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Load Tuning for Solar Energy Powered Embedded System Using ILP

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Abstract: In this paper direct-coupled solar energy powered multicore architectures that provide direct power supply between photovoltaic (PV) generation and the load without the adoption of battery. We present Solar-Tune, a real-time scheduling technique with load tuning for sporadic tasks on solar energy powered multicore systems. The objective is to fully utilize the available solar energy while meeting the deadlines of tasks. Scheduling and power management method for multicore real-time embedded systems. This work mathematically proves that by allocating the new task to the core with the lowest utilization, we can achieve the lowest overall energy dissipation. This method, combined with a new integer linear programming (ILP) algorithm with forms the heuristic algorithm to dynamically refine the task scheduling based on the predictions of the availability of solar energy. With periodical tasks in a multi-core platform, this partitioned scheduling method is optimal for energy dissipation if the proposed utilization based scheduling and ILP algorithm is applied on each core. Experimental results show that new algorithm achieves better performance in terms of deadline miss rate, comparing to the best of existing algorithm. When applied on a multi-core platform, the heuristic algorithm achieves better efficiency.

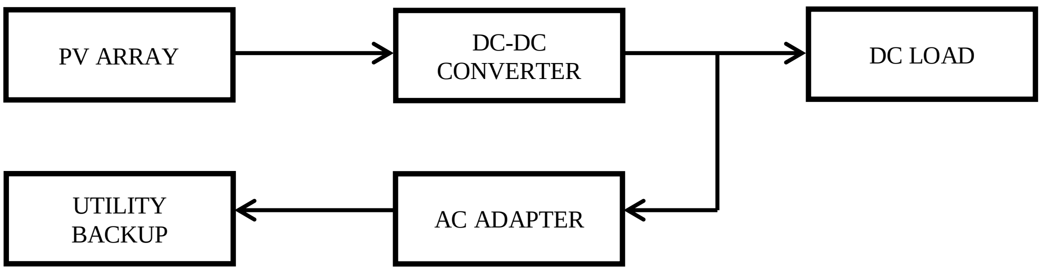
Keywords: *Photo Voltaic, ILP, Solar Tune, MPPT*

I. INTRODUCTION

Renewable energy such as solar energy and wind energy is a clean alternative to fossil fuels. It exists perpetually and in abundant quantity in the environment. Today solar energy is not only being used to provide power to various low power embedded devices but it is also used to generate electricity to supplement local consumption in high performance computing systems. Photovoltaic (PV) cells can convert sunlight directly into direct current (DC) electricity. Different from the conventional setup which directly connects PV arrays to a computing system (DC load). This direct coupled PV system eliminates the battery and unnecessary power conversion devices and it has been successfully applied to many applications.

II. DIRECT COUPLED PV SYSTEM

The direct coupled PV system is a cost effective design that directly connects PV arrays to a computing system. The direct coupled PV system is shown in Fig.1 the direct coupled system eliminates the battery and unnecessary power conversion devices. The design has been successfully applied to many applications. In these designs energy harvesting systems mostly equipped with batteries and the design objectives is used to minimize the energy consumption of computational loads.



Fig(1): Direct coupled PV system

PV systems are usually classified in reference with their operational and functional requirements, connections to electrical loads and power sources, as well as their component configurations. However, PV systems can be designed to produce AC or DC power. They can also operate without the utility grid as it is the case with direct-coupled PV systems.

The common ones have various components such as battery, inverter, utility meter, and charge controller, among others. A direct-coupled PV system does not contain all the mentioned components. It is sized and designed to supply specific AC or DC electrical loads. This system is powered by wind, utility power, PV array, or an engine generator.

In most cases, Direct-coupled PV systems are used during the day due to the availability of sunlight. Since there is no energy storage in batteries, the load makes it suitable to operate applications such as water pumps, ventilation fans, and circulation pumps designed for water heating. Between the array and the load is an electronic DC-DC inverter which is used to utilize the available power in the maximum output.

The total available solar energy is fully utilized. By using Direct-coupled PV system by implementing this design advantages are:

- *Environmental Benefits* - In majority of the cases, a direct-coupled PV system generates energy from the sun. It produces neither hazardous waste nor air pollution. It does not require gaseous or liquid fuel for it to be combusted or transport.
- *Social And Economic Benefits* - Direct- coupled PV systems require sunlight, which is abundant and free. The system allows you to generate electricity when you need it. It is not compulsory for you to store the energy in batteries since it is used immediately. Using a direct- coupled PV system is also cheap because you do not have to purchase potential batteries for storing the energy. It is also cheap to install.

