An Efficient Tracking of Global Solar Radiation using Tarang Modules

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Abstract— Everything in nature emits EM energy, sun emits solar radiation. Solar radiation is distributed over a wide continuous spectrum ranging from ultraviolet to infrared rays. In this paper, fuzzy based MPPT is used in PV module to make the efficient use of power. Solar panel embedded with LDR is used to estimate the position of the sun. The panel with LDR acts as a master to inform other panel about the sun's angle to attain a maximum utility in a desired direction. High power generation is achieved by mesh network created between the nodes. The realization of the proposed method has been stimulated using simulation at different temperature.

Key words: PV module, MPPT, LDR, Simulation

I. INTRODUCTION

Renewable energy is the energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat. These resources are renewable and can be naturally replenished. Therefore, for all practical purposes, these resources can be considered to be inexhaustible, unlike dwindling conventional fossil fuels. Maximum Power Point Tracking (MPPT), is an electronic system that operates the Photovoltaic (PV) modules in a manner that allows the modules to produce all the power. It is very important to know the maximum power point of the system to increase the efficiency of the photovoltaic system. The maximum power point algorithm to measure the maximum power at all conditions is shown in [1]. To overcome the disadvantages Perturb and Observe algorithm is widely used and most preferably used in industry. The Perturb and Observe (P&O) algorithm is used to control the measurement of power by adjusting the voltage [2]. The measured power is compared with the previous one and if the measured one is greater than the previous one then the solar panel is adjusted in that direction until there is no increase in power. The perturb and observe (P&O) is also called as hill climbing method is shown in [3] as it checks the rise of curves as it reaches the maximum power point and its fall after the maximum power point. The perturb and observe is easy to implement but it causes oscillations in power output and causes tracking failures of maximum power point as the environment changes rapidly. The ripple correlation control method uses constant voltage and current ripples in power converters are shown in [4]. It uses the current and voltage ripple already present in the system. In this paper a new technique or method is proposed in which the solar panels are used with LDR sensors, which collects data about the radiation on the panel. It is a very efficient technique to measure the maximum power point to increase the efficiency.

II. METHODOLOGY

The solar panel is rotated by using motors connected to the panel. The motor is controlled using motor control circuit by microprocessor. The sensors placed in solar panel regularly give message about the radiation in the panel to the controller of microcontroller. The maximum power point is measured from the panel using the maximum radiation and the data is given to the microcontroller by using MPPT circuit. The maximum power point is controlled by the relay circuit in microcontroller which is triggered by an external trigger. The microcontroller rotates the panel based on the maximum power point. The maximum power point from the panel is also given to the DC-DC converter and the output from the converter is given to the load or battery.

The model uses three solar panels of the same capacity and specifications. Among the three panels one act as a master and the remaining as slaves. Each panel has two light depending resistors (LDR) on both sides of the panel. The panel rotation depends on the data from the sensor. If the intensity of light on the left panel is high the panel rotates in that direction. If the light intensity on right panel is high then the panel turns in that direction. There will be no rotation if the panel has a balanced light intensity on both of its sensors. The model is designed using proteus software. The block diagram of the proposed system showing the operation of the model is given in fig 1.

