King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Senior Design Project Proposal Form

Project # C1

Project Title: Noninvasive Blood Glucose Monitoring

Professor(s) Name(s): Prof. Saleh Alshebeili

Number of Students: Two

Students Qualifications

1. Knowledge of digital signal processing,
2. Excellent skills in programming

Statement of Problem

The conventional strip based procedures of monitoring blood glucose can become painful if regular examination is required. Therefore, recent years have seen continuous advances in the development of noninvasive blood glucose monitoring (NIBGM) devices/sensors based on sate of the art technologies. In this project, a multi-modal spectroscopy combining impedance spectroscopy (IMPS) and multi-wavelength near-infrared spectroscopy (mNIRS) is proposed for high precision non-invasive glucose level estimation. A combination of IMPS and mNIRS can compensate for the glucose estimation error to improve its accuracy. For highly accurate glucose estimation, the measurement data of IMPS and mNIRS are combined by a data fusion algorithm implemented using FPGA/DSP device.

Objectives

The main objectives of this project are as follows:

1. Conducting literature review to determine IMPS and mNIRS sensors well suited for non-invasive glucose monitoring,
2. Designing the appropriate set-up to measure blood glucose non-invasively,
3. Developing codes for fusing IMPS and mNIRS data,
4. Assessing the performance of proposed fusion algorithm using real data,
5. Implementing the selected fusion algorithm on FPGA platform,
6. Testing the harware implementation in a real-time environment.

Technical Approach

Literature review and programming will be conducted using KSU electronic library and LABVIEW software, respectively. Hardware implementation will be conducted using NI hardware and accompanying software available at KSU.

Expected Deliverables

Real-time blood glucose monitoring platform.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project #C10

Project Title: Application of Low Cost COTS SDR Platform for Effective EM Surveillance

Professor(s) Name(s): Dr. Sami Mohammed Alhumaidi

Number of Students: Two

Students Qualifications:

Knowledge of Communications System, Electromagnetics, Antenna, and EM Propagation.

Excellent programming skills including MATLAB and C.

Good knowledge of electronics and Field Programmable Gate Array (FPGA) systems.

Statement of Problem

Electromagnetic surveillance and situational awareness is needed by government organizations and telecom operators to understand the EM emission environments either for regulatory or planning purposes. Military users also apply these techniques for signal intelligence and ensuring proper operations of certain operational equipment. Current EM surveillance equipment are highly expensive and require major investment to achieve such capability.

Recently the software defined radio (SDR) industry has gone through a remarkable growth which led to offering of a large number of very low cost commercial-of-the-shelf (COTS) platforms. Even though many of these platforms are targeting hobbyists, they are increasingly adding advance features that make them suitable for advanced research.

Brief Description of the Project

The project is intended to make an evaluation and comparisons of COTS SDR platforms and select those that can satisfy this project design objectives. Survey EM Surveillance system design and techniques and agree on the specification of a useful system design. The component of the system will be acquired and integrated to perform effective EM surveillance. The system will be field tested and findings and recommendations will be documented in the final report.

Objectives

(1) Document the latest SDR technology and low cost COTS systems,
(2) Survey EM surveillance system specification,
(3) Design and Implement an SDR based EM surveillance system, and
(4) Perform field tests and determine limitations and advantage.

Technical Approach and Expected Deliverables

STEP # 1 : Project planning

STEP # 2 : Research and information gathering

STEP # 3 : Design selection

STEP # 4 : Procurement and test of components

STEP # 5 : Integration and end-to-end evaluation

STEP # 6 : Field trials and operational evaluation

STEP # 7 : Documentation of findings and recommendations

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project #C11

Project Title: Study and the design of Sub-THz antennas for 5G high speed wireless communication

Professor(s) Name(s): Dr. HamsakuttyVettikalladi

Number of Students: Two

Students Qualifications

Knowledge of electromagnetic theory and basic knowledge of antennas

Statement of Problem

Over the last few years, wireless data traffic has drastically increased due to a change in the way today's society creates shares and consumes information. This change has been accompanied by an increasing demand of much higher speed wireless communication anywhere, anytime. In particular, wireless data rates have doubled every eighteen months over the last three decades. Following this trend, wireless Terabit-per-second (Tbps) links are expected to become a reality within the next five to ten years. In this context, Terahertz Band communication is envisioned as a key wireless technology to satisfy this demand, by alleviating the spectrum scarcity and capacity limitations of current wireless systems, and enabling a plethora of long-awaited applications in diverse fields. The THz Band is the spectral band that spans the frequencies between 0.1 THz and 10 THz. The very large bandwidth provided by the THz Band opens the door to a variety of applications in 5G Cellular Network links,WLAN,WPAN etc, which demand ultra-high data rates and allows the development of a plethora of novel applications in classical networking scenarios as well as in new nanoscale communication prototypes. Some of these applications can already be foreseen and others will undoubtedly emerge as technology progresses. Antenna is the fundemental element in all these communication system. Low profile, wideband, high gain and low cost antennas are needed for this purpose.