III. SOLAR ENERGY DRIVEN MULTI-CORE ARCHITECTURE POWER MANAGEMENT

Solar tune solar energy driven multi-core architecture power management that can achieve the maximal solar energy utilization and the optimal workload performance simultaneously. This design makes the first step on reducing the dependence on the utility power of a high performance computing system. A lower dependence saves more on utility bills and produces a lower carbon footprint, which is more sustainable.

IV. MULTI-CORE AWARE MPP TRACKING

Multi-core aware *MPP tracking* technique relies on successive tuning of both the DC/DC converter transfer ratio k and the multi-core load *w*. The Solar Core controller aims at coordinating the power supply converter and the multi-core load adaptation to achieve the maximal power drawn. In addition, this technique ensures

- A Correct Tracking Direction.
- A Stable Load Operating Voltage.

Tuning *k* or *w* can increase output power, load voltage and load current, depending on the location of the operating point. By simultaneously adjusting k and w, one can increase the output current while maintaining constant output voltage. As a result, the operating point moves closer to MPP and the multi-core processor can utilize more power.

4.1.*Steps Involved in Control Strategy to Perform MPP Tracking*

*STEP 1:*The algorithm starts with a normal operating voltage.

Due to supply variation, may not equal to at each beginning phase of periodically triggered MPP tracking. In this step, the Solar Core controller will restore the output voltage to by decreasing or increasing the load to an appropriate level. This step avoids system overloading and serves as preparation for the following stepwise tuning.

STEP 2: The transfer ratio tuning direction that approaches MPP depends on the systems current operating position.

To determine the tuning direction, our techniques set the transfer ratio of the DC/DC converter from to and observe the current. An increase in output current suggests that the panel generates more power and the system is approaching to the MPP. In this case, the actual operating point is on the left side of the MPP and our algorithm proceeds to step 3 for load matching on the other hand, a decrease in output current suggests a wrong tuning direction. In this case, we further decrease the transfer ratio by, which results in a net change of in transfer ratio. Consequently, our techniques resume the correct tuning direction and proceed to step3 to perform load matching.

STEP 3: In this step, by tuning the load until equals. Due to the adjustment of k in step 2,

The output voltage changes as well. By increasing the load, we can change the PV Operating point and decrease until it reaches VddDuring each control period, algorithm increases the load successively with the aid of tuning transfer ratio k, as discussed in steps 2 and 3. These methods progressively adapt multi-core power consumption and eventually reach to the new MPP. The goal of Solar Core power management is appropriate coordination of the variable power supply and demand. MPPT-aware power control is orthogonal to the underlying processor micro architecture and core-count.

V. FIXED POWER BUDGET

For the direct-coupled PV systems, the load starts to operate using solar power when the amount of renewable energy exceeds a power-transfer threshold. Evaluating the solar energy utilization on multi-core systems that use power-transfer threshold as a fixed power budget. This fixed power budget ensures that the multi-core systems operate reliably with sufficient power. If the power supply from renewable power source falls below the power-transfer threshold, the multi-core system will switch to the secondary power source.

The threshold affects processor *performance-time product (PTP)* in both throughput and effective operation duration. A higher power-transfer threshold will make the multi-core processor run at higher voltages and frequencies but only for short durations.