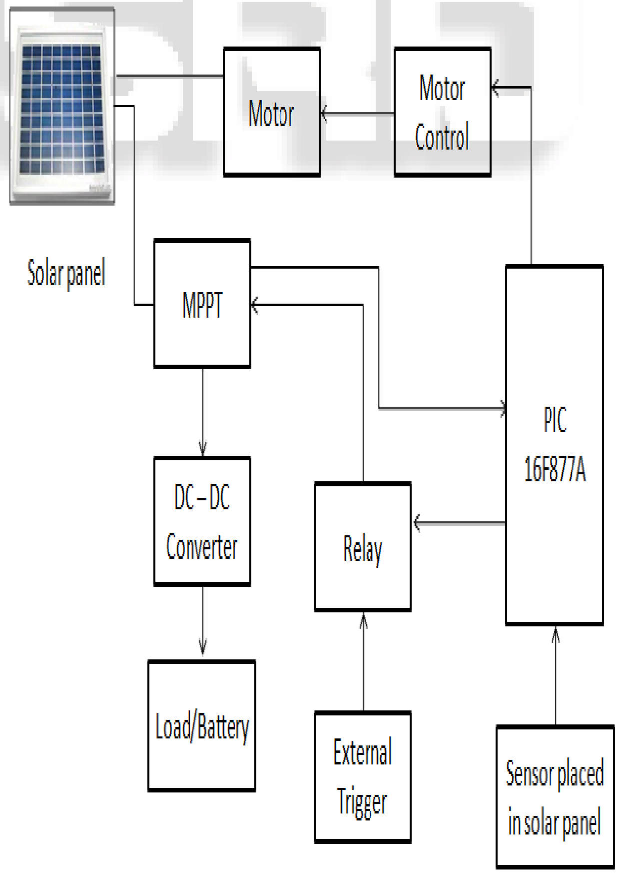

Fig. 1: Block diagram for proposed system

The microcontroller used is pic 16F877A.

