AN IMAGE PROCESSING BASED PHOTO VOLTAIC GENERATION.

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Abstract
The increasing demand for energy is one of the biggest reasons behind the integration of solar energy into the electric grids or networks. To ensure the efficient use of energy PV systems it becomes important to forecast information reliably. The accurate prediction of solar irradiance variation can enhance the quality of service. This integration of solar energy and accurate prediction can help in better planning and distribution of energy.This project examines the motivation, applications and development of short-term solar forecasting using ground-based sky imagery for controlling equipment on electrical grids. Also present a new technique for taking features extracted from sky-camera pixel data and building a model for predicting large shading events.our proposed system capable of being adapted for either very conservative or highly aggressive operation of a solar power system with a backup generator. MATLAB tool has been combined with embedded controller to show the effectiveness of proposed system

Introduction

Increasingly, new advances in solar forecasting research are tied to applications for solar power in electrical grids rather than the traditional uses in meteorology.

Numerous applications are seeking to forecast irradiance and solar power as a range of solar generation technologies reach higher penetrations. In particular, the rapidly increasing penetration of PV in electricity networks around the world is driving the need for accurate prediction in order to maximise the value of solar energy while minimising the impacts associated with solar energy variability. Additionally, new markets and business models are emerging as solar energy costs diminish, electricity supply costs rise and as electrical load becomes more adaptable.

In this environment, information on past, present and future solar generation is increasingly sought after for network management, market intelligence and plant

operation purposes. This paper reviews the state of the art in solar forecasting techniques, and their match to these applications. We discuss the numerous complex issues making solar forecasting necessary for optimal management of increasingly flexible modern electrical networks. We also illustrate the need for short-horizon forecasting methods with fast update rates and demonstrate how these can be used for more energy-efficient control of electrical power flows. A casestudy is provided of a novel skycam system and its application to managing solar energy in a minigrids through predictive solar inverter and generator control.

Related work

Vishal Palaniappan et al et al deals with photovoltaic power installations in urban environments. A general simulation method is developed to quantify the total energy yield for photovoltaic (PV) installation sites exploiting different levels of Distributed Maximum Power Point Tracking (DMPPT) granularity.

Alessandro Giustiniani et al propose a design of the one-cycle controller of a single-stage inverter for photovoltaic applications is carried out by means of a multiobjective strategy to optimize inverter performance at both high and low insolation levels. Design constraints that account for different weather conditions are adopted.

Takayoshi Inoue described a A control method to charge series-connected ultraelectric double-layer capacitors (ultra-EDLCs) suitable for photovoltaic generation systems in combination with a maximum power point tracking (MPPT) control method.

Santiago Reynoso et al presents a maximum power point tracking (MPPT) circuit for an Unmanned Air Vehicle. The design of the MPPT is proposed utilizing a boost-converter topology.

Maria Teresa Penella et al describes a new maximum-power-point-tracking (MPPT) method focused on low-power (<; 1 W) photovoltaic (PV) panels. The static and dynamic performance is theoretically analyzed, and design criteria are provided

T. Inoue et al describes a method for maximum power point tracking (MPPT) control while searching for optimal parameters corresponding to weather conditions at that time. The conventional method has problems in that it is impossible to quickly acquire the generation power at the maximum power (MP) point in low solar radiation (irradiation) regions.

Chan-Hui Jeon et al presents an energy-harvesting system that uses an adaptive maximum power point tracking (MPPT) circuit for 1-mW solar-powered wireless sensor networks. The proposed MPPT circuit exploits a successive approximation register and a counter to solve the tradeoff problem between a fast transient response and a small steady-state oscillation with low-power consumption. The proposed energy-harvesting circuit is fabricated using a 0.35-μm CMOS process. The MPPT circuit reduces the transient response time by 76.6%, dissipates only 110 μW , and shows MPPT efficiency of 99.6%.

EXISTING SYSTEM

Maximum power point tracking (MPPT) or sometimes just power point tracking (PPT) is a technique used commonly with wind turbines and photovoltaic (PV) solar systems to maximize power extraction under all conditions.

Although solar power is mainly covered, the principle applies generally to sources with variable power: for example, optical power transmission and thermophotovoltaics.

PV solar systems exist in many different configurations with regard to their relationship to inverter systems, external grids, battery banks, or other electrical loads.[5] Regardless of the ultimate destination of the solar power, though, the central problem addressed by MPPT is that the efficiency of power transfer from the solar cell depends on both the amount of sunlight falling on the solar panels and the electrical characteristics of the load. As the amount of sunlight varies, the load characteristic that gives the highest power transfer efficiency changes, so that the efficiency of the system is optimized when the load characteristic changes to keep the power transfer at highest efficiency. This load characteristic is called the maximum power point (MPP) and MPPT is the process of finding this point and keeping the load characteristic there. Electrical circuits can be designed to present arbitrary loads to the photovoltaic cells and then convert the voltage, current, or frequency to suit other devices or systems, and MPPT solves the problem of choosing the best load to be presented to the cells in order to get the most usable power out.

