Flexible Inverter

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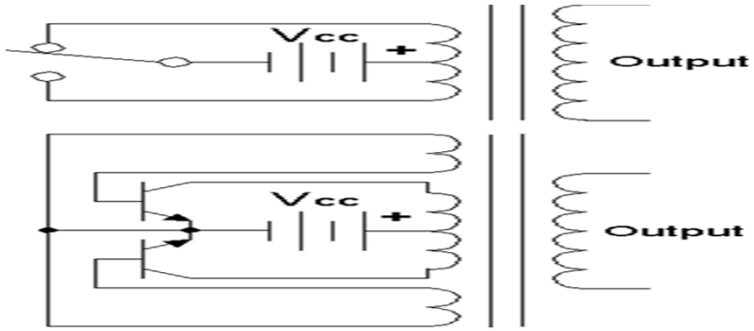
Background

- What is an Inverter?

An electronic device that changes direct current(DC) to alternating current (AC)



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Background

- What is meant by a flexible Inverter?
  - Modular inverter where more inverter can be added to increase output power

- Customers
  - Residential
  - Small business

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Problem Formulation

- What are the problems for existing/future solar power owners with string inverters

  Limited expansion flexibility

- What is the preventing homeowners going solar?

  High initial investment

Problem Statement

Because of expensive equipment and lack of resources, customers need an easy, reliable, and cost-efficient way of adding solar panels to their system.

Design Requirements

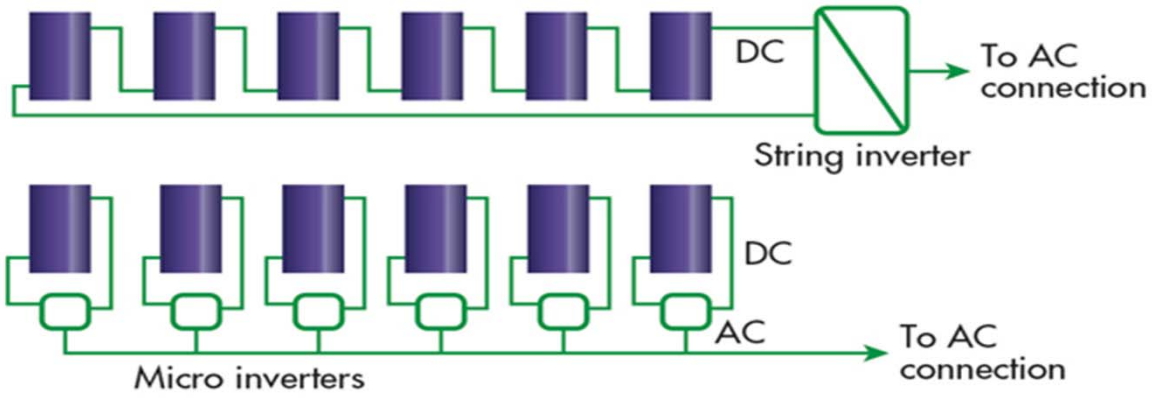
- Easy inverter expansion
- Cost effective