Brief Description of the Project

In the most recent years, wireless communication networks have been facing a rapidly increasing demand for mobile traffic along with the evolvement of applications that require data rates of several 10s of Gbit/s. In order to enable the transmission of such high data rates requires ultra-high bandwidths beyond 20 GHz. Such an amount of unregulated spectrum can be identified only in the sub-THz to THz frequency range of >~ 0.1THz-10THz in general (Sub THz range is 0.1 THz to 1THz). Systems operated at those frequencies are referred to as THz communication systems. The very large bandwidth provided by the THz Band opens the door to a variety of applications which demand ultra-high data rates. Some of the potential applications are in 5G cellular networks, ultra high speed Wireless Local Area Networks (LAN), ultra high speed Wireless Personal Area Network and secure wireless terabit communication. The technology enabling small integrated transceivers with highly directive, steerable antennas becomes the key challenges at THz frequencies in face of the very high path losses. This proreject plans to study the technology and design compact antennas suitable for Sub-THz frequency operation. Because of the atmospheric losses and oxygen absorption phenomena around 300GHz band, it is ideally suitable for the next generation extra high speed (24Gb/s) short range wireless communication after 2020. The speed is expected to be more than 10 times faster than 60GHz indoor communication systems which are available in the market soon.

Objectives

1) Study the THz waves and technology
2) Finding the best technology to design antenna around 300 GHz, because low frequency technology is not applicable at high frequencies.

Technical Approach and Expected Deliverables

Phase I: Students will study THz waves and its frequency spectrum
Phase II: Study the Potential Applications of THz technology
Phase III: Study the different antenna designing technologies by literature review
Phase IV: Design of simple THz antenna using CST Microwave studio simulation software.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project #C12

Project Title: Multiple spot diffusing geometries for indoor optical wireless communication systems

Professor(s) Name(s): Dr. Mohammed Alresheedi

Number of Students: Two

Students Qualifications: Hard working, Good understanding of Communication fundamentals, Good programming skills (MATLAB or C++).

Statement of Problem

The need for high-speed local area networks to meet the recent developments in multimedia and video transmission applications has recently focused interest on optical wireless (OW) communication. OW radiation offers some potential advantages over its radio frequency (RF) counterpart. RF transmission licenses are obtained with difficulties because of the increasing congestion of the frequency bands. RF transmission is regulated by the radio communications agencies. In contrast, the infrared spectrum offers huge bandwidth potential, which is unregulated. Infrared transmission in the indoor environment is confined to closed buildings or rooms, it cannot penetrate walls, which results in partial data security at the physical level. However, OW links are not without drawbacks. They are affected by background noise (artificial and natural light sources) and suffer from multipath dispersion. The former can degrade the signal-to-noise ratio, while the latter restricts the maximum transmission rate available. In addition to these drawbacks, the transmission of power in the OW system is restricted so as to comply with eye and skin safety regulations.

Brief Description of the Project

In an indoor OW environment, the optical signals are detected under the effect of surrounding noise sources, mobility and multipath dispersion. These aspects impair the performance of the OW system. In order to improve the performance of indoor optical wireless communication links, two multi-spot diffusing geometries based on diamond and line strip spot distribution geometries will be evaluated, analysed and compared to the known uniform spot distribution. Such geometries combine the advantages of the diffuse and the line-of-sight systems, giving great robustness and ease of use. The ultimate goal of this project is to investigate a number of techniques to overcome the drawbacks and design a robust high-speed indoor optical wireless OWs system.

Objectives

The objective of this project

1- Evaluate and model the basic diffuse system (CDS)

2- Design the multi-spot diffusing configurations: diamond and line strip spot distribution geometries.

3- Mitigate the impact of user mobility in an indoor office, especially at the weakest communication link (where the transmitter and the receiver are distant from each other).

