King Saud University
College of Engineering
Electrical Engineering Department *Semester:* **392**

Senior Design Project Proposal Form

Project # E1

Project Title: Performance comparison and cost estimation of a stand-alone bifacial photovoltaic (PV) modules with comparable one-sided ones.

Professor(s) Name(s): Professor Abdulrahman M. Alamoud

Number of Students: Two

Students Qualifications: EE404

Statement of Problem:
Saudi Arabia's large area and high concentration of solar energy makes it ideal for a vast number of applications such as generating electricity for home use, mobile phone towers, road signs, roads emergency phones, mobile military forces (army, national guard, and border guard), medical ambulances, and oil pipe lines cathodic protection to name but a few.
The recent manufacturing of bifacial (two sides) PV modules have given hope of cost reduction of PV power delivered to the load. The claim is based on the fact that the saving in area and cost compared to one-sided modules.

Brief Description of the Project:
The project is intended to teach students how to design a grid-connected rooftop photovoltaic (PV) system and give them hands-on experience of constructing a mobile PV system for use in remote areas. The work will involve the disciplines of electronics, solar radiation, solar cells, and photovoltaic electric system design. A team of two students will work on the evaluation and comparison of the two PV technologies. The team will construct a stand-alone PV system composed of one-sided and bifacial PV modules side by side to compare their performance and area and economical savings.

Objectives:
The project objectives are as follows:
(1) To put to use theory and tools the students acquired in previous electronic courses.
(2) To acquire experience in different module technologies of a stand-alone rooftop PV system.
(3) To implement their system in practical rooftop PV electric generator.

Technical Approach and Expected Deliverables:
The work will involve two phases covering one semester each. In the first semester the students will learn the basic principles of solar energy such as solar radiation, p-n junction solar cell design and operation, PV modules, storage batteries, and other PV system components. The students will then learn PV system design techniques. They will then construct a suitable rooftop stand-alone PV system. The students will take into account the realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, social impact.
In the second semester, the students will work on the implementation of a small-scale stand-alone PV system consisting of bifacial and one-sided modules. Testing of the constructed PV system will commence to ensure a practical performance of the two PV module technologies. The expected deliverable is a verification of the claim of the superiority of bifacial PV modules over one-sided ones matching the available area and budget.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 392**

Graduation Design Project Proposal Form

Project # E2

Project Title:
Design & Impelementation of Single Phase Grid Connected invereter

Professor(s) Name(s): 1. Prof. Mohamed Abouelela
2. Prof. Mohamed Alturaigi

Number of Students: Two

Students Qualifications

EE401 + EE353

Statement of Problem

A **grid connected inverter** converts direct current (DC) into an alternating current (AC) suitable for injecting into an electrical power grid, Grid connected inverters are used between local electrical power generators: solar panel, wind turbine, hydro-electric, and the grid. To inject electrical power efficiently and safely into the grid, grid-tie inverters must accurately match the voltage and phase of the grid sine wave AC waveform. The efficiency and harmonic distortion are important parameters that indicate the inverter performance .

The design objectives of an inverter circuit are to increase the efficiency and reduce the THD (Total Harmonic Distortion)

Brief Description of the Project

The objective of this project is to design and build an efficient grid connected inverter . A grid connected inverter converts DC electrical power into AC power suitable for injecting into the electric utility company grid. The grid tie inverter (GTI) must match the phase of the grid and maintain the output voltage slightly higher than the grid voltage at any instant. A high-quality modern grid connected inverter has a fixed unity power factor, which means its output voltage and current are perfectly lined up, and its phase angle is within 1 degree of the AC power grid. The inverter has an on-board computer that senses the current AC grid waveform, and outputs a voltage to correspond with the grid. However, supplying reactive power to the grid might be necessary to keep the voltage in the local grid inside allowed limitations. Otherwise, in a grid segment with considerable power from renewable sources, voltage levels might rise too much at times of high production, i.e. around noon with solar panels. Properly configured, a grid-connected inverter enables a homeowner to use an alternative power generation system like solar or wind power without extensive rewiring and without batteries.

Throughout the project, the student will design, build and test an inverter circuit while considering the efficiency and distortion for optimization.

Objectives

Often, the design has two to four specific objectives. You might consider listing them vertically as follows:

(1) Understanding different Types of grid connected inverter techniques
(2) Design and test several circuits used for grid connected inverter
(3) Learning the principles of using μ- controller in embedded systems and the associated software tools.
(4) Use simulation tools (Matlab) for testing the propsed design.
(5) Developing a prototype for the proposed circuit
(6) Lab testing the impelemented circuit

Technical Approach and Expected Deliverables

This section discusses how to achieve the objectives mentioned above and the expected end product (if any), etc.

