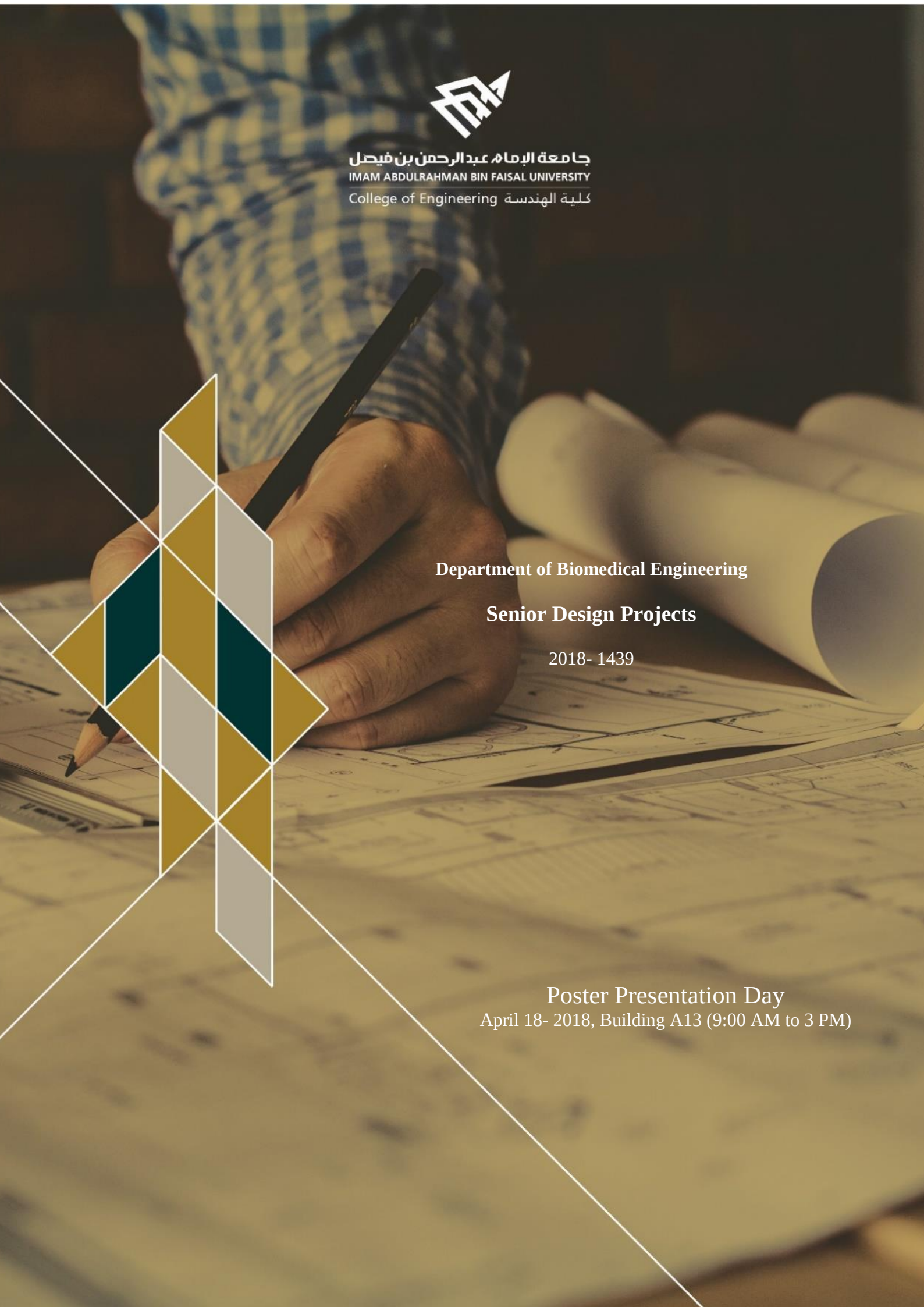

جامعة الإمام عبد الرحمن بن فيصل
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY
College of Engineering كلية الهندسة