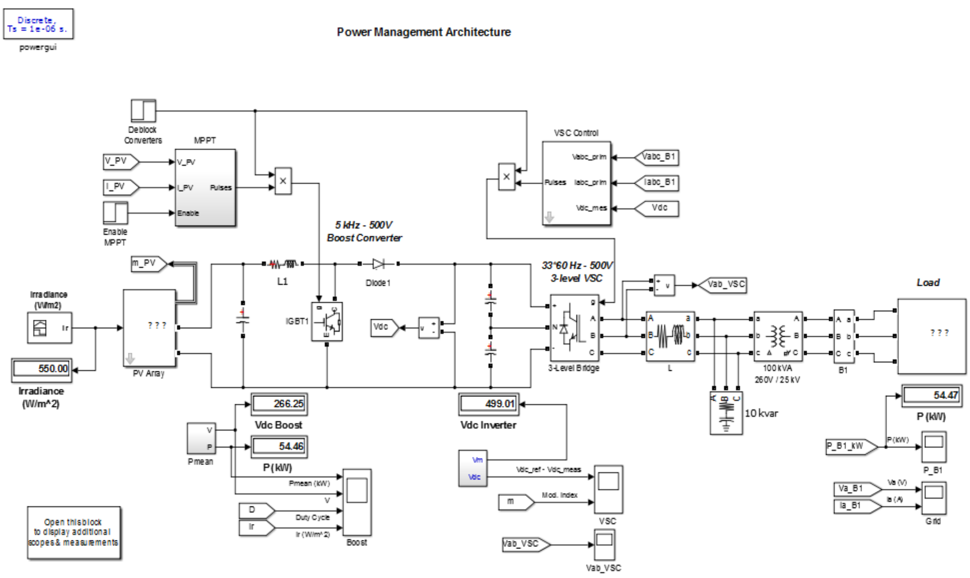
A conservative, low power-transfer threshold operating mode will have longer duration but lower clock frequencies. Intuitively, the processor should run under higher power budget to maximize its performance when the effective operation duration declines slowly (rapidly) the maximal solar energy drawn does not guarantee maximal performance. The maximal workload performance may occur under a high power budget, a moderate power budget or even a low power budget. Therefore, a single, optimal fixed power budget for the multi-core system does not exist. Even under the optimal fixed power budget, the best energy utilization and PTP that the Fixed-Power schemes can achieve is less than 70% of that yielded on maximum power tracking. In other words, Solar Core outperforms Fixed-Power control scheme by at least 43% in terms of both energy utilization and workload performance.

5.1.*Energy Utilization*

Energy utilization is calculated with various load adaptation scenarios. The average solar energy utilization drops when the renewable resource potential is low. For locations with abundant solar resource solar tune draws 5% more power compared to a typical battery equipped PV system which has an energy utilization upper bound of 81%.

VI. SIMULATION

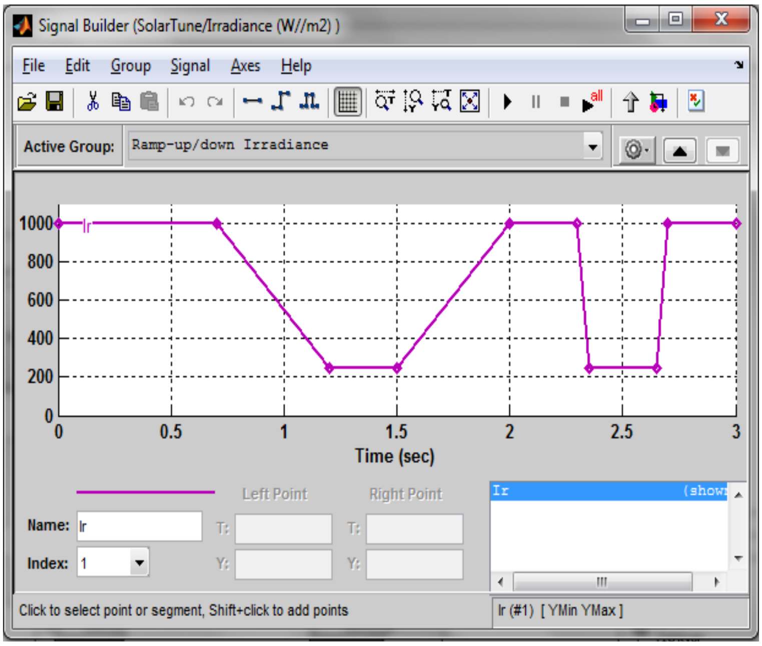
Simulink, developed by Math Works, is a data flow graphical programming language tool for modeling, simulating and analyzing multi domain dynamic systems. Its primary interface is graphical and a customizable set of block libraries. It offers tight integration with the rest of the MATLABenvironment and can either drive MATLAB or be scripted from it. Simulink is widely used in control theory and digital signal processing for multi domain simulation and Model-Based Design. Fig.2. shows the simulink block diagram for direct coupled powergeneration,



Fig(2):Schematic of Conventional Full Adder

6.1.*Irradiance*

In simulation Irradiance is the input given for the PV array where intensity of light falls on PV array in real time implementation. Based on the irradiance value the output power will be varied as in Fig.3.shows the Input Value Given To PV Array,