Technical Approach and Expected Deliverables

In order to achieve the objectives:

- Review of concepts and reading of literature.

- Model the characteristics of the indoor optical wireless channel and developing an existing ray-tracing algorithm that caters for the direct line-of-sight (LOS), first and second order reflections.

- Transform this model into a comprehensive software package to carry out the simulation in Matlab or C++.

- Design diamond and line strip spot multi-spot diffusing geometries.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project #C13

Project Title: Design and Simulate Dynamic Spectrum Access Protocols.

Professor(s) Name(s): Dr. Majid Altamimi

Number of Students: Two

Students Qualifications

- Well understanding of wireless communications and communication networks.
- Good programming skills in MATLAB or C++.
- Basic knowledge in simulation.

Statement of Problem

In the era of the dramatic growth of wireless technologies, the RF spectrum becomes fully occupied and cannot accommodate the demand for the RF bands by new wireless technologies. Therefore, the dynamic spectrum access is invented to overcome this problem by allowing more than one wireless network to share the RF bands. However, sharing the bands introduces a new problem, which is how to enable the sharing with minimum interference and transmission collision.

Brief Description of the Project

This project is designed to give the students an overview on the cutting edge technologies in the wireless communications. The students need to understand the current regulation for the RF spectrum and the anticipated future regulation. In addition, they are expected to design and simulate dynamic spectrum access protocols from the literature then examine the performance of these protocols.

Objectives

This project is intended to:

1) design and simulate dynamic spectrum access protocols;
2) examine the performance of these protocols; and
3) proposed a new protocol.

Technical Approach and Expected Deliverables

The project is expected to deliver the above objectives by conducting an academic research and write a short survey on the proposed algorithms for dynamic spectrum access protocols. Then, the students have to design their simulation platform using their programming skills to examine some attractive proposed protocols from the literature. Finally, the students will be encouraged to proposed their own protocols and compare their performance with other protocols.

King Saud University
College of Engineering
Electrical Engineering Department

Semester: 371

Senior Design Project Proposal

 # C2

Project Title: Design of Wideband Power Amplifier

Professor(s) Name(s): Abdel Fattah Sheta & Ibrahim Elshafiey

Number of Students: Two

Students Qualifications

Good Background in EM, Transmission line theory at RF/Microwave Frequencies. Basic knowledge of EM simulators.

Statement of Problem

The recent progress in wireless communication applications forced the design of RF components to cover wide bandwidth. The design of high performance wideband power amplifier presents one of the most important challenges for the current and future applications. Many design methods have been proposed. Balanced configuration is usually recommended for its simplicity in fabrication.

Brief Description of the Project

In this project, design techniques of wideband amplifier are explored at first. Balanced amplifier will be studied and discussed. Balanced amplifier consists of two typical amplifiers and one 3-dB quadrature coupler. Then, then the design of two typical wide band amplifiers and coupler will be designed, simulated, fabricated and experimentally characterized. Recently, power amplifiers play an important role in medical applications such as Hyperthermia system.

Objectives

(1) Explore and master suitable design tools and simulators
(2) Design of wideband 3dB quadrature coupler.
(3) Design two wideband power amplifiers.
(4) Integrate the balanced amplifiers.

Technical Approach and Expected Deliverables

The approach to achieve the objectives of this project should mainly be supported by EM simulation tools at student's convenience, such as Sonnet EM Simulator, IE3D, HFSS, ADS or Microwave Studio (CST) software. The approach to achieve the objectives of this project should mainly be supported by EM simulation tools such as IE3D, and ADS.

The steps to achieve these objectives:

- Phase I: Students will investigate and study the power amplifier and quadrature coupler.
- Phase II: Students will design balanced amplifier.
- Phase III: Students will validate and optimize the design using simulation.
- Phase IV: Students will manufacture the modules.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project # C3

Project Title: Millemeter-Wave Radar Systems: Analysis and Design

Professor Name : Professor Majeed Alkanhal

Number of Students: Two

Students Qualifications:

Statement of Problem

Design of Millemeter Wave Radars according to special requirments need several steps of system analysis and computations Each new radar specification requires the computation of new parameter values. When designing a radar for an application, there are a number of parameters which shape the design. Having a concise basic simulation models for such system components enables design and redesign to meet the determined performance for the complete integrated system.

