King Saud University
College of Engineering
Electrical Engineering Department **Semester: 421**

Graduation Design Project Proposal Form

Project # E1

Project Title: Design of Three-Dimensional Printer

Professor(s) Name(s): 1. Prof. Ehab Awad
2. Prof. Mohamed Ramy

Number of Students: Two

Students Qualifications: General knowledge in electronics and/ or communications

Description of the Project

Three-dimensional (3D) printers are currently important tools in many fields of life like mechanical and medical areas. They allow designing and printing of 3D objects in an easy and fast way. The printed object is usually designed by a computer. Then, it is sent to a microcontroller unit that moves a printer head in 3D Cartesian-coordinates in order to deposit printing ink at accurate locations in space.

In this project, a 3D printer will be designed and implemented. That includes building mechanical translation stages to move printing head, using a microcontroller unit to control printing process, and programming a software tool to design the printed objects.

Objectives

In this project the students will learn about:

1- The 3D printers.
2- Micro-controllers.
3- Software programing tools.
4- Mechanical translation stages.

Technical Approach and Expected Deliverables

By the end of project, the students will:

1- Design and build a 3D printer.
2- Design and build a micro-controller unit.
3- Design and program a printing software.
4- Write a technical report.

Project # E2

Project Title: Design and implementation of Oil Wells Monitoring System.

Professor(s) Name(s): Dr. Nacer Debbar
Dr. Mohamed Ramy Abdel-Rahman

Number of Students: Two

Students Qualifications:

1- Should have completed EE310 and EE401,
2- Certain knowledge of simulation packages for electronic circuits
3- Certain knowledge of logic design.

Statement of Problem

In oil fields, corporations need monitoring of oil production from within their base without the need to walk through the field. This electronic system will tackle such a need.

Brief Description of the Project

The project involves the design of a control system to monitor the output of field of 16 oil wells. The output of each well is measured with a flow meter that outputs a binary digit number corresponding to one of the following four flow conditions:

1. 00 no flow
2. 01 33.3 % flow
3. 01 33.3 % flow
4. 11 100 % flow

In the first phase the team will identify the different tasks required by the system. They will then formulate the design problem in block diagram form. Using software packages they simulate the system and re-adjust the design as necessary until a working system that meets all requirements is achieved.

In the second phase, the team will work to implement a prototype of the system. They will shop for needed components and make a cost estimate of the system. The prototype will finally be tested to ensure that the desired results are achieved. In case, the performance is not found to be up to the mark, the design cycle will be repeated.

Objectives

The project is intended to:

1- give students a hands-on experience of designing complex electronic systems,

2- illustrate to students how to use state of the art techniques and technologies learned in the program to realize a working system

3- expose students to projects that are multi-disciplinary in nature: Electronics, mechanical engineering, optoelectronics, digital signal processing, etc.

Technical Approach and Expected Deliverables

System Requirements:

1) The system should use the 60 Hz, 110 power lines for power supply and timing.

Deliverables:

- Block diagram of system design
- Simulation of all electronic circuits
- A working prototype

Technical Requirements:

- Good circuit design skills. Knowledge of digital circuits, logic levels, and interfacing of digital ICs is essential. This system requires also some analog design skills related to opamps and signal conditioning.
- Electronic circuit simulation using the available software.

Project # E3

Project Title: Design and Optimization of Silicon Solar Cell Performance

Professor(s) Name(s): 1. Dr. Mohamed Ramy
2. Dr. Nacer Debbar

Number of Students: Two to three

Students Qualifications

1. Completed EE310 and preferably completed EE404.
2. Willing to do hard work.

Statement of Problem

Solar cells are semiconductor-based electronic devices purposed to produce electrical energy from sunlight by the virtue of the photovoltaic effect. The process of designing a solar cell comprises specifying the parameters of a solar cell structure (absorber layer, emitter layer, antireflection coating, back surface field layer and others) aiming for a maximized performance, given various constraints (such as cost, efficiency, available manufacturing infrastructure, etc.). Understanding the parameters affecting the performance of a specific solar cell configuration is key to designing a solar cell with an optimized efficiency. This project aims to perform extensive parametric studies on several silicon solar cell configurations using PC1D simulation software. Simulation results will be validated against measured data of industrial solar cells. Next, optimized solar cell designs will be presented.

Brief Description of the Project

This project aims to perform extensive parametric studies on several silicon solar cell configurations leading to optimized solar cell designs. The design process will be performed using PC1D simulation software. In addition, experimental validation against measured data of industrial solar cells will be executed.

