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A Novel Solar Tracking Technique Using MPPT Controller for Single Axis Solar System.

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ABSTRACT:

Solar energy is a huge, limitless source of power. The goal of renewable energy as a source is to raise awareness of the green energy system, which creates an environment free from pollution. Additionally, it is noiseless and without any large mechanical components. The amount of solar energy that the earth intercepts is roughly 1.8X1011MW, which is thousands of times more than what the planet now uses in terms of all commercial energy sources combined. solar tracking system that can be used to harness the sun's energy. This straightforward way of generating electricity uses natural resources. To generate power, this merely requires the most sunshine. The goal of this project is to develop a sensor-based solar tracking system that will allow solar panels to harness the maximum amount of solar energy while automatically positioning the equipment to get the most sunshine. The proposed system is looking for the brightest possible light. This device automatically alters its orientation to obtain the most amount of light when there is a decrease in light intensity. The suggested approach involves building a Buck-Boost converter to step up and down the voltage, designing an electronic circuit to measure light intensity and control the DC motor driver for panel movement, and storing the maximum output voltage in Lead-Acid batteries.

Keywords:Solar energy, Solar tracking, MPPT, Boost Converter, Renewable energy, Microcontroller

Introduction

For many uses that are widespread throughout the world, modern industries rely on the solar system. As we struggle with the effects of global climate change, solar energy is becoming more and more appealing. Solar energy is unrestricted, clean, and unlimited, yet solar panels are fixed. As a result, they are unable to benefit from the maximum amount of sunlight as the weather and seasons change. Although the direction of the sun's rays fluctuates frequently with the seasons and weather, a solar panel receives the most sunlight when it is perpendicular to them. The majority of solar panels now in use are stationary, meaning that they do not rotate to follow the sun's path across the sky.We created a solar tracking energy generation system to maximise the unit area lighting of sunlight on solar panels. The primary goal of this work is to make the most of solar energy. As everything we use today may be dependent on these kinds of systems in the future, we currently have a great need for solar electricity.

1.1. Literature Survey

Files must be in MS Word only and should be formatted for direct printing, using the CRC MS Word provided. Figures and tables should be embedded When it comes to the development of any nation, energy is the main driving factor. There is an enormous quantity of energy that gets extracted, distributed, converted and consumed every single day in the global society. The world population is increasing day by day and the demand for energy is increasing accordingly. Oil and coal are the main source of energy nowadays but there is a fact that the fossil fuels are limited and hand strong pollution. Even the price of petroleum has been increasing year by year and the previsions on the medium term there are not quite encouraging. Utilization of this resources increases the emission of carbon monoxide (CO), hydrogen chloride (HCL), Nitrogen Oxides, and Sulphur Oxides which are responsible for the global warming and greenhouse effect. This results the devastating effect in the environment.

With the view point of minimizing above mentioned problems, many researched have been carried since late 19th century by researchers and engineers. Renewable energy sources as an alternative to fossil fuel were the major found out. They are derived from natural processes that are replenished constantly. Renewable energies are inexhaustible and clean. The energy comes from natural resources such as sun, wind, tides, waves, and geothermal heat. Solar energy is quite simply the energy produced directly by the sun. The history of solar energy is as old as humankind. In general, solar energy is radiant light and heat from the sun harnessed using a range of technologies such as photovoltaic and concentrator. In the last two centuries, we started using Sun's energy directly to make electricity.

By the 1920s, scientists referred to the phenomenon as the "photovoltaic effect." In 1953, Bell Laboratories (now AT&T labs) scientists Gerald Pearson, Daryl Chapin and Calvin Fuller developed the first silicon solar cell capable of generating a measurable electric current. The New York Times reported the discovery as "the beginning of a new era, leading eventually to the realization of harnessing the almost limitless energy of the sun for the uses of civilization. After years of experiments to improve the efficiency and commercialization of solar power, solar energy gained support when the government used it to power space exploration equipment in 1958. The first solar-powered satellite, Vanguard 1, has travelled more than 197,000 revolutions around Earth in the 50 years. Consequently, in 1982 and 1985 first solar parks and retractable RV solar panels are created respectively. In 1994, the National Renewable Energy Laboratory developed a new solar cell from gallium indium phosphide and gallium arsenide that exceeded 30% conversion efficiency. By the end of the century, the laboratory created thin-film solar cells that converted 32% of the sunlight it collected into usable energy. Due to dedicated research worldwide, the efficiency of photovoltaics has continued to increase while production costs have also dropped substantially over the years.

1.2. Problem statement

In many systems, a solar tracker is employed to better harness solar radiation. The deployment of a technology that can increase power generation by 30–40% is the issue that is raised. The microcontroller implements the control circuit. The motor utilised to best orient the solar panel is then moved by the control circuit.The project's main goal is to create a highly accurate solar tracker and communicate the data via IOT.The introduction of the IOT concept results in the formation of a solar tracking system for effective electricity generation.The two sides of the solar panel are connected to the LDR sensor in this instance. As a result, the panel will create the most electricity by tilting towards the direction of the sun's movement.

