P1

Dr. Saleh Alshebeili

Title: Forecasting Plug-in Hybrid Electrical Vehicles Charging Demand

Description: Plug-in hybrid electrical vehicles (PHEVs) have largely been penetrating power systems because of their great benefits compared to fossil fuel vehicles. PHEVs are a combination of gasoline and electric vehicles, so they have a battery, an electric motor, a gasoline tank, and an internal combustion engine. PHEVs rapid growth can potentially lead power grids to face new challenges due to load profile changes. Therefore, accurate PHEV charging load demand forecasting is one of the key concerns from the power grid management point of view.

Objective:

Forecast the PHEV charging station loads using machine learning (ML) techniques.

Deliverable:

ML-based software for PHEV charging station loads forecasting.

P2

Dr. Saleh Alshebeili

Title: Real-Time Monitoring of Optical Networks using Field Programmable Gate Array

Description:

Fiber optics are key drivers for future emerging technologies and networks due to their high capacity which outperforms the radio frequency and copper cable networks. Future optical networks are expected to be dynamic, spectrum grid-free, modulation format-free, and reconfigurable. These features improve the overall network performance, flexibility, and efficiency but require upgrading the current optical nodes to be intelligent. Part of this intelligence is monitoring the signal performance to enable the network to determine the degradation source and initiate precautionary procedures to improve network reliability. For example, the ability to monitor the signal quality at network nodes enables the network operator to make a trade-off between spectral efficiency, signal quality, and reach distance. In such a case, higher-order modulation formats can be transmitted over good condition optical channels while lower-order modulation formats can be used in bad condition optical channels.

Objective:

Develop a real-time optical performance monitoring system using field programmable gate array (FPGA) platform. FPGA is an integrated circuit that can be programmed by a user for a specific task after it has already been manufactured.

Deliverable:

A prototype of real-time FPGA-based optical performance monitoring system.

P3

Project Title:

Radar Cross Section (RCS) of UAV Antennas: Design and Placement

Professor Name : Professor Majeed Alkanhal and Dr. Hamsakutty Vettikalladi

Number of Students: Two

Students Qualifications:

Statement of Problem:

To investigate, compare, and design different antenna/UAV "possible" structures for specific purposes for RCS, communication, and electronic warefare (EW) applications. Antennas on UAVs with different shapes and performances will be analyzed , modelled and selected for different communication and EW environments.

Brief Description of the Project:

Unmanned Air Vehicle (UAV) system typically has several wireless links. These links include a remotely operated control system in addition to wireless communication (usually UHF) links to transmit information to the control base-station. These wireless links need high quality designed antennas that can operate with minimized destructive interaction among them and between them and the airplane body. The UAV/antenna structures should fulfil certain RCS measures fro truthful EW operation. This is the root of the problem of design and placement of UAV antennas to ensure best RCS performance and proper operation for the control and communication links between the UAV and the ground-based station.

Objectives:

Phase 1 (EE496):

Problem formulation, Antenna and RCS Sofware Package Practice, the UAV simulation model, simulations and result verification.

Phase 2 (EE497):

Design and selection of different band UHF antenna/ UAV structures and their placement on the UAV according to the proposed specifications (using the simulation model), conclusions and documentation**.**

Technical Approach and Expected Deliverables:

Technical Review of RCS and antenna Basics, Design Specifications and alternatives, Analysis and simulation, Evaluation and adjustments to meet Specifications, possible measurments of simple antennas on UAV model at microwave frequencies.

P4

Project Title: Antenna Design for Internet of Things (IOT Antennas)

Professor(s) Name(s): 1. Hamsakutty Vettikalladi

2. Majeed Alkanhal

Number of Students: Two

Students Qualifications

Knowledge of electromagnetic theory and basic knowledge of antennas

Statement of Problem

The growing market of the Internet of Things (IoT) calls for various types of electronic components and communication technologies for a wide spectrum of applications including smart cities and vehicles, home automation, telemedicine, and industrial applications. Obviously, the successful functionality of these applications is dependent on a reliable wireless component. Among the multitude of attention and discussion that surrounds the Internet of Things (IoT), the subject of antenna performance is not always properly considered. Sometimes, this lack of attention is driven by certain interpretations of IoT, based on which of several low cost devices are close to each other with no need for powerful transceivers. Even in those scenarios, antenna performance remains very important because of issues such as noise, fading and the need for efficiency. Therefore, antennas are an essential element for the IoT.

