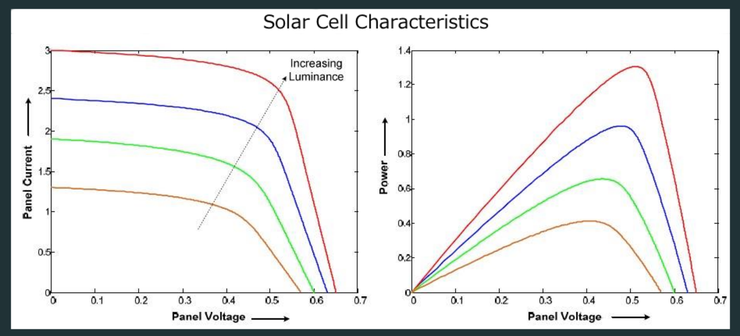
Maximum Power Point Tracking (MPPT) Operation using a C2000 Texas Instruments Microcontroller in a PV Implementation

Dharmraj Trivedi - Vishal Patel - Anthony King - Pearl Verma
Professor Hana Godrich
{dharmraj,vishp21,ark121,pearlv}@eden.rutgers.edu

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS
ECE

Problem:

A typical PV implementation does not have a linear voltage & current relationship.



Therefore, we do not get the most energy/ utilization out of a PV System, especially with such varying conditions (changes in temperature and light intensity), which vary from panel to panel. To get the most energy out of a PV system installation, it must be operated at the maximum power point of the curve.

Results:

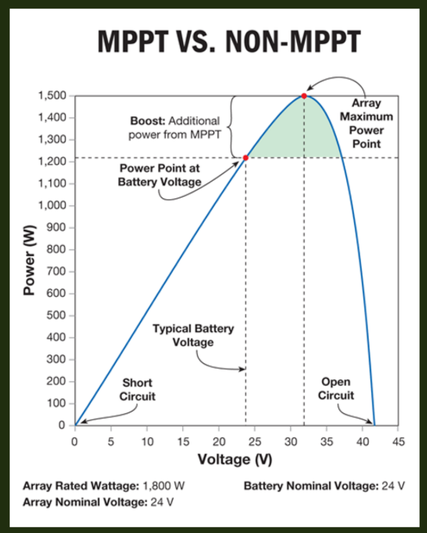
- Increased efficiency for a PV system
- A working MPPT DC-DC converter applicable for low voltage operations

Graphic interfaces are provided via Code Composer Studio to illustrate performance of the MPPT. The MPPT algorithms and code can be easily applied to a HV solar microcontroller for higher voltage operations

E.g. Residential Use

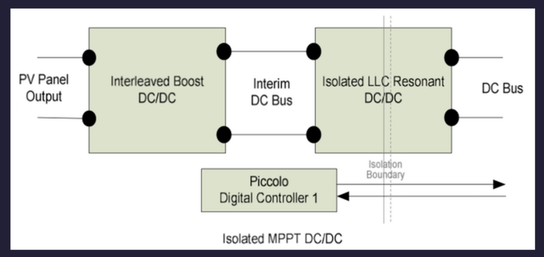
Solution:

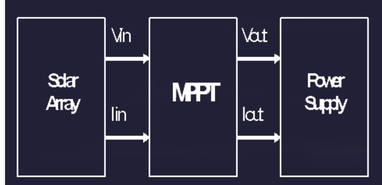
Maximum Power Point Tracking allows you get the most energy/utilzation out of the PV system. Different techniques are used to locate the maximum power point of the panel (perturb & observe, incremental conductance) - programmed into the microcontroller. The Texas Instuments TMDSSOLARPEXPKIT microcontroller allows you to evaluate and have control of different power stages used in a solar aplication. Our microcontroller includes a panel emulator using DC/DC power stage, allowing us to evaluate MPPT under different shading conditions. The MC is programed via Code Composer Studio to function as desired.

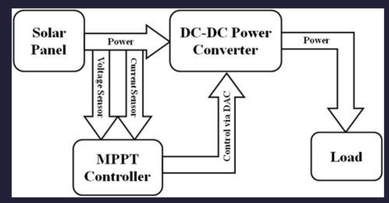


Design:

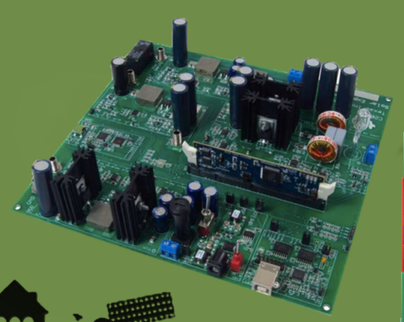
The design incorporates using a TI TMDSOLAREXPKIT in junction with Code Composer Studio and controlSUITE. The MC is to function as a digitally controlled solar MPPT DC-DC converter. It implements an isolated DC-DC stage with MPPT algorithm (we can choose as P&O or incremental conductance) to utilize the full capacity of the solar panel. MPPT algorithms/commands are written in C and compiled via Code Composer Studio. ControlSUITE provides lists of algorithms. A solar panel and battery (load) is easily applied by connecting them to the labeled connections on the MC.

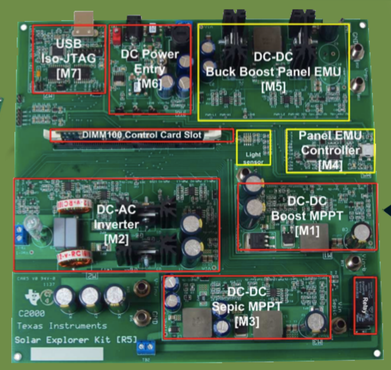






Algorithms for P&O and incremental conductance were written, therefore there is an option on what technique to incoorporate to the system.





Used to boost the voltage from the panel and track the MPP

Acknowledgements: We would like to thank Professor Godrich and Texas Instruments for the guidance