Current Status of the Art

There are two types of inverters in PV system

String inverter

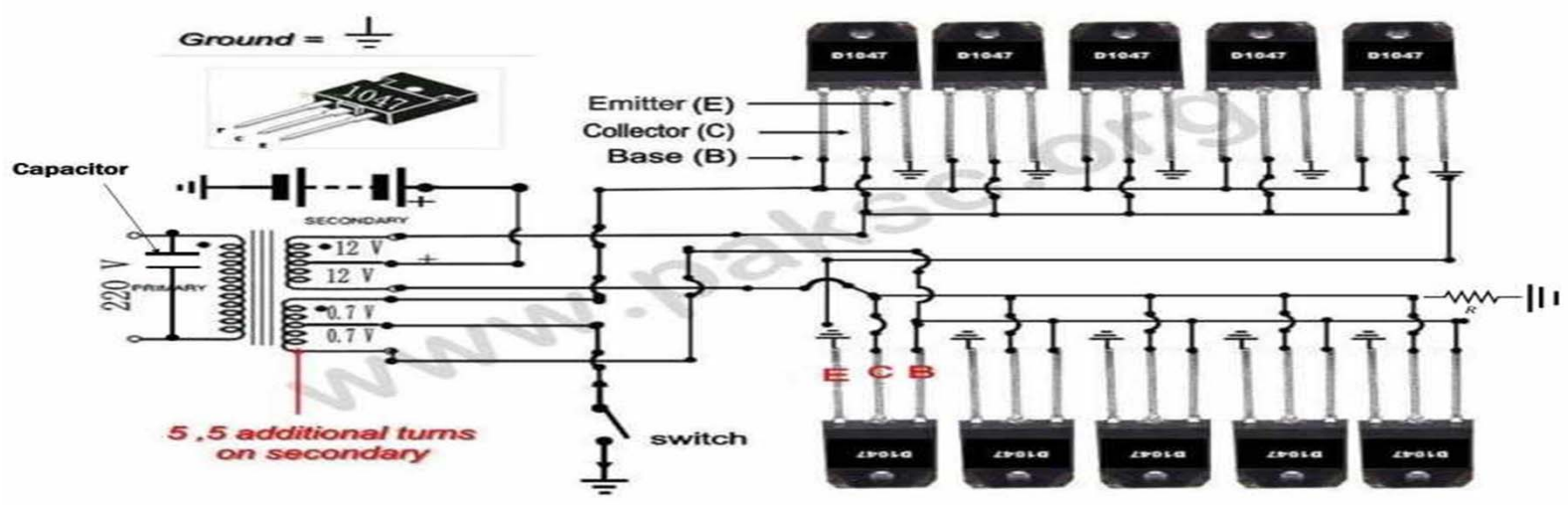
Microinverter



Solution Approaches

Conceptual design 1

Build inverter circuit from scratch



Solution Approaches

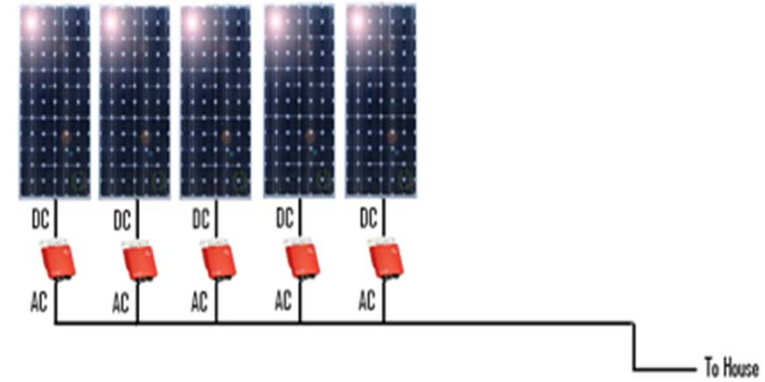
Reasons for not picking this solution:

- Limited time
- Lack of resources
- Difficult to implement

Solution Approaches

Conceptual design 2

Implement microinverters



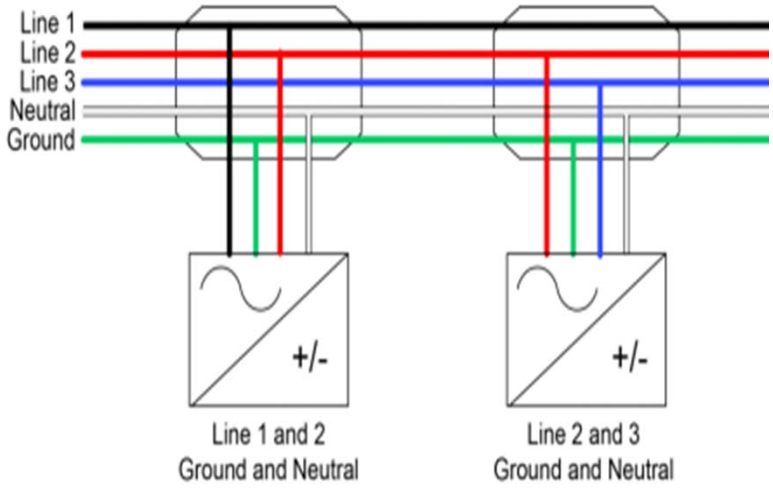
Solution Approaches

Reasons for choosing this design:

- Individual Optimization
  - Shading,dirt,snow wouldn’t bring entire down
- Easily Expandable
  - No need for restringing or expensive parts
- No Single Point of Failure
  - if one solar panel or inverter fails
    - The system is not affected

Project’s Spring 2016 Target Goal

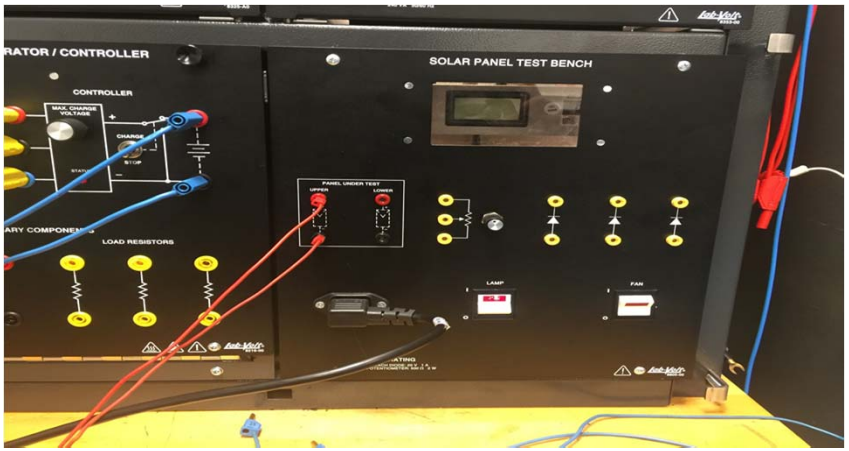
- Show output expansion flexibility by adding a microinverter to an existing micro inverter
- Testing output



Implementation

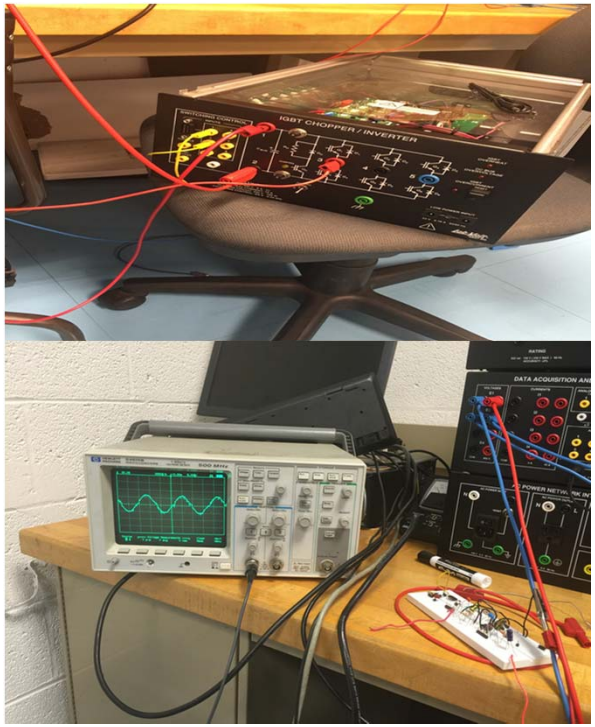
(Pre getting our microinverters)

