Automatic Solar Tracking using Microcontroller connected with Driving Circuit of DC Permanent Magnet Motor

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***Abstract* - This paper shows the potential benefits of simple tracking of solar system using a DC motor and light sensor. LDR sensors are used here to detect the maximum efficiency position and they sends signal to micro controller to adjust the position of the panels with the help of motor drive used. The output power received by the system using LDR control system is improves as compare to the system with out tracking applied.**

***Index Terms* - Maximum Power Point Tracking (MPPT), Light Dependent Resister (LDR), Automatic Solar Tracking System (ASTS).**

I. INTRODUCTION

Solar energy is the most abundant stream of energy and it is available directly as solar insolation and indirectly as wind energy. Solar energy is considered as a source of zero emission renewable energy. Its potential is 178 Billion MW, which is about 20,000 times the world's energy demand. Sun provides energy in the form of electromagnetic radiation. In this project we used the solar energy for generation of electrical power, by using the Solar cells. The solar cells receive the solar photons and they operate on the photo-voltaic principle. The energy generated from the photo voltaic cells is used to switch on the driving motor. At present solar electric power generation systems are having fixed solar panels whose efficiency of generation is less. The aim of the project is to introduce the solar tracking to the existing fixed solar panels, so that maximum possible power output can be generated. Thus by using this tracking system we can increase the conversion efficiency of the solar electric power generation [1].

Solar power is being widely researched, and solar energy costs have now reached within a few cents per kW/h of other forms of electricity generation, and will drop further with new technologies such as titanium oxide cells and large scale installations. With a peak laboratory efficiency of 32% and average efficiency of 15-20% [1-4], it is necessary to recover maximum possible power from a solar generation system. This includes reducing inverter losses, storage losses, and light gathering losses. Light gathering is dependent on the angle of incidence of the light source providing power (i.e. the sun) to the solar cell's surface, and power becomes maximum for perpendicular position. If a flat solar panel is mounted on level ground, it is obvious that over the course of the day the sunlight will have an angle of incidence close to 90°in the morning and the evening [2]. At such an angle, the light gathering ability of the cell is essentially zero, resulting in zero output. As the day progresses to midday, the angle of incidence approaches 0°, causing a steady increase in power until at the point where the light incident on the panel is completely perpendicular, [3] and the maximum power is achieved. As the day continues toward dusk, the reverse cycle happens, and the increasing angle causes the power to decrease again towards minimum value. From this background, we find the need to maintain the maximum power output from the panel by maintaining an angle of incidence as close to 0° as possible. By tilting the solar panel to continuously face the sun, this can be achieved. This process of sensing and following the position of the sun is known as Solar Tracking. It was resolved that real-time tracking would be necessary to follow the sun effectively, so that no external data would be required in its operation [4].

II. SYSTEM CONFIGURATION

Fig. 1. System Layout of the system

NUVOTON 8-Bit microcontroller is W78E052D/W78E051D series microcontroller. The NUVOTON is an 8-bit microcontroller which can accommodate a wider frequency range with low power consumption. The instruction set for the NUVOTON is fully compatible with standard 8052.

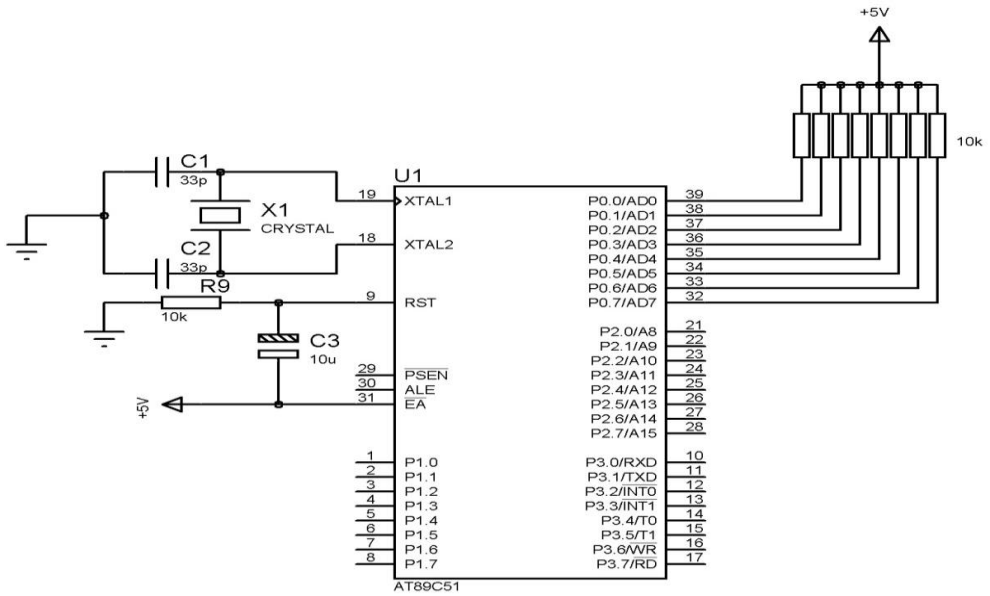

Fig.2. NUVOTON 8-Bit Microcontroller Pin Diagram

Here we used L293D to drive the motors, whatever signals it receives from the microcontroller on the basis of that it will drive the motors. An **H-bridge** is an electronic circuit which enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards. H-bridges are available as integrated circuits, or can be built from discrete components.