Brief Description of the Project

Millemeter Wave system has several blocks . The radar system and its blocks are designed for a specific purpose and can seldom be used for other applications effectively. Each new radar specification requires the computation of new parameter values. When designing a radar for an application, there are a number of parameters which shape the design. Some of these parameters are contained or derived logically from the customer specification. Others are selected arbitrarily using the design engineer's best judgement.

Objectives

Phase 1 (EE496):

Review of Radar Systems, Problem formulation, Design of Basic Modeles of Millemeter Wave Radar Components, MATLAB Simulations Practice, Basic System Specifications and Alternative-Comparisons.

Phase 2 (EE497):

Basic Millemeter Wave simulation Integrated model, Simulations and results verification for case studies , Design and selection of different Radar Components and blocks according to the proposed specifications (using the simulation model), possible Hardware Implementation of Millemeter-Wave Radar Subsystems, conclusions and documentation.

Technical Approach and Expected Deliverables

Technical Review of Basic System Components, Design Specifications, System Analysis, System simulation using MATLAB/SIMULINK, System Evaluation and adjustments to meet Specifications, possible Hardware Implementation of “partial” Millemeter-Wave Radar Subsystems.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Senior Design Project Proposal Form

Project #C4

Project Title: Design of A Transceiver for Microsatellite Earth Observation

Professor(s) Name(s): Ibrahim Elshafiey & Abdel Fattah Sheta

Number of Students: Two

Students Qualifications

Basic knowledge of simulation under Matlab environment.

Statement of Problem

Microsatellites and nanosatellites are small size, low weight, low cost, and low earth orbit (LEO) satellites. They provide efficient platforms, which are configured for specific missions, taking advantage of their mobility in real time monitoring of fast varying processes. With extended civilian and military applications, micro- and nanosatellites have attracted the attention of research community and hundreds of these systems have been launched by commercial companies as well as research institutes.

Brief Description of the Project

The focus of this proposal is directed to the communication between the earth station and the satellite, which is essential to transmit and demodulate command, telemetry, and payload data. The basic communication subsystem consists of a receiver, a transmitter, and a wide-angle (hemispheric or omnidirectional) antenna. Systems with high data rates may also use a directional antenna and tracking system in the earth station. The project aims at enhancing the use of earth observation systems in the Kingdom, by developing a testbed to test communication between earth stations with microsatellites.

Objectives

The objective of this project

(1) Investigate requirements of micro-satellite transceiver
(2) Design of transceiver system.
(2) Increase the efficiency of the system.
(3) Conduct tests on the developed system

Technical Approach and Expected Deliverables

The steps to achieve these objectives:

- Phase I: Students will investigate and study the subject of microsatellite.
- Phase II: Students will design system modules.
- Phase III: Students will validate and optimize the design using simulation.
- Phase IV: Students will manufacture the modules.

King Saud University
College of Engineering
Electrical Engineering Department **1st Semester: 371**

Graduation Design Project Proposal Form

Project #C5

Project Title: Simulation of Focused Ultrasound (FUS) Therapy for Hyperthermia

Professor Name: Dr. Mubashir Alam

Number of Students: Two

Students Qualifications: Students should be from the electromagnetic and signal processing area and strong willingness to learn the physics behind ultrasound and its use in hyperthermia.

Statement of Problem

This project will model the treatment of cancer/tumors using Focused Ultrasound (FS) therapy. The thermal necrosis of a tumor etc caused by an ultrasonic transducer will be modeled, and try to optimize the process to maximize tumor ablation and minimize tissue damage. The process can be modeled using COMSOL Multiphysics and Matlab.

Brief Description of the Project

Focused ultrasound (FUS) hyperthermia is a non-invasive technique for cancer/tumor treatment that does not require any incisions or percutaneous insertions. Ultrasound hyperthermia uses focused ultrasound waves to destroy targeted tissue. During this procedure, an ultrasound transducer delivers mechanical energy to tissues, resulting in temperature increase and thus cell death. This project will try to model the thermal treatment using FUS therapy. Thermal effects caused by an ultrasonic transducer are modeled, and then try to optimize the process to maximize tumor ablation and minimize tissue damage. The process can be modeled in COMSOL Multiphysics.

Objectives

(1) Learning the physics behind ultrasound
(2) Learning COMSOL Multiphyics environment
(3) Modeling FUS using COMSOL by incorporating tumor and ultrasound transducer model
(4) Obtain the heating pattern induced by FUS
(5) Optimization frequency/intensity of ultrasound based on focusing and heating pattern

Technical Approach and Expected Deliverables

This project will cover modeling FUS therapy using COMSOL. The deliverables will be a realistic model and simulation/optimization results of thermal effects induced by FUS treatment.

