AU DEPARTMENT OF BIOMEDICAL ENGINEERING

AIR UNIVERSITY

Conference on Biomedical Engineering and Innovative Technology

CONFERENCE PROCEEDINGS

BMEIT 2022

27TH & 28TH SEPTEMBER

Department of Mechatronics and Biomedical Engineering

Air University, Islamabad

Sponsored by

NCRA

NATIONAL CENTRE OF ROBOTICS & AUTOMATION

RF-NCRA-037

NCAI

NATIONAL CENTRE OF ARTIFICIAL INTELLIGENCE

RF-NCAI-064

PROGRAM

Day 1	
10:30-10:35	Conference Opening
10:35-10:45	Recitation, Naat, National Anthem
10:45-10:55	Opening remarks by the Dean Engineering
10:55-11:05	Plenary Speaker Principal FMC
11:05-11:20	Keynote Speaker 1: Dr. Asim Faridi, EPFL Switzerland
11:20-11:35	Keynote Speaker 2: Dr. Fasial Ahmed, KNU South Korea
11:35-11:50	Keynote Speaker 3: Dr Hee Kyung Kim, KMedi South Korea
11:50-12:05	Keynote Speaker 4: Engr. Rida, Woman in Biomedical Engineering
12:05 12:20	**Break**
12:20-2:20	Session 1- Chaired by Dr. Nauman Nasser (Chair Department Mechatronics & Biomedical Engineering)
2:20-4:20	Session 2- Chaired by Dr. Ashiq (Chair Department Electrical Engineering)
4:25-4:40	Certificate distribution by the Dean Engineering
4:40-4:50	Certificate distribution to the best presenters
4:50-5:00	Closing remarks by Dr Zia Mohy ud Din (HOD Biomedical Engineering)
Day 2	
11:00-11:10	Recitation, Naat, National Anthem
11:10-11:20	Review of Session 1
11:20-11:25	Introduction of guests
11:25-12:00	A Talk by Dr Yasar Ayaz
12:00-12:30	Product launch by NCAI and NCRA
12:30-12:35	Remarks by Vice Principal on Product
12:35-12:55	Souvenir Distribution
12:55-1:00 PM	Remarks by the Vice Chancellor

ORGANIZING COMITTEE

Prof. Dr. Rana Iqtidar Shakoor	
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Dr Jahan Zeb Gul	Engr. Aleena Mazhar
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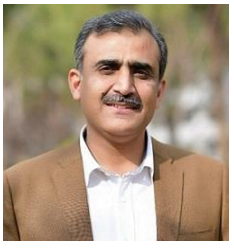
Message by Conference Chair BMEIT'22

Prof. Dr. Rana Iqtidar Shakoor

Dean of Engineering

Air University, Islamabad



Welcome to conference on Biomedical Engineering and Innovative Technologies (BMEIT'22). On behalf of the BMEIT'22 Conference Committees, I would like to thank you for coming to BMEIT-2022 and I hope you will enjoy the conference technical program.

The BEMIT'22 is being jointly organized by Air University, National Center for Cyber Security and National Center for Robotics and Automation. Through BMEIT'22, we tried to provide a leading forum to our participants to bring together researchers and practitioners from diverse fields of engineering, health sciences, information technology, systems engineering and robotics and their applications in the broad field of biomedical engineering. We are confident that BMEIT'22 will provide an excellent international platform for sharing knowledge and results in theory, methodology and applications impacts and challenges of Biomedical Engineering. The conference documents practical and theoretical results which make a fundamental contribution for the development of Biomedical Engineering. BMEIT'22 aims that the researchers and practitioners from both academia as well as industry to meet and share cutting-edge developments in the field.

Last but not the least, I once again, on the behalf of organizing and technical committee of BMEIT'22, would like to thank all the authors of submitted papers and the attendees for their contribution and participation. Without their strong support, we could not have a successful conference.

Message by Chair Department, Biomedical Engineering

Dr. Zia Mohy Ud Din

Chair Department, Biomedical Engineering

Air University, Islamabad

Let me first extend a warm greeting to all the keynote speakers, presenters, and conference attendees on behalf of the administration of Air University, Islamabad Campus. It is quite gratifying to note that the Department of Mechatronics and Biomedical Engineering is hosting its First Conference on Biomedical Engineering and Innovative Technology BMEIT'22. Our Vice Chancellor, Air Marshal Javaid Ahmed, HI(M) (Retd), has been an inspiration for all the Air University's activities and serves as a mentor to our community of students and employees.