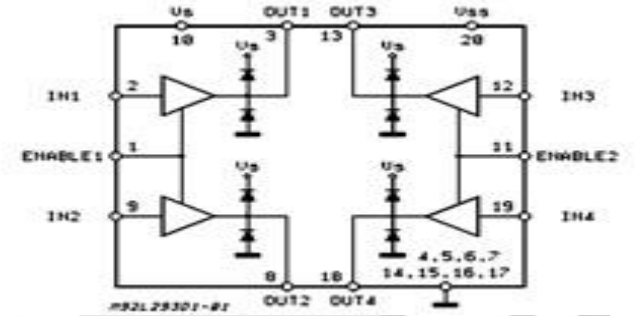

Fig.3. Internal Logic diagram of Microcontroller

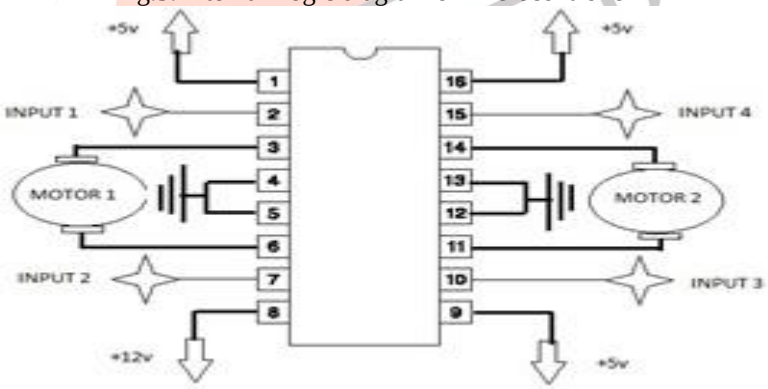

Fig.4. Connection diagram of Microcontroller

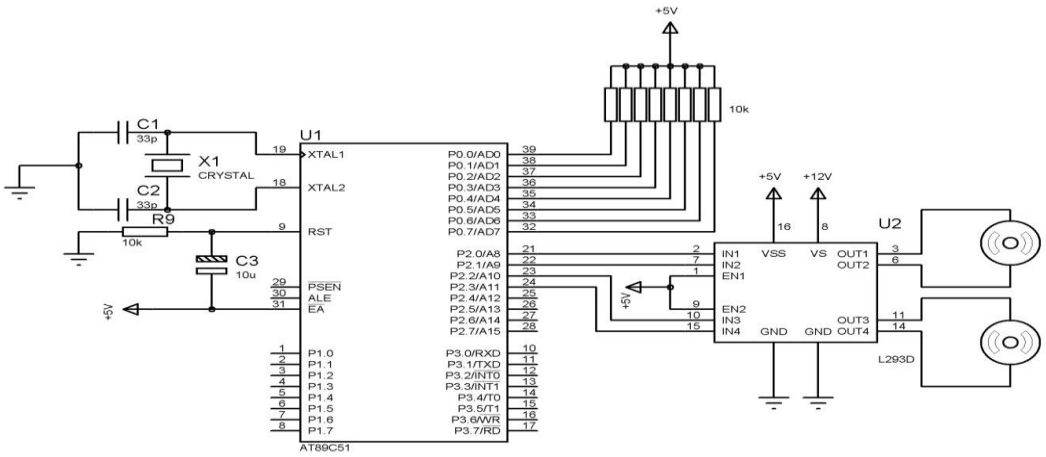

Fig.5. Connection of DC Motor to P2 through L293D Motor Driver IC

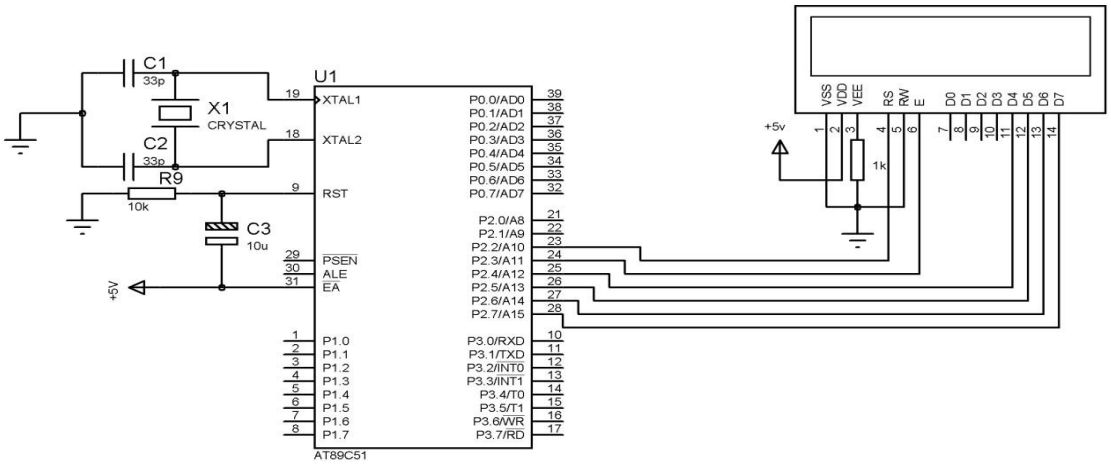

Fig.6. Connection of LCD in 4 Bit Mode

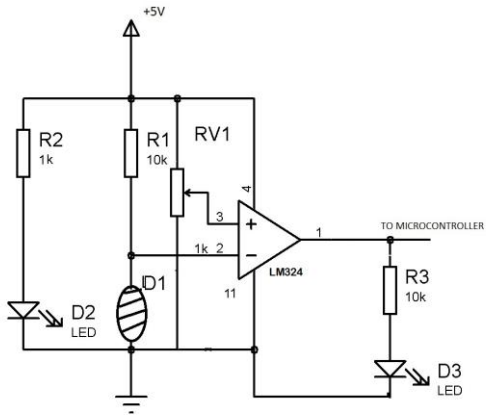

Fig.7. Connection of an LDR Sensor with LM324 Comparator IC

III. MAXIMUM POWER POINT TRACKING

Many different methods have been proposed and used to track the position of the sun. The simplest of all uses an LDR– a Light Dependent Resistor to detect light intensity changes on the surface of the resistor. The main objective of this project is to generate maximum power from the sunlight. [5][6]This project helps for power generation by setting the equipment to get maximum sunlight automatically. This system is tracking for maximum intensity of light. When there is decrease in intensity of light, this system automatically changes its direction to get maximum intensity of light [7][8].

PROGRAMING OF MICROCONTROLLER:

```
P0 = 0
Dim F As Word , R As Word , L As Word
Do
L = Getrc(p1.0)
F = Getrc(p1.1)
R = Getrc(p1.2)
Cls
Lcd "F=" ; F ; " R=" ; R
Lowerline
Lcd "L=" ; L
If F < R And F < L Then
P0 = 0
Cls
Lcd "SOLAR TRACKER"
Lowerline
Lcd ""
End If
If L <= R And L <= F Then
P0 = 2
Cls
Lcd "SOLAR TRACKER"
Lowerline
Lcd "TURNING LEFT"
End If
If R <= L And R <= F Then
P0 = 1
Cls
Lcd "SOLAR TRACKER"
Lowerline