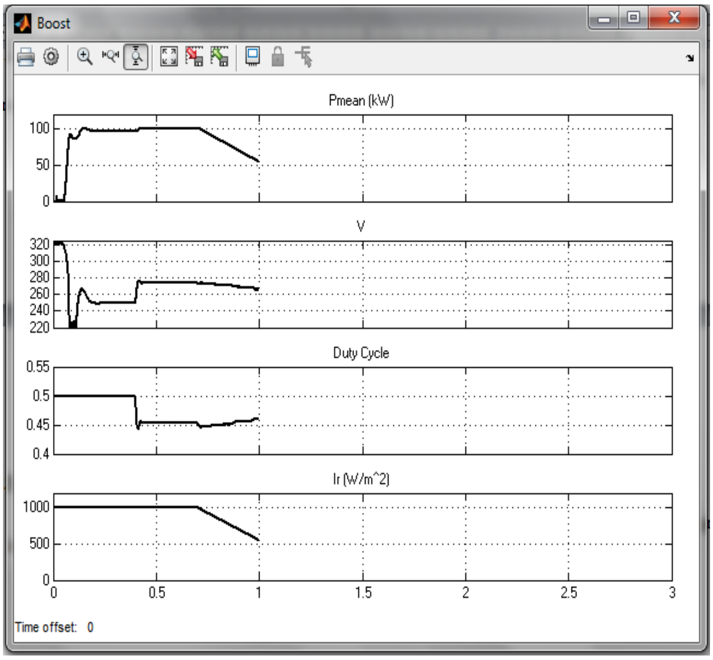
Fig(3):Input Vale Given To Photo Voltic Array

6.2.*Photo Voltaic Array*

A photovoltaic system, also photovoltaic power system, solar PV system, PV system or casually solar array, is a system designed to supply usable solar power by means of photovoltaic.

6.3.*Boost Converter*

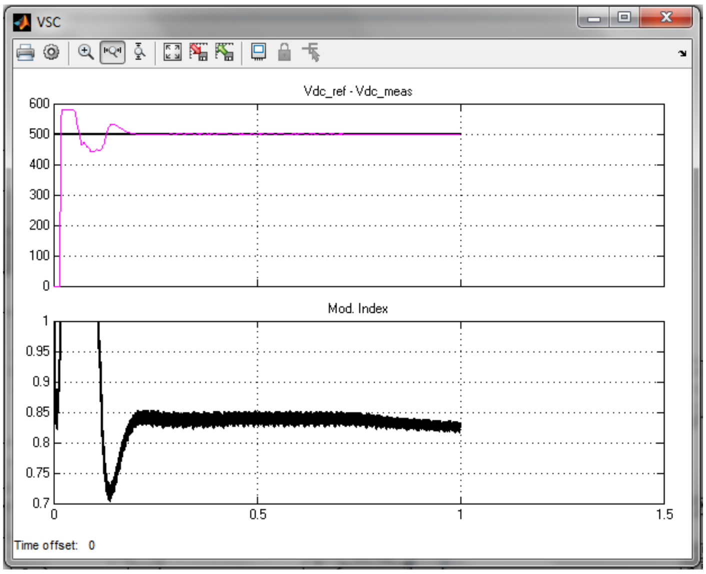
A boost converter (step-up converter) is a DC-to-DC power converter with an output voltage greater than its input voltage as in Fig.4.



Fig(4):Simulated outputof boost converter

6.4.*Voltage Source Converter*

The name voltage source converter signifies those circuits which are used to convert or transfer one type of voltage source to another. Voltage source converter means which device converts a AC voltage source into DC voltage source and vice versa. Fig.5. shows the simulated output of voltage source converter,



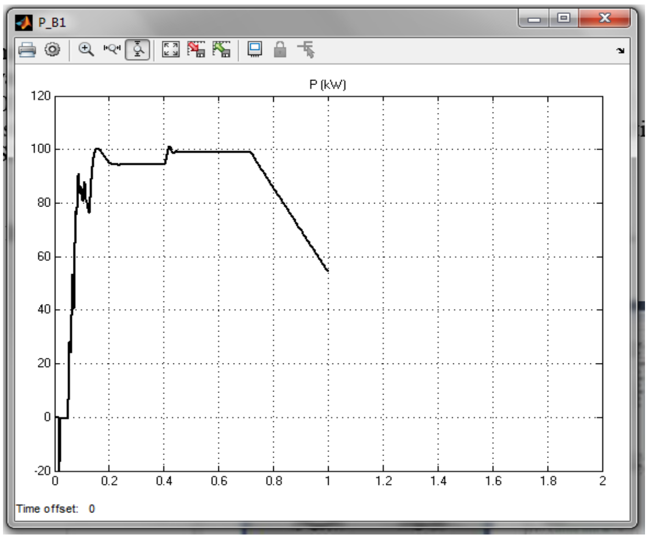
Fig(5):Voltage Source Converter

VII. SOFTWARE USED

MatlabR2013a is the software used for the Simulation of Direct coupled PV System**.**