Organizing such an event emphasizes our goal of creating a forum for the exchange of ideas on technical advancements in the field of Biomedical Engineering. I am confident that this event will create an enjoyable environment for the young researchers and academicians to openly discuss thoughts and ideas with others, and the guests will leave the event with wonderful memories in their hearts.

KEYNOTE SPEAKERS

S.No.	Speaker	Affiliation
1	Dr. Asim Faridi	Engineer EPFL, Royal Institute of Technology, Switzerland
2	Dr. Sheikh Faisal Ahmed	Chief Researcher, Institute of Advance Convergence Technology, Kyungpook National University, South Korea
3	Dr. Hee Kyung Kim	K-MEDI hub, Preclinical Research Centre, Senior Researcher, South Korea
4	Dr. Yasar Ayaz	Project Director National Centre of Artificial Intelligence (NCAI), Pakistan & Professor of Artificial Intelligence & Robotics, NUST
5	Dr. Omer Shahbaz	Project Director National Centre of Robotics and Automation (NCRA), Pakistan
6	Engr. Rida	Women in Biomedical Engineering

ORAL PRESENTATIONS

Sr. No.	Abstract Title	Authors
1	Diabetic Retinopathy detection by Classical - Quantum Hybrid Model	Basanta Joshi
2	Designing of Smart Vein Injection Mannequin	Alina Ali, Noor Ul Huda, Engr. Alina Akhlaq, Dr. Jahan Zeb Gul
3	Simulation of a Heart Model with VSD to observe fusion of deoxygenated and oxygenated blood with varying hole sizes on Ansys	Hafsa Obsaid Qureshi, Amna Jadoon, Engr. Nabeeha Ehsan
4	Biomechanical Simulation of Shape Memory Alloy-Based Smart muscle for Mimicking The Movement of Extraocular Muscles	Zainab Ali, Dr. Jahan Zeb Gul
5	Modelling and Simulation of epiglottis	Mnahil Javed, Dr. Jahan Zeb Gul
6	Design of real heart and Velocity analysis with and without Blockage in Aorta	Hawaida Kanwal, Wania Aftab, Engr. Nabeeha Ehsan
7	Stability Analysis	Alina Ali, Hawaida Kanwal, Anusha Ishtiaq, Engr. Jamila Akhter
8	Electromyography; Signal Acquisition, Processing and Feature Extraction	Zeenia Khan, Ayesha Zeb, Muhmmad Yahya, Aamara, Engr. Anum Rashid, Engr. Bilal Siddique
9	Biomechanical Analysis of Bicep Muscle during Push-ups using Force Plates	Uzair, Irum Fatima, Engr. Jamila Akhter
10	Comparative study and Analysis of Actual Human Arm and Pasco Human Arm Structure Set	Ayesha Sarwar, Engr. Jamila Akhter
11	A cost effective Mannequin based Breech delivery Simulator	Hafsa Obaid Qureshi, Hadia Saleem, Iram Fatima, Dr. Jahan Zeb Gul
12	Determination of the pattern of chewing Using flex sensor and logic gates through a bite counter	Moiz Wali Khan, Hamza Bin Khadim, Maida Nadeem, Fizza Zaheer, Engr. Alina Akhlaq