Department of Biomedical Engineering

Senior Design Projects

2018- 1439

Poster Presentation Day

April 18- 2018, Building A13 (9:00 AM to 3 PM)

Automated Closed-loop Intravenous Anesthesia Delivery Model using PID Controller

Students: Sara Alatrash; Layla Alawwad; Ala'a Alsaeed; Fatima Almughalliq; and Ala'a Alabdrabalnabi

Supervisors: Dr. Ibrahim Abdulrahman Aljamaan; Dr. Ibraheem Al-Naib

ABSTRACT

Anesthesia is applied to the patient by the anesthesiologist during the surgery to provide a temporary state of unconsciousness for the patient. Applying the anesthesia by the intravenous method is extremely critical and may result in severe complications if done improperly. Many of these complications can be avoided by applying and maintaining the correct drug dose. The main objective of this project is to ensure that the dose is within acceptable confidence interval from a set point. A Proportional, Integral, and Derivative (PID) controller is used to automatically control the delivery of the propofol anesthetic drug leading to the regulation of the depth of hypnosis state of anesthesia based on the patient's consciousness feedback from a bispectral (BIS) monitor. A simulation of the prototype is provided using LabVIEW.

Design and Implementation of Electrooculogram (EOG) Based Prototype System

Students: Reema Althabit; Hussah Alateeq; Fatima Alfilfil; and Atheer Alhamadi

Supervisors: Eng. Kamran Hameed; Eng. Sana Ijlal

ABSTRACT

Electrooculogram signal acquired from a bi-channel signal acquisition system and processed for its use in biomedical instrumentation systems. EOG signal has weak amplitude varies from 10 – 200μV, with frequency ranges from DC to 25Hz, which makes it very difficult to be acquired and processed. Moreover, the signal is interfered by many sources of noises surrounding the eyes such as face muscles, eyelid movement and blinking. Therefore, filtering and amplification was applied in order to get clear usable signal. In this project, we aim to empower people with disabilities, by enabling them to control their environment, using the movement of their eyes. Multisim and Arduino are used to simulate and process the signal.

Automated Temperature Controller and Monitoring of Infant Incubator

Students: Lana Altarteer; Alaa Aljumah; Kawthar Al Olaiwi; Hawraa Alnemer; and Alaa Almintakh

Supervisors: Dr. Abdul-Hakeem H. Alomari; Eng. Aysha Salman

ABSTRACT

Annually, an unacceptable number of infant deaths occur in the world, with premature birth being one of the major causes. A well-controlled thermal environment is crucial for survival. The incubator plays a vital role in taking care of premature infants who lack the ability to regulate their body temperatures on their own. In this paper, the purpose is to implement and design a closed loop control system with a PID controller that regulates the temperature inside a premature incubator. The closed-loop system implemented involves actuators and sensing elements that operate to provide a consistent thermal environment. Moreover, the developed incubator will rely on solar cell energy; therefore, it should be able to work, if electrical power fails. The microcontroller of the system is an Arduino mega2560 board that provides the efficient control of temperature automatically. The simulation results in MATLAB show a low settling time value of 363s as well as an acceptable overshoot value of 0.0638% that made the system stable.

Wireless Periodic Diagnosis of Some Vital Signs for Chronic Patients Using HARRE Drone System

Students: Ala'a Elesh; Eman Ateeq; Haneen Nayef; Reem Alfadhli; and Rehab AlZharni

Supervisors: Dr. Osama Albataineh; Eng. Bushra Melhem

ABSTRACT

Chronic diseases need a periodic examination so, the patient needs to go to the hospital regularly for diagnosis. With time, these visits become tiring to the patients. Therefore, HARRE system has been designed to find a faster and easier way for periodic examination of chronic disease patients. HARRE system is a wireless periodic diagnosis system which will be built inside a box attached to the bottom of a drone. This system is used as a communication bridge between chronic disease patients and doctors. It consists of three main parts: wireless periodic monitoring circuit, drone, and a medical phone application.