We tried to implement microinverter approach using our lab equipment



- Using a solar panel test bench as PV DC source

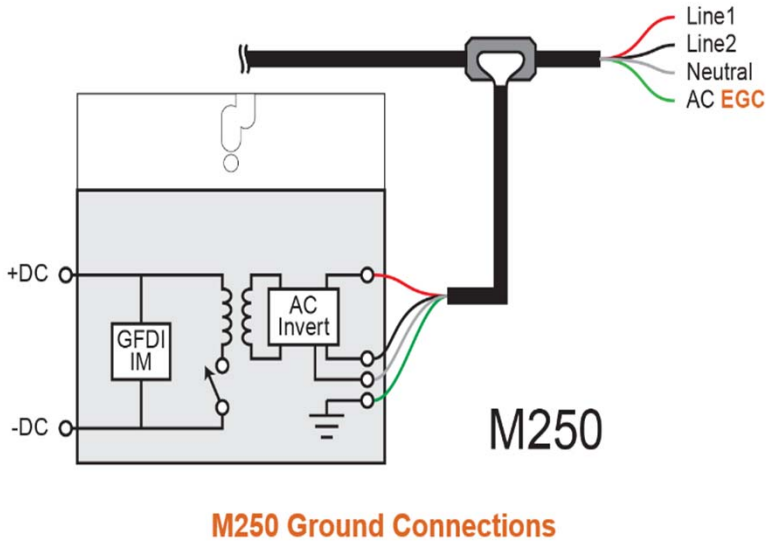
Implementation



- Connecting an inverter to solar testing bench
- Testing the output AC signal

Implementation

Enphase M250 microinverter



Enphase M250 microinverter internal schematics

Implementation

How to connect micro inverters?

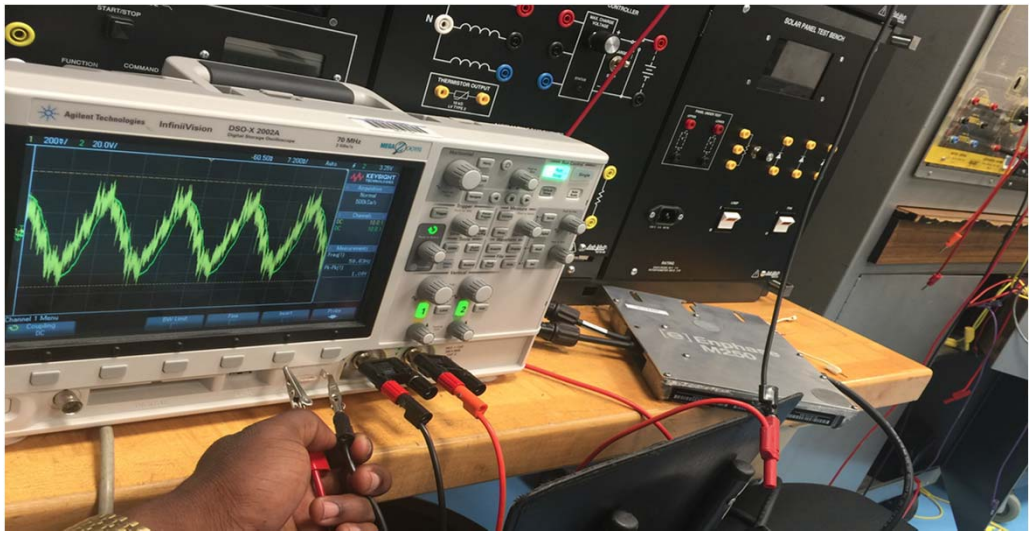
- Use trunk cable wire

- Minor problem
  Cable came with one connector

Work around of connecting microinverter and trunk cable

Implementation

Testing for the output AC signal from the 2 microinverters



Cost and Resources

Budget of $340 to be used for:

- Two micro inverters
- Trunk cable
- Trunk cable connector

The following resources that were used for the development of the project were:

- Howard University laboratories and facilities
- Sources obtained from advisors and the internet

Conclusion

Team FLEX achieved our project goal of expansion flexibility of PV inverter by implementing microinverters by the end of Spring 2016

We as a team were able to achieve completion by doing the following:

- Coming up with conceptual designs to solve the expansion problem of inverters
- Choosing a top conceptual design (microinverters)
- Researching microinverter technology and its implementation
- Connecting and testing 2 microinverters
- Achieving expansion flexibility in a cost effective manner

Future Works

For future works, we as a team would like the design to implement these features:

- Find ways to reduce cost
- Implement a microprocessor that would monitor system performance
- Implement and test more than 2 micro inverters


Questions