King Saud University

College of Engineering

Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project # C6

Project Title: Design of Long-range Microwave-based Wireless Chargers for Mobile Phones

Professor(s) Name(s): Ahmed Iyanda Sulyman, Abdulhameed Alsanie

Number of Students: Two

Students Qualifications

Communications students

Statement of Problem

Wireless chargers for cell phones are gradually appearing in the market. The technology however is not matured yet to encourage wide-spread deployments due to the fact that existing solutions have limited range (few centimeters). Over the last two years, our EE496/497 students in EE department assembled a wireless charger for mobile phones using basic inductive coupling technique. The system was tested and significant power was transferred wirelessly between the base charger and the remote unit (mobile). Nokia, i-phone and Samsung mobile phone brands were charged wirelessly using our prototype. Our design however currently has few problems such as low efficiency and low range. It is also too bulky to be used in any real-life application. The objective of the current project is to explore alternative design approaches that can help solve these problems. Main design objective in this version of the project is the use of microwave-based wireless charging approach. Safety issues associated with this method will also be studied.

Brief Description of the Project

In the first stage of the project, students will be taken through design approaches implemented in the previous versions of the project. Students will understand clearly the difference between the approach used for implementing wireless charging system implemented in our EE496/497 in the last two sessions and the micro-wave based approach to be explored in this project. In the second part of the project, students would be required to assemble basic microwave-based wireless charging system using off-the-shelf technology. The ideal design will be capable of providing long- range wireless charging, will have good wireless charging efficiency, and must be compact enough to be employed in real-life wireless charging applications.

Objectives

The objectives of the project are as follows:

(1) To understand the design steps involved in building wireless charging systems.
(2) To develop a long-range wireless charger that can be used with mobile phones over few meters.

Technical Approach and Expected Deliverables

The first step consists of learning the generic design steps involved, and the components needed to build a long-range wireless charging system. The second step consists of putting these components together to build a prototype wireless charger for evaluation purposes. Last step involves exploring several other design approaches that will help improve the range, efficiency and compactness of the developed system.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Senior Design Project Proposal Form

Project # C7

Professor Name:
1. Dr. Abdulmohsen Mutairi (CE dept.)
2. Dr. Yahya Alharthi (EE dept.)
3. Dr. Achraf Gazdar (SWE dept.)

Project Title: Smart Socket for Electrical Energy Management

No. of Students: 6 (2 Computer Eng, 2 Electrical Eng, 2 Software Eng.)

Prerequisites:
CE team: at least B+ in CEN316, CEN439 and EE201
EE team:
SWE team: at least A in SWE 381 and B+ in SWE 321, CS 113 and CS 111

Abstract:

Students shall develop a smart socket that transform any home appliance into a smart, web-enabled appliance that can be monitored and controlled remotely over the Internet. The final product will be a system that sits between the appliance and the wall socket and measures/record various energy consumption metrics and allow the user to remotely switch the power manually or according to a user-defined rule/schedule. The system shall include three main components:

1. AC power monitoring/switching circuit.
2. Embedded system to read and record AC power and temperature measurements and to control the power switch.
3. Software system for recoding, analyzing and profiling energy consumption of multiple connected smart sockets.

Required Features:
The system must provide the following features at minimum:

1. Ability to define the device name, type and model in the setup phase.
2. Ability to view the average AC power consumption rate, per minute, per hour, per day and per month of the connected device.

3. Ability to build an energy consumption profile for the device based on the measured data.
4. Ability to consolidate the views of multiple smart-sockets in the house into a single view (web page).
5. Ability to compare consumption rates of different devices based on their energy profiles.
6. Ability to record and display temperature along with current AC power rate in order to compare efficiency of different air-conditioning units.
7. Ability to switch ON/OFF the device manually and based on user-defined rule and schedules.
8. Each smart socket must be accessible in two ways:
    a. Via a smart phone app which communicate directly with the smart-socket over WiFi
    b. Via a web interface served by an Energy Management Server (EMS) running on standalone computer which manages multiple smart sockets in the house.