Objectives

1- Understand the physical operational concepts of solar cells and in specific silicon solar cells.
2- Performing comprehensive parametric studies using PC1D simulation software on selected silicon solar cell configurations and experimentally validating the simulation results.
3- Producing optimized (educated/practical) designs for various silicon solar cell configurations.

Technical Approach and Expected Deliverables

- Background study on solar cell technologies and solar cell operation concepts.
- Indetifying and understanding all the key parameters affecting the solar cell design.
- Using computer simulation software, PC1D, for simulating silicon solar cells.
- Performing exhaustive paramteric studies and understanding the effect of different paramaters on solar cell perfomance.
- Devising an experimental setup for characterizing solar cells and experimentally validating the simulation results.
- Producing optimized designs for several silicon solar cell configurations.

Expected Deliverables

- Extensive parametric studies on several silicon solar cell configurations.
- Optimized designs for several silicon solar cell configurations.
- An experimental setup for charactrizing solar cells. And experimental validation of simulation results.

Project # E4

Project Title: Design and Implemantaion of Enervated Muscle Stimulation System using Remote sEMG Signals

Professor(s) Name(s): 1. Dr. Mohamed Abbas
2. Dr. Ahmed Al-Zuhair

Number of Students: Two Students

Students Qualifications
Candidate students are preferred have basic microcontroller programming skills.

Statement of Problem

Peripheral nerve injury is a serious medical problem which usually causes permanent or temporally loss of motor or sensory function. With the increasing number of human accidents, the problem became more prominent among the civilians and militaries as well. Surgurical operations might repir the injured nurve. Depending on the injury location, It usually takes a half to two years to completely restore the nerve function. Furthermore, the success rate of the repair depends on how well the nerve axons rejoin to the neuromuscular junctions. In many cases, the nerve axons regrew in inappropriate direction, which results in permanent paralyzed limb. The problem is existing worldwide and becoming more series in Kingdom of Saudi Arabia mainly due to the ever increasing traffic accidents. In short, Patients with proximal nerve injury undergo repair and post-operative electric muscle stimulation of enervated muscles awaiting reinnervation. This requires regular visits to the Occupational Therapy Department, which results in overhead on the MOH budget and relativily complicate the life of the injured people and/or there families.

Brief Description of the Project

The number of people, having paralized limbs, is increasing worldwide due to road accidents, wars, etc.. In many cases, accedent results in temporal or continues loss of the perephiral nerve that feeds a limb musscle. If a peripheral nerve is damaged then muscles stimulated by this nerve will not receive information from the brain and, therefore, the muscle become paralyzed or weakened. Unlike the spinal-cord, peripheral nerves are capable of healing this may make damaged ones require medical interventions. One of these interventions is the electro-physical therapy which is an important intervention to remediate impairments and promotes mobility functions, which enhance their life quality. A technique for peripheral nerve injured persons will be designed . The purpose is to train limb muscles of the people having perephiral nurve injury by themselves or under physician supervision. The targeted technique depends on sensing and acquiring the EMG signal from the healthy muscle by surface electrodes, pre-processing, and simultaneously transferring it to the other limb to stimulate the corresponding muscles. In this project, the student will design an electronic system to (1) sense and amplify surface electromyography (sEMG) signal. (2) designa a circuit to generate an electrical muscle stimulation signal. (3) utilize the amplified sEMG signal to control the stimulation signal generator.

Objectives

At the end of the project the students should be able to

(1) Understand the nature of EMG signal and the method(s) of its sensing,
(2) Implement a system to reliably sense the EMG signal of a target muscle.
(3) Build a circuit to generate an electrical signal to noninvasively muscle stimulation
(4) Integrate the subsystems implemented in (2) and (3) using "off shelf" electronic components.

Technical Approach

Phase I

1.1 Literature review and comprehensive understating of the topic.

1.2 Design and simulation of sEMG sensing system using an appropriate CAD tool.

1.3 Design and simulation of muscle stimulation signal generator using an appropriate CAD tool

1.3 Preparing the component list and placing the purchase order.

1.4 Writing the report of the first phase.

Phase II

2.1 Implementing the sensing system and exporting real EMG signals.

2.2 Implement the stimulation circuit and test it.

2.3 Integrate the circuits if 2.1, 2.2 .

2.5 Test the full system on a real subject.

2.6 Update the report to its final form.

Expected Deliverables

1. sEMG signal sensing system
2. Non-Invasive electrical muscle stimulator.
3. System for Enervated Muscle Stimulation Control using Remote sEMG Signals

Project # E5

Project Title: Design and Implementaion of Monitoring and Control System for Home Water Consumption

Professor(s) Name(s): **Dr. Abdulhameed Al-**Sanie.
Dr. Mohamed Abbas

Number of Students: Two to three

Students Qualifications

Electronics and/or Communications group

Statement of Problem

Although the government is doing many efforts to provide potable water in reasonable price, after application of the new tariff in the Kingdom of Saudi Arabia, the consumers need to observe their water bills so that it does not became unnecessarily high. Since the price per cubic meter is increased as the amount of monthly consumption increases, one of the possible way to lower the bill is to set the monthly consumption to its minimum limit.