Microwave Imaging System Design Using Ultra-Wideband Antenna For Intracerebral Hemorrhagic Stroke Detection

Students: ALHanouf AlZamil; Fatimah Al-Alaiw; Fatimah Al-Janubi; Hind Al-Yahya; and Wafaa Mohammed

Supervisors: Dr. Ibraheem Al-Naib; Eng. Sana Ijlal

ABSTRACT

Stroke is an impeded blood supply to some parts of the brain. The main types of stroke are ischemic and hemorrhagic. Ischemic stroke occurs when there is an occlusion in the arteries leading to the brain. Hemorrhagic stroke occurs when there is a rupture in a blood vessel inside the skull. In Saudi Arabia, 31% of stroke patients are diagnosed with hemorrhagic stroke. Computed tomography (CT) and Magnetic Resonance Imaging (MRI) are widely used for stroke detection. However, CT could be harmful with its high radiation dose over a long-period of time. Moreover, the time-consuming process and low sensitivity of MRI to identify intracerebral hemorrhagic (ICH) in earlier stage place actual limitations on its performance. In contrary, microwave imaging systems could be considered as an alternative or assistive tool to diagnose stroke. One of the key elements to build such a system is the part responsible to transmit and receive the microwave signal, which is an antenna. In this work, we adopt an Ultra-wideband (UWB) antennas for microwave imaging as it features compact size, low cost for implementation, and low power consumption. The aim of this project is to design a system using UWB antennas with a frequency range of 1- 4 GHz. The proposed system will be designed and tested to detect the ICH stroke using CST® software. Preliminary results show the possibility to design a compact antenna which function in the selected range. Currently, we are optimizing the geometrical dimensions in order to minimize the return loss. Later on, a realistic head phantom will be fabricated to test the validation of the designed antenna experimentally. The measurement data will be used to reconstruct the image using MATLAB® software. A comprehensive systematic study will be carried out regarding the sensitivity and the spatial resolution. In future, such a system is expected to complement the current modalities to detect the stroke.

Design of Flexible Textile Wearable Antennas for Medical Applications

Students: Bassmah AlAbdullah; Waad AlZahrani; Shahad AlGhamdi; Sara Nader; and Reem AlShuuwayer

Supervisors: Dr. Gameel Saleh; Eng. Ijlal Ateeq

ABSTRACT

In this Project, a flexible, textile, wearable antenna is designed for medical applications. The proposed antenna operates at a resonance frequency equal to 2.4 GHz, and fabricated over a felt, as a dielectric substrate. The antenna reflection coefficient (S11), electric and magnetic fields, far field radiation pattern, and finally the human body exposure to electromagnetic radiation will be investigated. The designed antenna, exhibited an excellent return loss of -42 dB, at the operating frequency, with Fairfield radiation pattern greater than 8.2 dBi. These results will be compared to the situation when a different phantom that emulates the human body hand is used. In this project, the patient safety is the main constraint since the antenna operates nears the human body tissues to communicate with any implant, such as peacemakers. The interaction of electromagnetic waves and the tissues as well as its effect on increasing the temperature of the tissues is measured using the energy Specific Absorption Rate (SAR). In the final manuscript, the peak SAR value on the hand phantom will be calculated to assure that it is within the engineering standards' limits (1.6 Watt/Kg, when calculated over 1-gram based of tissues) and as followed by the Federal and Drug Administration (FDA).

Accurate diagnosis of coronary artery atherosclerosis using image enhancement and virtual reality

Students: Saadia Talay; Huda Al-Mubarak; Amjad Aldarwish; Fatimah Alhamoud; and Noor Aljabr

Supervisors: Eng. Kamran Hameed; Dr. Mahbubunnabi Tamal

ABSTRACT

Coronary artery disease (CAD) is one of the leading causes of death worldwide. Accurate detection of the site and extent of atherosclerosis would facilitate complete and timely treatment of the disease and therefore the mortality rate. This project proposes a new method to improve the diagnostic accuracy of coronary arterial atherosclerosis by exploiting multiple techniques including nonlinear diffusion filtering, region growing segmentation, and virtual reality (VR) visualization.