Required equipment and/or SW:

1. Circuit components for measuring AC power
2. Microcontroller with WiFi interface for the embedded system
3. On-board computer (e.g. Raspberry Pi)
4. Smartphone (Android or iOS)
5. General purpose computer for hosting the EMS system

Phase 1: The work to be completed in CEN492 (CE team)

1. Survey on smart socket/ smart plug market
2. Research on AC power measurements theory
3. Initial embedded system design
4. Material procurement
5. Embedded system development
6. Progress report

Phase 2: The work to be completed in CEN493 (CE team)

1. Integration with AC power measurement circuit
2. Integration with Energy Management Server
3. Final system testing
4. Final report

Estimated budget

5,000 SAR

Multidisciplinary Related*:

The project combines multidisciplinary design problems from electrical and computer engineering and computer software design. Students will be exposed to AC power measurement theory, embedded system design, network interface design, and integrated web-based software design.

*According to ABET Student Outcome (d), Students need to demonstrate their ability to function in multidiscplinary teams. Hence, supervisors are required to indicate above key points in response to the outcome statement: (d). an ability to function on multidisciplinary teams.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project # C8

Project Title: Improved Speed Detector System

Professor(s) Name(s): Dr. Ahmad Fauzi bin Abas and Dr. Majid Attamimi

Number of Students: Two

Students Qualifications

Statement of Problem

With the introduction of the automation systems, many objects may need to move without human direct monitoring. One of the parameters that need to be taken into account is the speed of the object. In order to know the speed, accurate speed detectors need to be design. Currently, speed detector are widely used by the traffic department to detect the over speeding cars. Even though the technology has been used for quite some time, several problems such as incorrect detected speed, car identification problem, and other still arise. These problem shows that there is still rooms for speed detector to be improved.

Brief Description of the Project

This project involves the development of improved speed detector system that can minimize false alarm. The proposed system may use the time interval as the input, or others. The hardwares that are needed for this project will depend on the proposed design. For example, Infrared (IR) transmitter and a receiver can be installed on the set points on either side of the road. A control unit may be used to calculate the time taken by the vehicle to travel from one set point to the other. The speed can then be calculated. If the calculated speed limit exceeds the set speed, the alarm will be sent to the control station. This project consists of simulation and experimental work. The first part will focus on design of the speed detector system. The limit of the detectable speed range needs to be derived. At the same time the sensitivity of the sensor need to be determined. In the second part, the complete hardware of the system needs to be developed. Knowledge in microcontroller is expected from the students. This system need to be tested for performance verification.

Objectives

The objectives of this project are:

1. To study the working principles of speed detector
2. To design the speed detector
3. To perform experiments

Technical Approach and Expected Deliverables

In simulation the Matlab can be used. The student may also use any other suitable software. The expected deliverables will be the design optimization. For the experiment, a prototype needs to be developed and tested.

King Saud University
College of Engineering
Electrical Engineering Department **Semester: 371**

Graduation Design Project Proposal Form

Project # C9

Project Title: Design and implementation of a video and telemetry wireless communication link for an unmanned aerial vehicle (UAV) using software defined radio (SDR) tools

Professor(s) Name(s): Dr. Saeed Aldosari

Number of Students: Two

Students Qualifications

Wireless and digital communication principles. Basic software skills.

Statement of Problem

Wireless communication subsystems are an essential part of any Unmanned Aerial Vehicles (UAV). They are needed to deliver telemetry, sensor, and imaging information to the UAV's ground control station (GCS). In addition, control commands needs to be transmitted from the GCS to the UAV for proper mission control. We aim to design and implement a wireless communication system to satisfy these requirements.

This is a challenging problem because a UAV may be deployed in differing areas and environments, which require more flexibility in the specifications of its communication link such as the operating frequency band, modulation technique, transmission power, etc. In addition, the implemented communication system must obey the strict constraints of power, size, and weight that are imposed by UAVs.

Brief Description of the Project

The requirements stated above can be satisfied by using software defined radio subsystems (SDR). In this case, most communication specifications such as the modulation techniques, operating frequency, etc. can be modified by simple software update without changing the hardware.

The first part of the project involves learning SDR concepts, tools, in addition to executing few experiments using the available tools. Then, the team should analyze the general requirement of UAV wireless communication links, develop suitable waveforms to satisfy the requirements, then implement those using SDR tools. Finally, the performance of the implemented system should be evaluated against the set requirements.

Objectives

(1) Learning SDR concepts and tools
(2) Understanding UAV communication requirements and system constraints.
(3) Develop an SDR-based system with the given constraints.

Technical Approach and Expected Deliverables

The project is expected to result in a working prototype of an SDR-based UAV wireless communication link providing to transport telemetry and video information.