RESULTS:

The output is obtained between the time and power generated with respect to the input irradiance applied to PV array as shown in Fig.6. Simulated output for total power generated,



Fig(6): Simulated output for total power generated

VIII. CONCLUSION

The proposed Solar tune, novel power management schemes for solar energy driven multi-core processors. While existing techniques seek to minimize multi-core power dissipation under performance constraints or to maximize throughput for a given power budget, this techniques harvest the maximum amount of solar energy to maximize the power budget for optimal throughput without using short lifetime and expensive storage elements. Furthermore, Solar tune applies load optimization based on the workload throughput-power ratio to ensure that the dynamic load tuning across multiple cores achieves the optimal performance. Because of its ability to extract additional solar energy and its ability for load optimization. Enabling techniques which are proposed will open new research opportunities on multi-core power management in light of the clean, renewable energy.

IX. FUTURESCOPE

In the future, this technique is used for other multi core architectures and proposes scheduling techniques to other different task models and planned to implement the proposed approach in Hardware and verify our approach on a direct coupled solar energy powered embedded system.

REFERENCES

[1] Yi Wang, Renhai Chen, Zili Shao, Tao Li.”Solar tune: Real-time Scheduling With *Load* Tuning For Solar Energy Powered Multicore Systems”.*IEEE International Conference OnEmbedded And Real-time Systems And Applications*,2013.

[2] A. Abbas, E. Grolleau, M. LOUDINI, And D. Mehdi. “A Real-time Feedback Scheduler For Environmental Energy Harvesting”. *International Conference On Systems And Control,Algiers, Algeria*, October 29-31, 2013.

[3] ManishBhardwaj, SubharmanyaBharathi, BilalAkin.”Controlling And Monitoring Solar Energy Production In The Smart Grid Using Heterogeneous *Dual* Core MCU”. 978-1-4577-1216-6/2012 IEEE.

[4] A.Kassem (IEEE Member)And M. Hamad (IEEE Member). “A Microcontroller-based Multi-function Solar Tracking System”,
2011 IEEE.

[5] CesareAlippi, *Fellow, IEEE*, AndCristianGalperti.”An Adaptive System ForOptimal Solar Energy Harvesting In Wireless Sensor Network Nodes”, *IEEETransactions On Circuits AndSystems—i: Regular Papers*, Vol. 55, No. 6, July 2008.

[6] ShaoboLiu,junLu,qing Wu, QinruQiu.»Harvesting-aware Power ManagementFor Real-time System With Renewable Energy», *IEEE Transactions On VlsiSystems, Vol.20, No.8,August 2012.*

[7] Qiang Liu, Terrence Mak, JunwenLuo, Wayne LukAnd Alex Yakovlev.”PowerAdaptiveComputing System Design In Energy Harvesting Environment”.IEEE 2009.

[8] SravanthiChalasani, James M. Conrad. “A Survey Of Energy HarvestingSources For Embedded Systems”, 978-1-4244-1884-8/2008 IEEE.

[9] Christopher O. AdikaAndLingfeng Wang. "Autonomous Appliance SchedulingFor Household Energy Management”,1949-3053 /2013 IEEE.

[10] YifengGuo, Dakai Zhu, HakanAydin. “Reliability-aware Power ManagementFor Parallel Real-time Applications With Precedence Constraints”. 978-1-4577-1221-0/2011 IEEE.

[11] Yu Xiaohai, Jin Jianshe. “The Application Design of Smart Home ModelSystem Using Solar Energy Based on Embedded System”, *The 2nd International Conference on ComputerApplication and System Modeling*(2012),pp.0383-03836.

[12] Yuan Lu, Xingxing Cui. “Study On Maximum Power Point Tracking For Photovoltaic Power Generation System “,978-1-4244-5539-3/2010 IEEE.

[13] S. K. Bhargava, S.S.Das, P. Paliwal. “ Multi-Objective Optimization for Sizing of Solar-Wind Based Hybrid Power System: A Review “, IEEE *InternationalConference onInnovations in Engineering and Technology On 21st&22ndMarch2014.*

[14] YananBao, Xiaolei Wang, Xin Liu, Sheng Zhou and ZhishengNiu. “ Solar Radiation Prediction and Energy Allocation for Energy Harvesting Base Stations ”