Brief Description of the Project

Internet of Things means an infinitude of connected devices and small sensors, integrated in a bigger network with a permanent access to the user. One of its major application is in the Smart home concept, allowing more convenience, efficiency (at various aspects) and safety. With more and more devices, it is nowadays mandatory for these devices to be small, low-power and at the same time more capable and efficient. In this project, the students will study the importance of small and effiecient antenna for IOT applications and also design antennas suitable for IoT devices,by developing high bandwidth antennas according to the growing needs of wireless networks. This antenna has a reduced dimensions, ideal to be integrated in most of IoT sensors.

Objectives

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

(1) Study the concepts of IOT antennas

(2) Design compact IOT antennas: low cost, compact and wide band antennas

(3) Develop the IOT antennas designed based on the manufacturing capacity in KSU

Technical Approach and Expected Deliverables

Phase I: Students will study internet of things and IOT antennas
Phase II: Study the frequency spectrum used for IOT antennas also simulation packages to design antennas.
Phase III: Study the different IOT antenna designing technologies by literature review

Phase IV: Design effiecient antennas suitable for IOT applications.

P5

Project Title: LED-based Robot-to-Robot Communications

Professor(s) Name(s): 1. Dr. Mohammed Alresheedi
2. Dr. Ahmad Fauzi Abas
3. Yayah AL-harith

Number of Students: three

Students Qualifications

Knowledge and skills in electronics circuit and microcontroller programming.

Statement of Problem

The role of robots in today life is very important. They play important roles as manufacturing machine in big industries down to a small toy in our house. Within a few years, it is expected many home and office devices will be mobile, which are powered by robots. Today, we can see home appliances such as vacuum cleaner moving around the house automatically. Soon there will be more appliances that will do the same. To support this, small sizes robot will become demanded devices. It is very important the robot-to-robot (R2R) communication be studied. As Light-Emitting-Diode (LED) is a high potential and cheap technology, the study to integrate LED in R2R implementation is very important.

Brief Description of the Project

In this project the students need to:

1. Design the concept of the system
2. Develop the printed circuit board (PCB) of the controller circuit
3. Use microcontroller as the brain of the system
4. Determine and install required sensors

Many design parameters can be studied such as the movement direction and speed, collision avoidance, distance calculation and others.

Objectives

1. To design mobile robot with integrated LED
2. To develop a system PCB
3. To use microcontroller as the system decision maker
4. To integrate full system

Technical Approach and Expected Deliverables

To achieve above objectives, the students need to first analyze all possible system designs. Once the final design is selected, the student need to start designing the required electrical circuit, test and verify its performance. At the same time, the students need to work with the microcontroller, which can provide the control to the board. The student will know that this project has reached it complete state once they manage to build mobile robots that can know the distance between them and move to appropriate direction. The students should also be able to set the travel distance of the robots and other important parameters that should be discovered by the students themselves.

Project Title: Autonomous Mini Greenhouse

Professor(s) Name(s): 1. Dr. Mohammed Alresheedi
2. Dr. Ahmad Fauzi Abas

Number of Students: Two

Students Qualifications

Knowledge and skills in electronics circuit and microcontroller programming.

Statement of Problem

The importance of food safety and quality motivates the idea of having a greenhouse at home-scale, which is known as mini greenhouse. Mini greenhouse allows us to grow high quality vegetables just at the corner of our backyard. It replicates the controlled conditions used by professional farmers in large glass greenhouses, but at a much lower cost and suitable for home use. Current mini greenhouse is too much simplified to assure the cost is affordable. This project explores the potential to develop a working green house at affordable cost, while still maintaining the features offered by the industrial standard greenhouse. Among the parameters that need to be studied and developed are smart ventilation, temperature control, water saving, fertilizer and pest management, and others.

Brief Description of the Project

In this project the students need to:

5. Design the concept of the mini greenhouse
6. Develop the printed circuit board (PCB) of control unit
7. Use microcontroller as the brain of the system
8. Determine and install required sensors

Objectives

5. To design a mini greenhouse
6. To develop a smart control system
7. To integrate full system

Technical Approach and Expected Deliverables

The students can start by designing the working principles and operational procedure of the system. All possible system designs need to be analyzed. Once the final design is selected, the student need to start designing the required electrical circuit, test and verify its performance. At the same time, the students need to work with the microcontroller, which can provide the control to the board. The input to the control system can be done through computer. For more advanced system, the student can also try to control using mobile phone. Expected deliverable is a model of a greenhouse that can operate based on the input instruction given by the operator.