Proposed System

The proposed system is looking for the brightest possible light. This device automatically alters its orientation to obtain the most amount of light when there is a decrease in light intensity. The suggested approach involves building a Buck-Boost converter to step-up and step-down the voltage, designing an electrical circuit to sensor light intensity and control the DC motor driver for panel movement, and storing the maximum output voltage in a lead-acid battery.

2.2. System Implementation

The project concept aims at extracting maximum power from solar panel by using light senor (LDR'S).And by the status of LDR's the panel rotates with the help of Motor in any direction and if the sunlight is more in any direction then it rotates to that direction.The output from panel is derived and which is used to increase the voltage without change in current rating.

The methodology implemented is mainly to generate maximum output, by tilting the position of the solar panel.The solar panel both sides are connected with LDR, it will track the movement and direction of sun. Also, by IOT the voltage in the panel can be measured.The panel is also provided with voltage sensor and Current sensor. The sensors sense the respective parameters and data is sent to the monitoring unit.LDR's helps in increasing the efficiency of the solar panel.

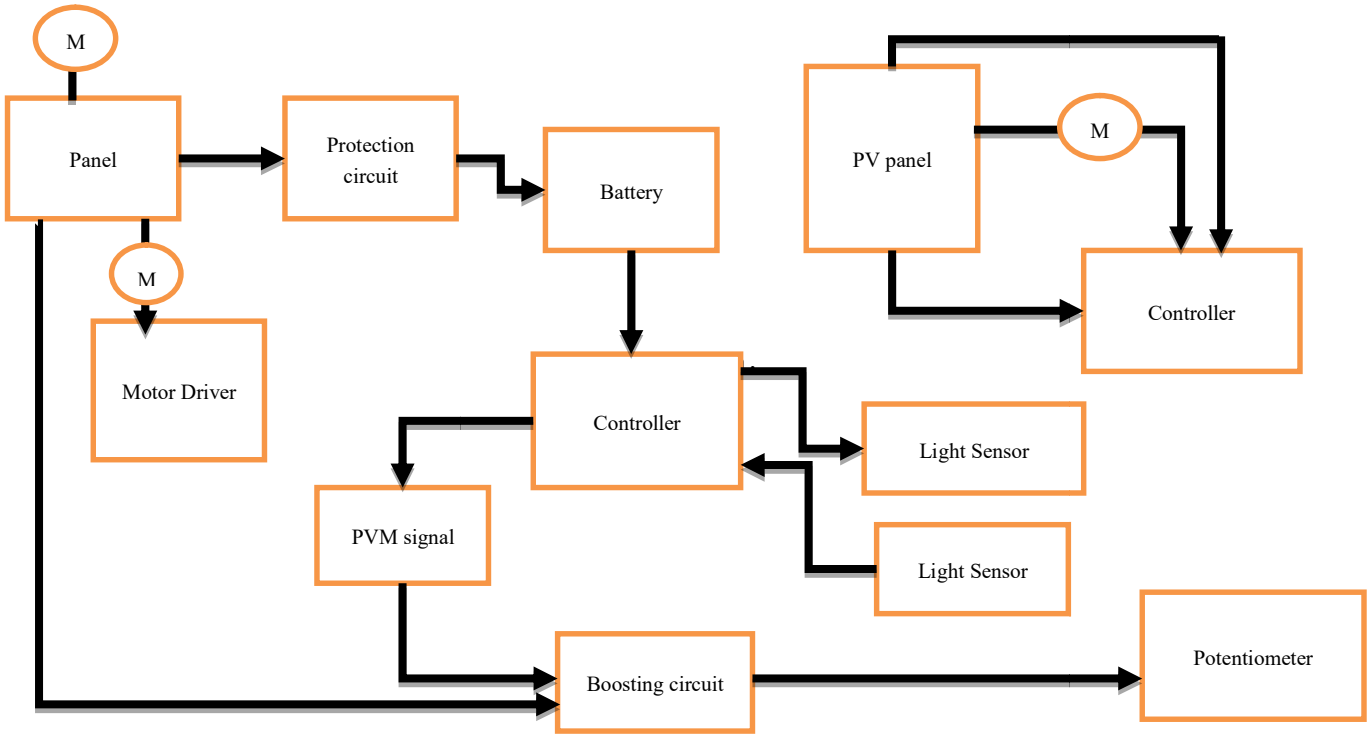
2.3. Factors Affecting The Efficiency of Solar Cells

Mismatch impact

The connecting of solar cells or modules with differing characteristics or under various environmental conditions from one another results in mismatch losses. or when the electrical characteristics of one solar cell differ greatly from those of the other solar cells. This can then result in extremely localised power loss, and the local heating that follows could harm the module permanently.