Lcd "TURNING RIGHT"
End If
Waitms 200
Loop
```

IV. CONTROL STRATEGY OF ASTS

For a successful operation, the ASTS has two Automatic control With the help of an efficient algorithm (written in C) only one Microcontroller is being used to manage the automatic operation of ASTS. This controller has functions like Senses all of sensors, Drives DC motor, Operate LCD,Controls the warning indicators e.g. buzzer, LED's etc[9][10].

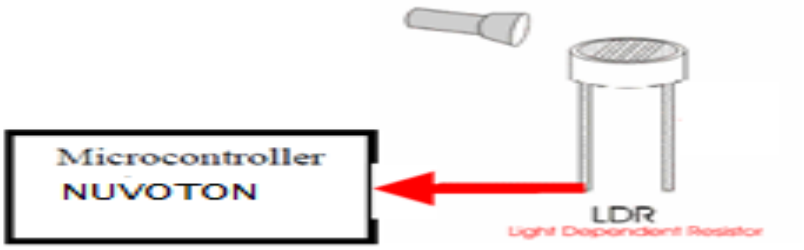

Fig.9: LDR connection with Microcontroller.

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V. CONCLUSIONS

A solar tracker is designed employing the new principle of using small solar cells to function as self-adjusting light sensors, providing a variable indication of their relative angle to the sun by detecting their voltage output. By using this method, the solar tracker was successful in maintaining a solar array at a sufficiently perpendicular angle to the sun. The power increase gained over a fixed horizontal array was in excess of 30%. This project which was enhanced with the scope of conserving the conventional fuels is successfully completed. The main objective, to increase the usage of renewable energy source for power generation is perfectly implemented. Taking into consideration the future energy scenario in the world, solar energy would be a major energy source. We wish that our project would be a mini encyclopaedia for those who want to implement the above system.

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