P7

Project Title:

Professor(s) Name(s): 1. Dr. Faris E. Alfaris

2. Dr. Mohammed Alharbi

Number of Students: Two

Students Qualifications

Knowledge on power systems and basic knowledge on MATLAB.

Statement of Problem

The project aims to improve the performance and cost profile of the PV cleaning systems by proposing a new method for detecting the contaminations (especially dust) over the PV panels surface. The sun radiation models and estimation of the PV power is the main key factor to establish a Senseless dust detection units for optimized PV cleaning system.

Brief Description of the Project

Students will need to obtain a solar radiation model that is suitable for Saudi Arabia region. Then they have to establish an assessment tool to predict the production power for PV systems. Then this tool will be utilized to detect dust and contaminations over the PV panels surface, along with other climate condition inputs.

Objectives

(1) Ability of estimating the future production of the PV farm generated energy.

(2) Improve the efficiency and performance of PV panels cleaning systems, therefore enhance the overall PV systems effectiveness.

(3) minimize the cost of PV cleaning systems, and

(4) Ability of modelling, coding and analyzing.

Technical Approach and Expected Deliverables

With the knowledge of solar radiation models, students must figure out the proper approach to estimate the PV power production to compare it with the actual PV output power, and then detect the different causes of degradation in the generated power. The main deliverable of this work is proposing a completed system to detect dust (and other contaminations) on PV panels surface, for optimized PV cleaning system.

Project Title: Operation of Balanced and Unbalanced Three Phase Static AC Regulator

Professor(s) Name(s): 1. Prof. Abdulrahman I. Alolah

2. Dr. Saleh Al-Senaidi

Number of Students: Two

Students Qualifications

EE 432 (co- requisite) + Basic Matlab

Statement of Problem

Three Phase Static Voltage Regulator (SVR) is a power electronics based device that varies the voltage of both linear and non-linear, ac loads. Different semiconductor devices are used in building the circuit of the regulator, such as thyristors or IGBT's. In addition, different techniques may be applied to control the waveform of the output voltage of the regulator. These techniques are phase angle, chopping and Pulse Width Modulation (PWM).

Brief Description of the Project

(i) Review of Three Phase Static Voltage Regulator (SVR), advantages and disadvantages

(ii) Review of related power electrnics devices usualy used in SVR

(iii) Analysis of the system under study

(iv) Results verification

Objectives

(1) Understanding the consept of power electronics systems

(2) Understanding the operation Principle of Three Phase Static Voltage Regulator (SVR).

(3) Understanding rectifier circuits and control.

(4) Study of effect of system parameters on output voltage.

(5) Study of variable unbalance factor on SVR

Technical Approach and Expected Deliverables

(a) Development of a computer program to achieve the required analysis

(b) Use of MATLAB to confirm the analysis of (a)

(c) Verify some results experimentally

P9

Project Title: Unbalanced Operation of Three Phase Induction Motor

Professor(s) Name(s): 1. Prof. Abdulrahman I. Alolah

2. Dr. Saleh Al-Senaidi

Number of Students: Two

Students Qualifications

EE433 (co- requisite) + Basic Matlab

Statement of Problem

Three phase balanced induction motor is usually designed to operate on three phase balanced supply. Under some conditions, the available supply is just single phase. Three phase induction motor can be operated on single supply by using a phase balancer. The simplest phase balancer is a single capacitor which is connected to one terminal of the supply while the other two terminals are connected to the supply.

Brief Description of the Project

(i) Review of induction motor theory, advantages and operation

(ii) Review of induction motor operation under balanced/unbalanced supply

(iii) Analysis of the system under study

(iv) Results verification

Objectives

(1) Understanding concept of induction motor operation.

(2). Understanding three phase balanced and unbalanced supplies

(3) Study of effect of system parameters on motor performance

(4) Develop a measure factor to define supply unbalance

(4) Study of the effect of unbalance factor on motor performance

Technical Approach and Expected Deliverables

(a) Development of a computer program to achieve the required analysis

(b) Use of MATLAB to confirm the analysis of (a)

(c) Verify some results experimentally