produced in the circuit.Arduino board/ atmega328 microcontroller analog inputs pin are connected with all sensors. As A0, A1, A2, A3 connected with light sensor 1, light sensor 2, light sensor 3, light sensor 4 (to sense light intensity). PIN 2, 3, 4, 5 are connected to motor to drive as X and Y direction, L298D motor driver is connected for that. Humidity and temperature sensor DHT11 is connected with A5 pin do determine temperature and humidity.All capacitors of 0.1uf & 100uf connected to reduce unwanted spikes in the circuit, spikes produced by inductive load/ sparking contacts of loads. Capacitor of 1000uf/25V at regulator output is connected for the cancel loading effect in the circuit while driving the high current source.

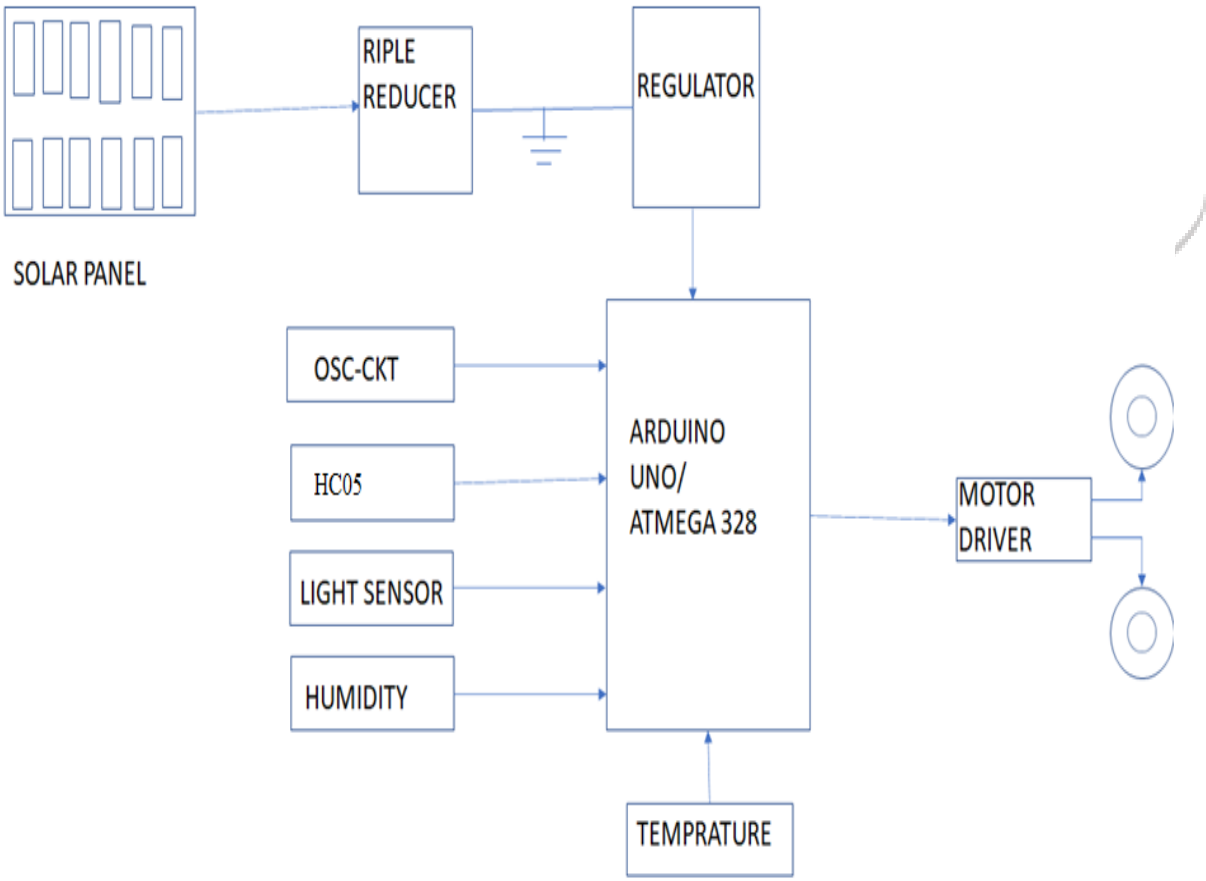

Figure 1: Block Diagram

III. COMPONENTS

A) Arduino Nano

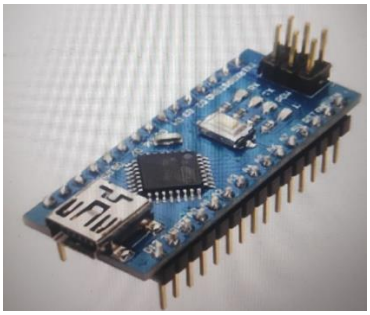

Figure 2

- Microcontroller Atmel ATmega328
- Operating Voltage (logical level) 5 V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 8
- DC Current per I/O Pin 40 mA
- Flash Memory 32 KB (ATmega328)
- SRAM 2 KB (ATmega328

B) Servo Motor

Figure 3

- Super Debug SG 90 Tower Pro Micro Servo Motor
- POM gear set Operating speed: 0.1sec/60 degree (4.8v) Operating voltage: 4.8v Temperature range: Dead band width: 1us Power Supply: Through External Adapter servo wire length: Servo Plug: JR (Fits JR and Futaba) Inside Box: 1Pc x Upgraded Tower Pro SG90 9g Micro Digital Servo

C) HC05 Bluetooth Sensor

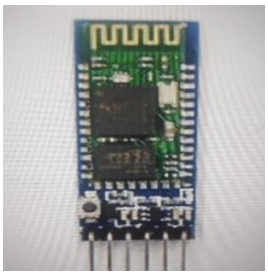

Figure 4

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