(a) Practicing techniques foe attaching different types of data to a μ- controller boards.

(b) Developing the software needed to complete the system operation .
(c) Processing the collected data from Inverter suppliers concerning different types available in the market
(d) Design the inverter circuit HW .
(e) Design the microcontroller interfac needed to control the PWM of inverter circuit.
(f) Integrating the above system components into one equipment that can be commercialized .

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Graduation Design Project Proposal Form

Project # E3

Project Title:
Design & Impelementation of micro controller based RFID system

Professor(s) Name(s): 1. Prof. Mohamed Abouelela
2. Prof. Abdelfatah Sheta

Number of Students: Two

Students Qualifications

EE401 + EE353

Statement of Problem

This project aims at developing a simple and low cost RF ID system. The principle of operation depends on an electronic circuit programmed to hold an ID data. It can communicate with any PC or laptop using commercially available wireless modules within certain coverage area. The system design will consider and optimize the performance regarding size, power consumption, standards, communication protocols and cost. Simulation and experimental work will be used for achieving the project objectives and a system prototype is expected as an outcome .

Brief Description of the Project

The objective of this project is to design and build an efficient RFID (Radio Frequency Identification) system. RFID is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies. Typical application may include : Asset Tracking & Monitoring ,Condition Monitoring, People Safety, High Speed Tracing, Real-Time Locating , Education of Surgical Teams, and Customized Solution. In addition, RFID is increasingly used with biometric technologies for security. The powerful active RFID technology consists of Tags Controllers and accessories .

Process of RFID system : The antenna emits radio signals to activate the tag and to read and write data to it. The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation

signal.The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to a host computer for processing. Wide Area Network may be accessed for a complete database.

RFID components: a typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate. The chip can store as much as 2 kilobytes of data. To retrieve the data stored on an RFID tag, you need a reader. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. The reader then passes the information in digital form to a computer system. In this work the proposed system uses the Bluetooth technology for implementing the RF channel connecting tag transponder to the reader unit .

Objectives

Often, the design has two to four specific objectives. You might consider listing them vertically as follows:

(1) Understanding different Types of RFID system techniques
(2) Design and test several circuits used for RFID system components : Tags and readers
(3) Learning the principles of using μ- controller in embedded systems and the associated software tools.

(4) Use simulation tools (Matlab) for testing the propsed design.
(5) Learning the principles of using wireless data communication modules and associated protocols and the associated software tools.

(6) Developing a prototype for the proposed circuit and system.

(5) Lab testing the impelemented circuit

Technical Approach and Expected Deliverables

This section discusses how to achieve the objectives mentioned above and the expected end product (if any), etc.

(a) Practicing techniques foe attaching different types of data to a μ- controller boards.

(b) Developing the software needed to complete the system operation .
(c) Processing the collected data from RFID components suppliers concerning different types available in the market
(d) Design the system and the associated circuits.
(e) Design the microcontroller interfac needed to control the data communication link between the tags and the reader,
(f) Integrating the above system components into one equipment that can be commercialized for certain application.

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Graduation Design Project Proposal Form

Project # E4

Project Title: Design and Implementation of a Solar Thermoelectric Generator Array for Cellular Phone Battery Charging

Professor(s) Name(s): Dr. Mohamed Ramy; Dr. Ehab Awad

Number of Students: Two

Students Qualifications

1. Willing to get involved in extensive experimental work.
2. Should have completed EE310.

Statement of Problem

A themoelectric generator (TEG) operates by the virtue of "Seeback effect" where it acts to produce power across its terminals that is proportional to temperature differential between its surfaces. A solar thermoelectric generator (STEG) system will concentrate incident sun radiation onto a TEG's hot surface, where the TEG will generate an output electric power in accordance with the temperature difference between the surface facing solar radiation and its other cooled surface. Solar thermoelectric generators are potentially complementaty solutions to solar cells for harnessing incident solar energy.

Brief Description of the Project

The project involves designing, implementing, and testing an array of TEG modules that can be used for charging a typical cell phone battery.

Objectives

1- Design a solar thermoelectric generation system.
2- Experimental implementation of the system.
3- Testing and characterizing the performance of the implemented system.

Technical Approach

- Survey will be conducted on STEGs and their concept of operation; solar concentrators, solar selective absorbers.
- Design and implementation of a Solar STEG system with TEG modules, cooling module and solar concentrators.
- Proper selection of a thermoelectric power generation module(s) and detailed estimation of expected power generated based upon temperature differential measurements collected from different practical situations conducted.
- Design and implementation of a voltage booster circuit(s) for power delivery to a load (cell phone battery)
- STEG system integration and testing.

Expected Deliverables

- System block diagram with design and operational concept details.
- Simulation results.
- A working prototype for a solar thermoelectric generation system and battery charging system.