13	Electroculogram (EOG) of a person with normal eyesight and with refractive disorder	Ahsan Naveed, Kahab Abdullah, Abdur Rehman, Engr. Alina Akhlaq
14	Study of ecog signal acqusition and processing system	Eeman Tariq, Shan e Muhammad
15	A biomechanical study of the Vertical Jump Using a Force Plate and Goniometer	Sana Mahmood, Dawood Ahmed Waseem, Engr. Jamila Akhter
16	Differentiation between swallowing of solids and liquids through pharyngeal Electromyography	Maida Nadeem, Moiz Wali Khan, Hamza Khadim, Engr. Anum Rashid, Engr. Bilal Siddique
17	Modeling And Transient Fluid Analysis of Obstructed Ureter	Anusha Ishtiaq, Irum Fatima, Hadia Saleem, Engr. Nabeeha Ehsan
18	Research study of Factors affecting Range of Motion across knee joint including Height, Weight and Gender	Um e Sumia, Zafran Tahir, Engr. Jamila Akhter
19	Relationship between smoking and blood pressure	Noor ul Ain, Anum Faisal, Laiba Idrees Kayani, Engr. Alina Akhlaq
20	The Grip Force Experiment Using Electromyography	Aliza Ranash, Manahil Fatima, Sarah Zareen, Hira Bint e Usman, Engr. Alina Akhlaq
21	Arrhythmia Detection and Differentitating using MATLAB	Hadia Nadeem, Fizza Zaheer, Malaika Fazal Khan, Zeeshan Nauman, Engr. Anum Rashid
22	Study of effects of caffeine on ECG signal	Manal Haider, Mahnoor Jabeen, Muhammad Arslan, Engr. Alina Akhlaq
23	Diclosing the locale of membrane proteins by SVM	Mehwish Faiz, Saad Jawaid Khan, Fahad Azim, Daniyal Alvi, Sumaya Abid. Areej Ahmed
24	Smart infant foot sleeve to prevent sudden infant death syndrome	Muhammad Daniyal Maqsood Alvi, S.M Faizan Raza Shah Zaidi, Hareem Jaffery, Hira Qamar Siddiqui, Mehwish Faiz

25	Design and Fabrication of Telemedrone: A drone to wirelessly Transmit Vital Signs	Sarfaraz Khan, Saad Jawaid Khan, Muhmmad Daniyal Maqsood Alvi
26	Non-Invasive Blood Sugar Measurement Methods	Moazzam Ali Khan, Ammar Tariq, Myra Aslam Qureshi, Ansharah Hasib, Choudhary Sobhan Shakeel, Hareem Aslam Qureshi, Mohsin Ali, Khan Muhammad Daniyal Maqsood Alvi, Syed Muhammad Faizan Raza Shah
27	Fabrication of cheap conductive ink for wearable sensors using Graphite and Carbon	Amna Jawed, Engr. Tooba Khan
28	Comparative study on effect of range of motion on daily life style by using PASCO interfaced Goniometer	Saba Fatima, Engr. Tooba Khan, Engr. Hassan Ali
29	A non-Invasive Blood Group Detector	Sumayya Hameed, Nida Abdullah, Qandeel Zahra, Maryam Furqan, Zaiba Muhammad, Engr. Hassan Ali
30	Designing of cost- effective smart Shoes for Visually Impaired/ Blind people	M. Ahsan Mirza, Naqi chatta, Waheed Sultan, Engr. Tooba Khan, Engr. Hassan Ali
31	Posturector (The Posture Corrector)	Mirza Areeb Baig, Zarish Majid Shaikh
32	Li Fi- Transfer of data through light	Mirza Areeb Baig, Zarish Majid Shaikh
33	Fabrication and Comparative Analysis of Bone Implant Using Calcium Sulfate Hemihydrate and Epoxy Resin	Sadia Arshad, Muhammad Rizwan, Hafsa Aijaz, Engr. Tooba Khan, Engr. Hassan Ali, Dr. M. Zeeshan Ul Haque
34	Developing a glove controlled robotic arm using cost effective flex sensors	Shanzae Zubair, Zuraiz Baig, Saad Imtiaz, Amna Wagley, Engr. Hasan Ali, Engr. Tooba Khan
35	Design and Development of Oscillometric Digital Blood Pressure Monitor	Syed Uzair Iftikhar, Qamar ud Din, Engr. Maria Tahir