IV. prototype model of dual axis solar tracker

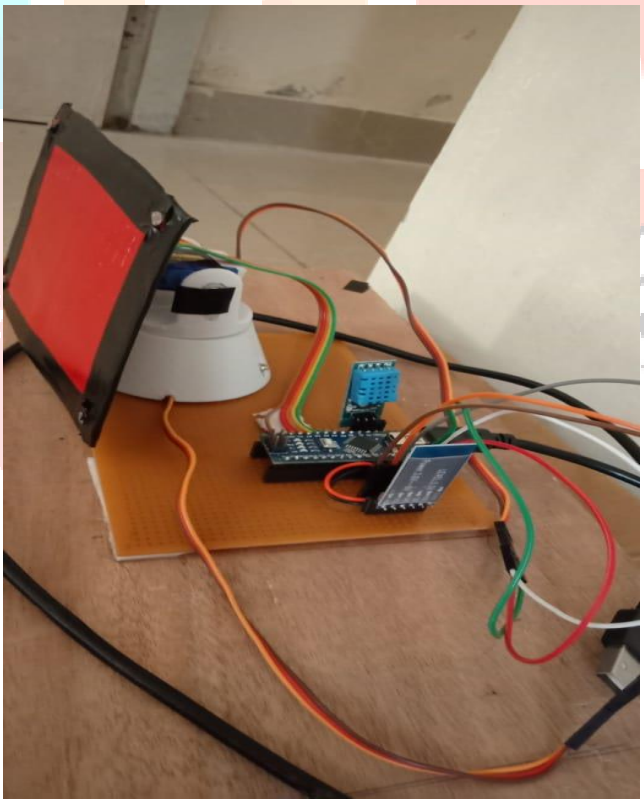

Figure 5

In this prototype we can see the all the components used there assembly and connections. As light comes on panel LDR sense light and send analog signal to Arduino which Arduino convert into digital signal and with the help of PWM technique position of servo motor changed to position where maximum light incident and hence vertical servo motor rotates panel to vertical axis and horizontal panel to horizontal axis and about 20% to 30% more collection compared to single axis.

V. RESULTS

Thus our group actively coupled with project, and we develop this project named as "DUAL AXIS SOLAR TRACKER".
In this project we have used multiple light sensors (four), to detect light in horizontal or vertical directions. According to sensed condition microcontroller drives motor through motor driver IC and solar panel follows maximum energy.

VI. CONCLUSION

This project we have come to a conclusion that dual-axis solar tracker is more efficient in terms of the electrical energy output when compared to the single axis tracker and fixed system. The gain of the dual-axis tracking system is about 40% compared with the fixed system. we can't neglect that dual axis tracker is more complex due to the tracking system used so it will be more expensive and less reliable than fixed system. The gain of the single- axis tracker systems is about 28% compared with the fixed system, so a compromise between maximum power collection and system simplicity in is obtained.

VII. REFERENCES

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