Design of a Wristwatch as a precaution of the skin damage induced by UV and IR radiations

Students: Bashayer Al-Shehri; Haya Alumair; Israa Youssef; Lujain Alosaif; and Zenab Aljassas

Supervisors: Dr. Syed Mehmood Ali; Eng. Maha Alshammari

ABSTRACT

UV absorbed by the skin can drive photochemical reactions which range from sunburn to skin cancer. On the other hand, the repeated exposure to IR reduces the number of procollagen and collagen fibers in the skin resulting in premature skin aging or photo-aging. This project aims to design a protective measure in order to avoid these damages. The proposed protective measure is a wristwatch with audio alarm which is able to sense UV and IR radiations. These radiations are detected by UV and IR sensors and assigned, using Arduino, to an appropriate UV index and IR radiation level. Several reading was performed to collect sensors' data and program the alarm. A prototype was built using the two sensors, the LCD, the real time clock, and the alarm. The future work would be designing the real wristwatch and transferring its data to an application on a smartphone.

Wireless Blood Pressure Self-Monitoring System

Students: Fatimah Alshafei; Hadeel Alafif; Maryam Alalawi; Wala'a Alswiket; and Zahra Al Rabie

Supervisors: Eng. Ijlal Shahrukh Ateeq; Dr. Gameel Saleh

ABSTRACT

Mobile phone technology using wireless monitoring tools become widely available and positively affect healthcare awareness and clinical improvement. This project is designed specially to help individuals aware about their blood pressure level by giving an alarm in abnormal conditions. Additionally, the measurements are sensed non-invasively, transmitted wirelessly, and the results are presented in a mobile phone application. The first stage is designing the analog signal circuits using Multisim software and building them in the lab. The second stage is implementing the microcontroller circuits to control motors, record results, and alarm users by using Mega Arduino. The last stage is the transmission of results wirelessly to a mobile phone.

Smart phone: a cost-effective point-of-care (POC) medical device for non-invasive diagnosis of anemia.

Students: Meernah Al-Abdullah, Dana Alotaibi, Fatimah Najeeb, Mona Alhwaj, Noor Alhwaj,

Supervisors: Dr. Mahbubunnabi Tamal, Eng. Maram Abdullah Alqarni

ABSTRACT

Anemia is a condition that is generally caused by a lack of iron in the human body which leads to a reduction in the number of red blood cells. If untreated, iron deficiency anemia can make the body more susceptible to illness and infection since lack of iron affects the body's natural defense system (the immune system). It is thus important to treat anemia at relatively manageable stage before it can lead to more serious complication specially for pregnant women, babies and elderly people. The first step of managing anemia is to detect it as early as possible. At present, for detection and monitoring anemia, patients need to visit hospital or health care clinic to provide blood through the puncture of the skin at regular intervals which is invasive and painful. To facilitate the process of detecting and monitoring anemia as and whenever required, a point-of-care (POC) device for anemia detection using smart phone camera is proposed in this work. It is based on the principle that reflected monochrome lights with various wavelengths directed towards finger tips can be correlated with the blood hemoglobin concentration. One of the major limitations of the smart phone camera to be widely used as a point-of-care (POC) medical device for anemia detection is that each phone provides different colorimetric measurements. This proposed work also aims to address this issue by incorporating a chromatic calibration factor for each individual smart phone that would enable each smart phone model to non-invasively detect anemia accurately and precisely.

Generalized Tonic-Clonic Seizure Detection Using Accelerometer And Heart Rate Sensors

Students; Banan AlHarthi, Eman AlNattar, Fatimah AlDagdoug, Fatema AlKhabaz, Khlood AlHarbi

Supervisors: Dr. Ibrahim AlJamaan, Dr. Ebtisam Aldaais

ABSTRACT

Nearly 1% of the world's population suffer from epilepsy. The unpredictable nature of seizures entitles epileptic patients to danger, which emphasizes the need for a home monitoring seizure detection device. EEG provides valuable ictal data that is used in detecting the onset of seizure; however, most patients prefer a nonstigmatising wearable device. This project proposes a seizure detection device with an alarm system tested on different ictal data using accelerometer and heart rate sensors.