36	Designing an IOT Based Assistive Device Using Force Sesnsing of Grip for Hand Motor Rehabilitation	Shifa Maryam, Sania Khan, Engr. Maria Tahir
37	Application of FSR and DHT11 based smart device in healthcare	Rehan Tariq, Natasha Mohsin Butt, Khadija Khan, Engr. Maria Tahir
38	Examining the risk of interstitial lung diseases by comparing the Respiratory Volumes and Respiratory Capacities in Men and Women before and after the exercises by using PASCO Spirometer	Engr. Maria Tahir, Hoor Arshad Khan
39	Image Registration - An Image Processing Technique on Medical Images	Fahad Shakeel, Engr. Maria Tahir
40	Identification of respiratory paramter that helps in primary diagnosis of Asthma	Asmna Mazhar, Shahzadi Arzak Semab, Engr. Maria Tahir
41	Designing Artificial Cardiac Pacemaker using PID Controller for Heart Rate Stabilization	Natasha Mohsin Butt, Laiba Junaid, Engr. Maria Tahir
42	Non-Anthropomorphic Hand for Multi-Purpose	Engr. Maria Tahir, Muhmmad Abrar Baig, Muhammad Hussain Haider, Laiba Junaid
43	Simplified model of hand motion for picking objects	Khadija Khan, Engr. Maria Tahir, Aqsa Zahoor
44	Accurate and feasible stress level estimation through Photoplethysmography sensor for Healthcare	Khadija Khan, Engr. Maria Tahir, Hassan Imam, Aleena Arshad
45	Wearable device for continuous blood pressure and pulse rate monitoring via piezoelectric based-sensor properties	Nabeeha Nawab, Amina Bashir, Engr. Maria Tahir
46	Measurement Muscular activity of Bicep with and without Hinge joint assisting device for Elbow movement	Syeda Iqra Naveen, Aroosha Irfan, Shanzay Nadeem, Engr. Alina Akhlaq
47	Differentiating between rapid and slow eye movement using filtration and peak detection in Matlab	Sabahat Khan, Engr. Anum Rashid

Diabetic Retinopathy Detection by Classical – Quantum Hybrid Model

Dr. Basanta Joshi

Institute of Engineering, Tribhuvan University, Nepal

ABSTRACT

Diabetic Retinopathy (DR), one of the major eye disease which eventually cause blindness if not detected in early phase. The primary cause of DR is due to increase in blood sugar, which blocks the tiny blood vessels eventually causing the hemorrhages in the retina. This paper proposes the hybrid model to detect the DR by addressing the problem in automatic detection of DR. The main concept behind this is embedding of classical CNN and Quantum computing(QC) in which classical CNN extracts the feature and QC is responsible for classification task. Three different pre-trained models ResNet-34, Inception V3 and VGG-19 are used for feature extraction and best performing model is chosen for feature extraction. The dataset used in the experiment is benchmark MESSIDOR-I with two classes, one containing the infected and another the normal one. The performance of hybrid model is compared with the output of classical CNN where, hybrid model with accuracy 86.75 outperformed the classical CNN with accuracy of 82.97.

Key Words

Diabetic Retinopathy, Quantum computing, CNN, ResNet.

Designing of Smart Vein Injection Mannequin

Alina Ali, Noor Ul Huda, Engr. Alina Akhlaq, Dr. Jahan Zeb Gul

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Practicing is one of the most major aspect of medical studies where doctors apply their theoretical knowledge on patient. Doctors have to practice their treatment on any artificial body before they do it on human beings. This need is fulfilled by designing mannequins that are just like human beings or any body part. Mannequins help doctors to do their practice before they apply any kind of treatment to the human body. One kind of this mannequin is a Vein injection mannequin. This mannequin is used basically for doctors to practice the delivery of intravenous injections. Some work was done on a mannequin and manual vein injection mannequins were developed. The main purpose of our study is to design a Smart Vein Injection mannequin to indicate to doctors if the injection is placed in the right location or not so that they can have efficient practice. In this Smart Vein Injection Mannequin, an electronic circuit is installed that also contains a microcontroller, PCB, and many other components. Artificial skin was also designed that covers the electronic system. This whole setup will act like a human body part where doctor have to give intravenous injection. This system helps doctors to practice more accurately as this mannequin indicated if the injection has gone into veins or not. As a result, whenever injection goes into veins in mannequin that indicated correct position led indicate it and thus it increases confidence of doctor during practice. In the future, more work can be done to make a more advanced electronic system that includes a camera inclusion so that video of the whole process can be seen.