Brief Description of the Project

The kingdom of Saudi Arabia has a vast desert area with limited natural water resources represented by underground water and short rainy season. To cove the ever continuous needs for water, the Kingdom resort to desalination of sea water, and turn it into potable water, which cover around 70% of the Kingdom's water needs [1]. The high cost of producing fresh water is one of the reason that push the government to raise the price per cubic meter [2],[3], though it is the least worldwide. In turn , consumers water bill has been observably increased. Therefore , a method for rationalization of water consumption is required.

The aim of this capstone project is to design a system to help the customer minimizing his monthly water bill. According to the current billing system, the bill value is not linearly increased with number of consumed cubic meters. since the price per cubic meter is increased as the drawn quantity increased. The intended system will be designed to perform the following tasks ; (1) it monitors the status of water tank in a house by calculating the amount of stored water. (2) It calculates the average daily consumption. (3) It conveys this information to the owner (4) It automatically or manually controls the input to the water tank. (5) Optionally, the system observe the level of cleanness of the tank to help determining the tank cleaning necessity. The first four tasks will help the customer minimize his monthly consumption , hence , minimize the water bill.

The students will implement the system by integrating water level, impurities and parasitic sensors, water flow meter with a control unit , which will be interfaced by the customer through a communication link and android application.

Objectives

At the end of the two phases of the project, the student should

(1) Understand the operation of water level sensor, Flow meter, Impurities and parasitic sensores, programming and utilizations of microcontrollers and system simulation.,
(2) Design an integrated system to monitor the water level and cleanness of a water tank
(3) Design an android application to interface the system in (2)
(4) Test and verify the operation of the full system including soft/hardware.

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Technical Approach

The project will be executed in two phases.

Phase one:

(1) Literature review of the required materials including (i) clarity of the problem and objectives (ii) understating theory of operation of the different items of the project.

(2) system simulation using one of the appropriate CAD tools.

(3) preparing list of components and/or equipments and placing a purchasing order.

(4) Writing the report of the first phase

Phase Two.

(1) Receiving and testing the project components.

(2) Preparing a sample tank equipped with the sensor, valves and meters

(3) Programming the microcontroller and connecting with the sensors , valve and meter

(4) Preparing an Android app to interface the system.

(5) Test the full system.

(6) Update the project report

Expected Deliverables

(1) Water tank monitoring and control system using Android and Internet

References:

[1] https://mawdoo3.com/ما_مصادر_المياه_في_المملكة_العربية_السعودية
[2] https://www.nwc.com.sa/Arabic/Pages/NewTarrifCalculator.aspx
[3] Omar K M Ouda, "Review of Saudi Arabia Municipal Water Tariff", World Environment 2013, 3(2): 66-70

Project # E6

Project Title:

Design & Impelementation of IoT based wireless sensor network for survillance applications

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

Number of Students: Two

Students Qualifications

EE401 + EE353

Statement of Problem

IoT (Internet Of Things) provides a solution that ensures fast and secure connectivity anywhere. A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical orenvironmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.". The problem we treat in this project is how to use the internet to build this network and secure its function.

Brief Description of the Project

The main objective of this project is to design, build and test IoT based wireless sensor network for surveillance applications. The problems associated with implementing the system are: Energy constraint, Unreliable communication, Unreliable sensors , Ad hoc deployment , Limited computation power , and Distributed execution. Typical application are Monitoring Detecting fires indoor or outdoor, Detecting chemical or biological attacks . Wireless sensor networks can be also placed on farm lands to monitor temperature, humidity, fertilizer and pesticide levels. The System will be build around a microcontrollers that receive signals from its attached sensors through low range wireless modules . Each microcontroller with its attached sensors represents one node in the whole network . These microcontrollers will communicate with other similar monitoring nodes through public internet connection in order to complete the overall IoT based Network.

Objectives

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

(1) Understanding different Types of wireless modules and interfaces to μ- controller
(2) Design and test several circuits used for fire detect , gas detect and other sensors
(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 system connections
(4) Developing a driving software and GUI for the monitoring system

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 sensor suppliers concerning different types available in the market
(d) Design the circuit HW .
(e) Design the microcontroller interfac needed to control the wireless network .
(f) Integrating the above system components into one equipment that can be commercialized