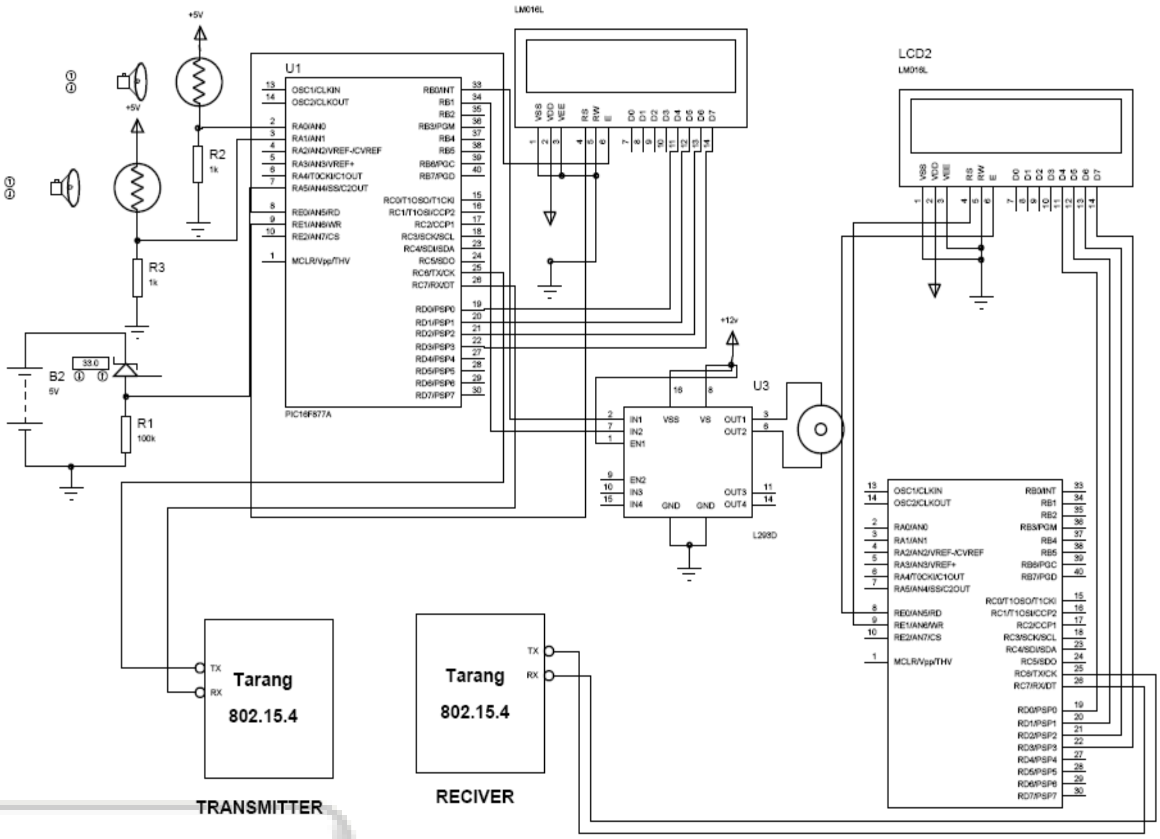

Fig. 2: Schematic diagram

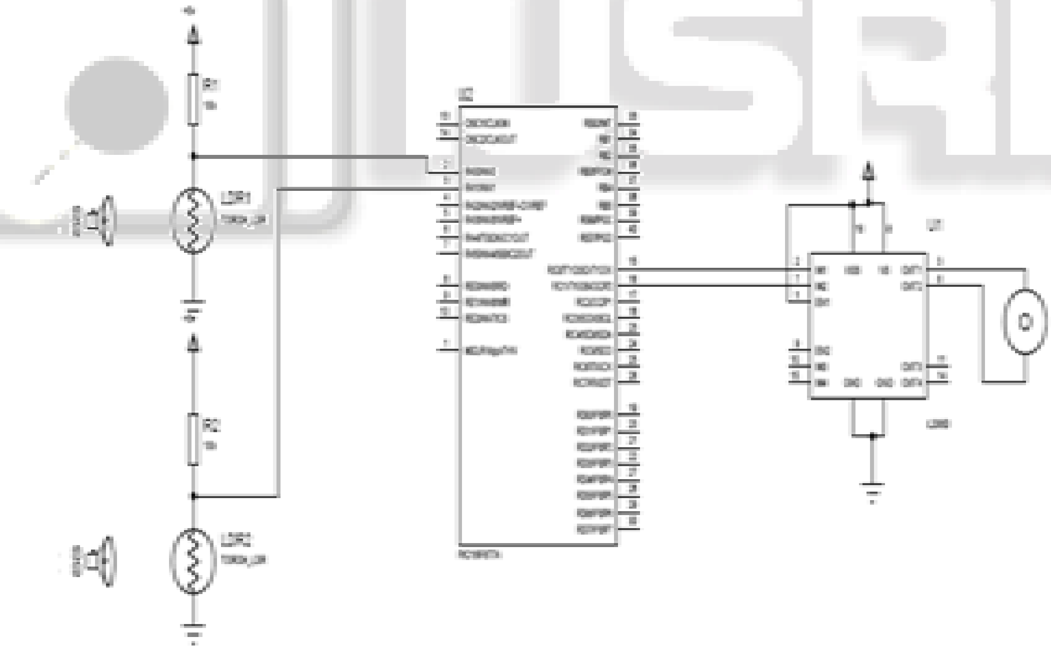

Fig. 3: Solar panel controlling system

Tarang modules are used in the wireless networks. Tarang transmitter range outdoor line of sight up to 50 kms. It transmit power up to 1watt/30 dBm nominal. Tarang receiver sensitivity up to -107 dBm.

III. RESULTS AND DISCUSSION

The proposed model is designed using proteus software and analyzed.