Key Words

Smart Injection.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Simulation of a Heart Model with VSD to observe fusion of deoxygenated and oxygenated blood with varying hole sizes on Ansys

Hafsa Obsaid Qureshi, Amna Jadoon, Engr. Nabeeha Ehsan

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Ventricular septum disorder also known as VSD is a birth defect, in which an opening is formed in the median septum or septal wall between the left and right ventricles, which prevents the mixing of oxygenated (OB) and deoxygenated blood (DOB). The mixing of blood proves to be fatal causing extreme anemia and other side effects due to lack of oxygen provided to the tissues. In this paper we are intended to study the mixing of DOB and OB, with varying diameter of holes, to observe at which hole size the maximum amount of anomaly can be produced, and result in fatality. To simulate this theory, we have used ANSYS software, and to model the exact structure of heart SOLIDWORKS is used.

Key Words

ANSYS, SOLIDWORKS.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Biomechanical Simulation of Shape Memory Alloy-Based Smart muscle for Mimicking The Movement of Extraocular Muscles

Engr. Zainab Ali, Dr. Jahan Zeb Gul

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

People with lost and damaged eye muscles struggle with the functional disability of eye movement. The Ocular prosthesis made so far targeted the ocular defects usually related to vision and diseases/defects associated with it. Understanding the mechanics of human eye movement has major implications for the treatment of extraocular muscle disorders. The detailed study of extraocular muscle (EOM) mechanics is desirable for scientific studies and ophthalmological applications. The particular aim of this research is to provide a 3D model, which is based on the bio-metal series, specifically BMX 150 which mimics extraocular muscle functioning. The extraocular muscle movement was mocked by Bio-metal helix 150 which was designed and developed using a CAD model and computational simulation. The Simulation was performed using thermo-mechanical analysis to further study the computer simulation of SMA based muscles which would result in the movement of the eye by performing four major movements of an eye i.e. elevation, depression, adduction, and abduction. The simulation result is comprised of deformation, stress-strain curves, and hysteresis loop, which obeyed the simulation of smart material that is shape memory alloy. For future prospects, the model and simulation movements can be fabricated and achieved respectively by using 3D printing technology and further analysis.

Key Words

EOM, Shape memory Alloy, Computational model, Ansys Simulation, Force, Ophthalmological studies, Total deformation, Stress, Strain.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Modelling and Simulation of epiglottis

Engr. Mnahil Javed, Dr. Jahan Zeb Gul

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

The epiglottis plays a crucial role in swallowing by acting as a protective barrier that keeps food from entering the trachea. Many difficulties can occur if food enters the trachea, ranging from life-threatening choking to aspiration of solids into the lungs, which can raise the risk of pneumonia and other pulmonary diseases. In certain circumstances, epiglottis surgery is performed, in which the epiglottis is removed in a procedure known as epiglottidectomy. The removal of the epiglottis increases the chances of food entering the trachea. Understanding the movement of epiglottis will help in the studies of Otolaryngology. the aim of this study is to provide a detailed 3D model of epiglottitis along with simulation results. Force was a parameter that was applied on epiglottis. Through movement graphs were plotted on total deformation vs time, stress vs strain, and directional deformation. These graphs were acquired as an output by Ansys software that is used in simulation. For future studies the model can be used for implant studies.

Key Words

Simulation, Epiglottis.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Design of real heart and Velocity analysis with and without Blockage in Aorta

Hawaida Kanwal, Wania Aftab, Engr. Nabeeha Ehsan

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

The rate at which blood flows through a vessel is referred to as blood velocity. Blood velocity differs from blood flow in that while the flow remains constant, the velocity is inversely related to the blood vessel's cross-sectional area. Simulation modeling is a method of resolving real-world problems in a safe and effective manner. The numerical analysis of blood flow velocity through heart valves is investigated in this paper. Velocity in the aorta with and without any blockage was observed. Firstly, the real heart model was imported to ANSYS, and fluent flow analysis was performed on it. Then for the same model, a blockage is created in the aorta using SolidWorks. Then the model was imported to ANSYS, and fluent flow analysis was performed. And at last, these two models were compared and the difference in velocity was analyzed. The velocity in the aorta without any blockage was more as compared to velocity in the aorta with blockage.