Solar cells have a complex relationship between temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve. It is the purpose of the MPPT system to sample the output of the PV cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions.[8] MPPT devices are typically integrated into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving various loads, including power grids, batteries, or motors.

Photovoltaic cells have a complex relationship between their operating environment and the maximum power they can produce. The fill factor, abbreviated FF, is a parameter which characterizes the non-linear electrical behavior of the solar cell. Fill factor is defined as the ratio of the maximum power from the solar cell to the product of open circuit voltage Voc and short-circuit current Isc. In tabulated data it is often used to estimate the maximum power that a cell can provide with an optimal load under given conditions, P=FF*Voc*Isc. For most purposes, FF, Voc, and Isc are enough information to give a useful approximate model of the electrical behavior of a photovoltaic cell under typical conditions.

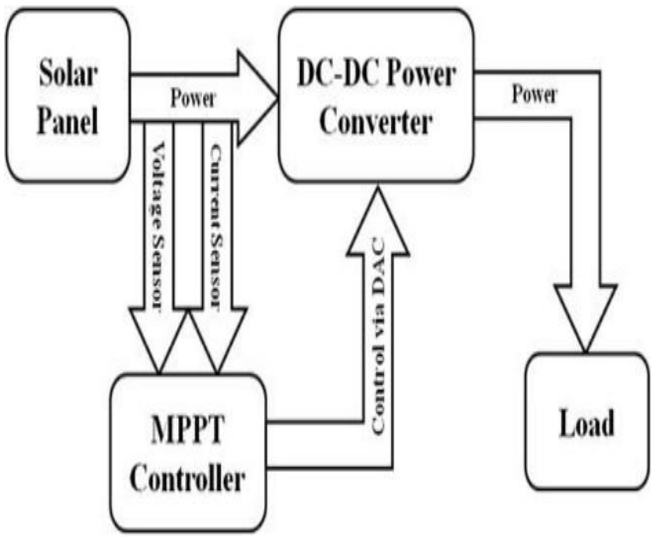
For any given set of operational conditions, cells have a single operating point where the values of the current (I) and voltage (V) of the cell result in a maximum power output.[9] These values correspond to a particular load resistance, which is equal to V / I as specified by Ohm's Law. The power P is given by P=V*I. A photovoltaic cell, for the majority of its useful curve, acts as a constant current source.[10] However, at a photovoltaic cell's MPP region, its curve has an approximately inverse exponential relationship between current and voltage. From basic circuit theory, the power delivered from or to a device is optimized where the derivative (graphically, the slope) dI/dVof the I-V curve is equal and opposite the I/V ratio (where dP/dV=0). This is known as the maximum power point (MPP) and corresponds to the "knee" of the curve.

A load with resistance R=V/I equal to the reciprocal of this value draws the maximum power from the device. This is sometimes called the 'characteristic resistance' of the cell. This is a dynamic quantity which changes depending on the level of illumination, as well as other factors such as temperature and the age of the cell. If the resistance is lower or higher than this value, the power drawn will be less than the maximum available, and thus the cell will not be used as efficiently as it could be. Maximum power point trackers utilize different types of control circuit or logic to search for this point and thus to allow the converter circuit to extract the maximum power available from a cell.

Implementation

When a load is directly connected to the solar panel, the operating point of the panel will rarely be at peak power. The impedance seen by the panel derives the operating point of the solar panel. Thus by varying the impedance seen by the panel, the operating point can be moved towards peak power point. Since panels are DC devices, DC-DC converters must be utilized to transform the impedance of one circuit (source) to the other circuit (load). Changing the duty ratio of the DC-DC converter results in an impedance change as seen by the panel. At a particular impedance (or duty ratio) the operating point will be at the peak power transfer point. The I-V curve of the panel can vary considerably with variation in atmospheric conditions such as radiance and temperature. Therefore, it is not feasible to fix the duty ratio with such dynamically changing operating conditions.

MPPT implementations utilize algorithms that frequently sample panel voltages and currents, then adjust the duty ratio as needed. Microcontrollers are employed to implement the algorithms. Modern implementations often utilize larger computers for analytics and load forecasting.



Proposed system

Skycam forecasting

One emerging technique showing promising solar forecasting results for dealing with the effects of intermittent solar electrical generation is the use of skycams, also

known as sky cameras or whole/total sky imagers. Traditionally, whole-sky imagers have been prohibitively expensive, but with the advent of inexpensive digital security cameras and more powerful graphical processing capabilities, the wider adoption of localised solar forecasting it is much more practical than ever before.