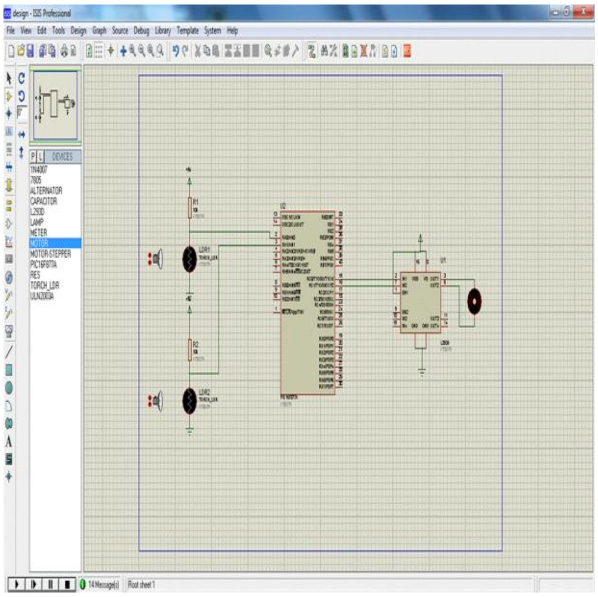

Fig. 4: Design of solar panel controlling system

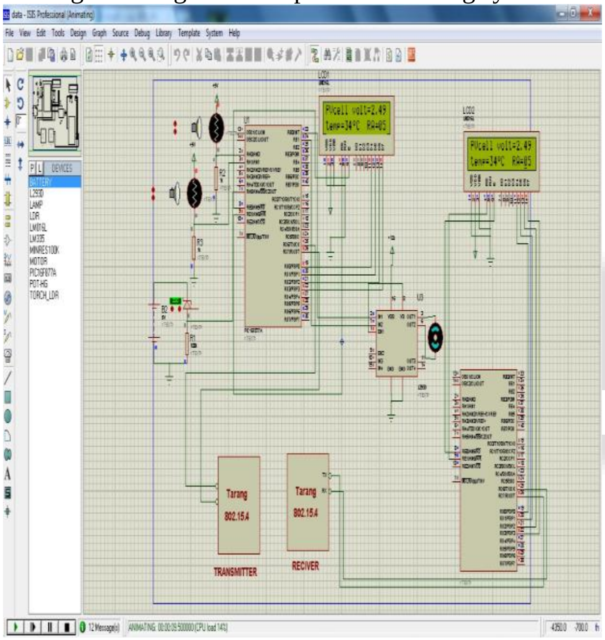

Fig. 5: Solar panel testing without boost converter

The solar panel is tested without boost converter as given in fig 6 and with boost converter as in fig 7.

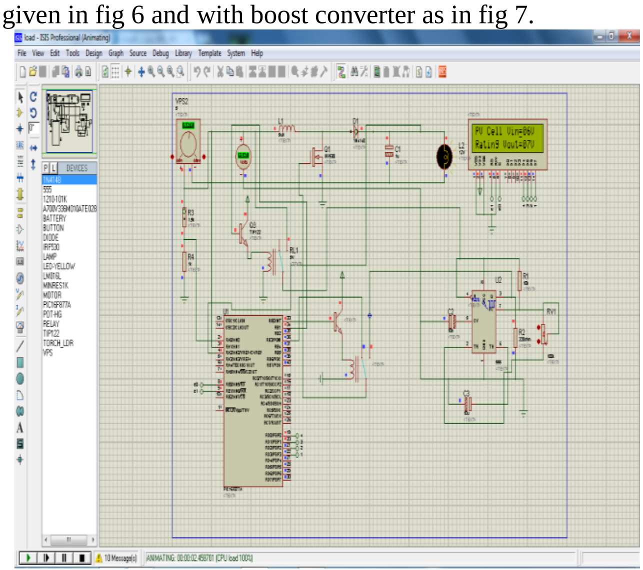

Fig. 6: Solar panel testing with boost converter

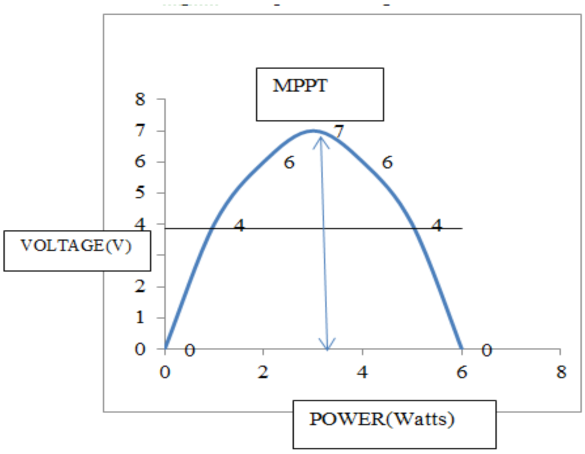

Fig. 7: Output graph

IV. CONCLUSION

The proposed MPPT using fuzzy logic can improve the performance of the system. The fuzzy controller is faster than the P&O controller in the transitional state and presents also a much smoother signal with fewer fluctuations in steady state. The controllers by fuzzy logic can provide an order more effective than the traditional controllers for the nonlinear systems, because there is more flexibility. Proteus software is used to obtain the simulation of the model; Simulation results show that the proposed MPPT can track the MPP faster, when compared to the conventional P&O method.

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