A PV module's temperature impact

The heat flow into and out of the PV module is altered as a result of the encapsulation of solar cells in a PV module, which raises the operating temperature of the PV module. Due to the PV module's reduced voltage caused by these temperature rises, the output power is significantly decreased. Additionally, as elevated temperatures increase strains related to thermal expansion and also increase deterioration rates by a factor of around two for each 10°C rise in temperature, they are implicated in a number of PV module failure or degradation scenarios. The balance between the heat generated by the PV module, the heat lost to the environment, and the ambient operating temperature determines the operating temperature of a module. The operating point of the module, the optical characteristics of the module and solar cells, and the solar cell packing density in the PV module all affect how much heat is produced by the module. Conduction, convection, and radiation are the three basic ways that heat is lost to the environment.



Performances

In mathematics, and more specifically in graph theory, a graph is a representation of a set of objects where some pairs of objects are connected by links. The interconnected objects are represented by mathematical abstractions called vertices, and the links that connect some pairs of vertices are called edges.

3.1.PV Voltage and Current

The solar array or panel is defined as a group of several modules electrically connected in series parallel combinations to generate the required current and voltage.

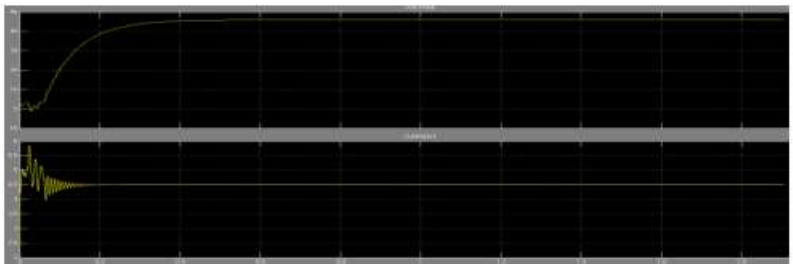


Fig.2- current Vs voltage

3.2. PULSES

Two oscillators would be used for generating square waves. The sensors are connected to these two oscillators which generate square pulses in accordance to the intensity of the light falling on the sensors

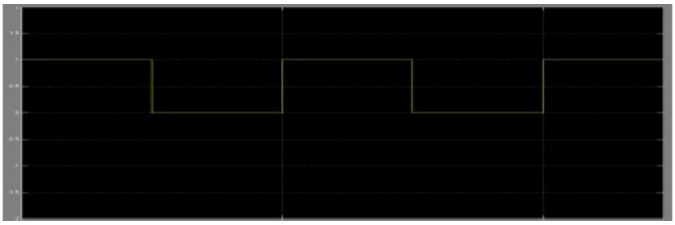


Fig. 3- Pulses

3.3. Output

Voltage Battery stored the final output voltage from Buck-Boost Converter. Power supplied by solar arrays depends upon the insolation, temperature and array voltage. It is also the function of the product of voltage and current. By varying one of these two parameters; voltage or current, power can be maximized.

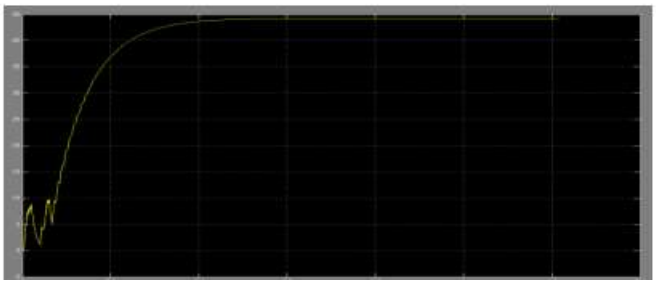


Fig. 4 – output

4. Results and Discussion

In this circuit, light sensors (LDRs) are used to harvest the most power possible from the solar panel.The panel rotates with the aid of a motor in any direction based on the state of LDRs, and if more sunlight is present in one direction than another, it rotates in that direction.The voltage can be raised without changing the current rating by using the output from the panel.

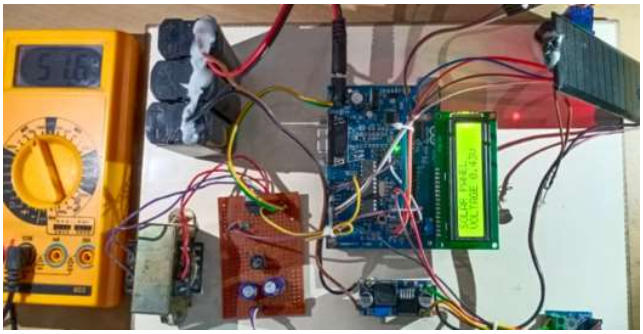


Fig. 5–Hardware kit of Proposed Method

CONCLUSION:

The charge controller and sun-tracker systems have been successfully put into use as described. To accelerate responses for achieving the precise MPPT of solar panel arrays under changing solar insolation and ambient temperature, this solution integrated the extension theory with a buck-boost converter. The results demonstrate that, in rapid atmospheric conditions, the MPPT controller has superior reaction, lower oscillation, and can quickly follow the highest power point. The simulation results show how effective and reliable the suggested strategy is. Small-scale systems including home appliances, electricity production, water treatment, heating, cooling, and ventilation, architecture and urban planning, transportation, and reconnaissance could all use a power system.

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