Skycams can provide localised visual information about the overall state and transient characteristics of the visible sky. When combined with modern computer vision and machine learning techniques, skycams can be used to determine the motion vectors and classification of visible clouds. Solar occlusion events and changes to global and direct irradiance can be correspondingly forecast. Further, sola

irradiance to electrical power conversion models can be used to predict likely solar production impacts and facilitate mitigation measures. These measures may include the control of storage, load and generation assets

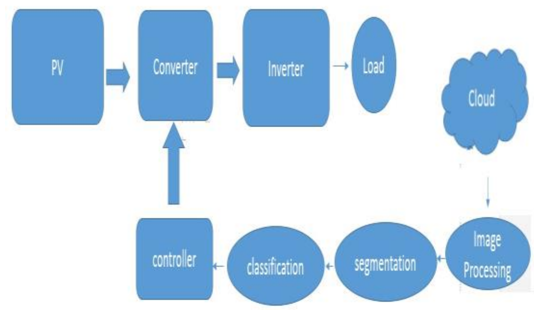


Figure proposed system

Skycam-based forecasting techniques can make important contributions to short-term solar forecasting by identifying and predicting cloud movement and forecasting

changes in solar availability. When combined with demand forecasting and storage or discretionary load control, a potent system for managing the supply–demand balance is established. Such a system enables a much more dynamic network operating range and potentially allows significantly more renewable energy to be integrated, while ensuring that sufficient generation and network capacity exists and that quality of supply is maintained. Even in the absence of demand forecasting and additional controllable elements, solar generation forecasting is becoming increasingly important to ensure that an efficient supply and demand balance is achieved as significant growth occurs in the penetration of variable renewable generation

IMPLEMENTATION RESULTS

Figure cloud GUI

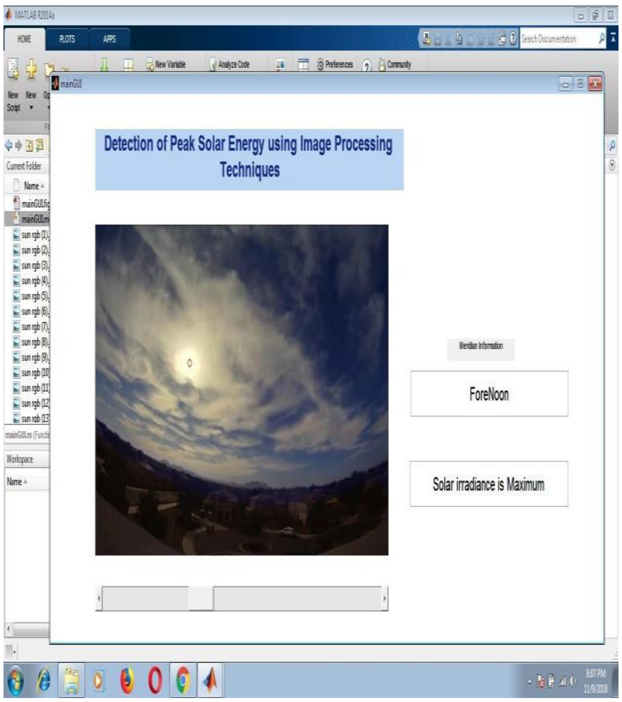


Figure image processing

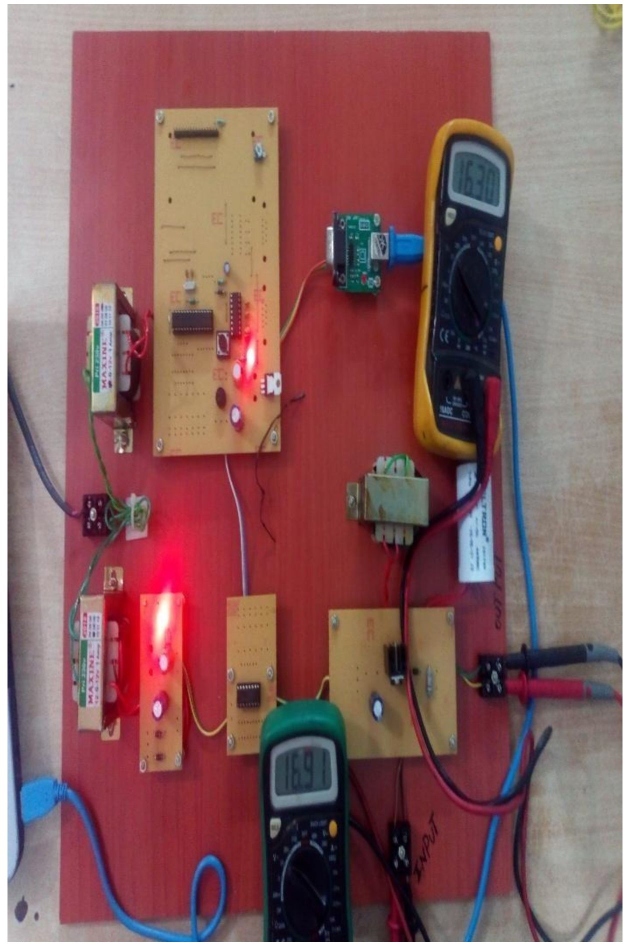


Figure hardware implementation

CONCLUSION

This paper has reviewed the state of the art in solar forecasting, and examined the challenges that the world's electrical grids are facing from the rise of solar power levels. We have shown that the use of skycam-based solar short-term solar forecasting is widely useful for a range of solar power applications, and specifically, that it can help solve the problem of solar intermittency on electrical grids and minigrids by enabling predictive control of loads and generation

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