Key Words

ANSYS modelling.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Stability Analysis

Alina Ali, Hawaida Kanwal, Anusha Ishtiaq, Engr. Jamila Akhter

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Stability is one of the most important aspects of biomechanics that comes under the study of Gait Analysis. Gait analysis helps us to stabilize our gait so that it saves us from any injury caused by falling. Some other works have been done on topics related to stability. The core purpose of our study is to find the distribution of forces that are applied to the body due to our weight and how it can be balanced for old people and people with lower-limb amputees. We are studying body stability and balancing by distributing forces by using different aids and supports. We are using walking sticks of different styles (with different supports) and different shoe types for our study. We will analyze which shoes and walking stick helps in easy and comfortable walking for old people and amputees. We are going to check which leg provides more stability. The results of our study showed that when we use flat shoes the rate of stability was high. Additionally, walking with four supports helps the elderly keep their stability better. Additional study was done to check in which single stance either left or right stability is high. Results shows that right single stance depicts more stability as compared to left single stance. In the future, we can also use stability to make prosthetics and shoe styles, especially for older people and amputees.

Key Words

Stability, Biomechanics.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Electromyography; Signal Acquisition, Processing and Feature Extraction

Zeenia Khan, Ayesha Zeb, Muhmmad Yahya, Engr. Anum Rashid, Engr. Bilal Siddique

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Utilization of biological signals has become a major procedure for diagnosis of disorders, research purposes, and operating interfaces. Electromyography is the visualization of electrical activity generated in muscles. Most muscular and nervous diseases are associated with and reflected by the electrical activity of muscles. Human-Machine Interfaces are also aided by this process. These raw biological signals are acquired via sensors and require proper processing before they are analyzed or made accessible to a device. Hence, signal processing is the vital step in any kind of system interacting with human beings. Processing involves signal acquisition and further amplification and filtration. Our objective is to acquire EMG signals from Mylohyoid and Digastric Muscles generated during speech with minimum noise and artifacts, process them in MATLAB, and extract features precisely and specifically for each alphabet.

Key Words

Biopotentials.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Biomechanical Analysis of Bicep Muscle during Push-ups using Force Plates

Uzair Qayyum, Irum Fatima, Engr. Jamila Akhter

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Push-ups represent one of the simplest and most popular strengthening exercises. Proper alignment of the scapula during upper extremity motion is important in maintaining shoulder joint function and health. Push-up plus exercise is considered one of the exercises that strengthen the muscles that stabilize the scapula. The purpose of the study is to examine the effects of pushups plus variants on the elbow in the vertical position. The aim of this study was to systematically review and critically appraise the literature on the kinetics-related characteristics of different types of push-ups, with the objective of analyzing the forces acting on the respective muscles such as bicep muscle and joint reaction forces using force plates. Ground reaction force and electro-myographical activity of four shoulder muscles during concentric contraction. This study assessed the vertical ground reaction forces (GRFs) of push-ups i.e. normal bicep force (N) during elbow flexion. Five healthy male individually recreationally fit individuals (5 men) performed 3 push-ups in a randomized order, with their hands pronated, and placed on force plates. The 3 pushups data acquired shows 6 peaks consisting of two sub-peaks indicating the flexion and extension of elbow joints of both arms.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Comparative study and Analysis of Actual Human Arm and Pasco Human Arm Structure Set

Ayesha Sarwar, Engr. Jamila Akhter

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Biomechanics is a vast field with great opportunities in research field ranging from molecular level to individual levels. Here we provide brief comparison of actual human arm with The PASCO Human Arm Structures and its validity in the research field. As PASCO declares that the Human Arm Structures Set mimics the real human arm function and allows the students to build a realistic arm model and directly measure the force exerted by the muscle so we experimented the validation of PASCO Human Arm Structure Set model ME-7001 by its biceps muscle's load analysis using scaling method that measures the effects on the bicep muscle force by increasing loads at different angles of elbow joints for both the PASCO structure set and actual human arm. Measurements determined the validity of PASCO Human Arm Structure Set model ME-7001in accordance with actual human arm.

Key Words

Human Structure Set.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

A cost-effective Mannequin based Breech delivery Simulator

Hafsa Obaid Qureshi, Hadia Saleem, Iram Fatima, Dr. Jahan Zeb Gul

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

The birth of a baby is a natural process but it's very painful for the mother. The normal delivery rate is very low in Pakistan these days. Doctors mostly go for C- sections leaving scars on the bodies of females. The main reason for this decision by doctors is lack of hand on experience. The solution to this is our medical mannequin that'll be used by medical students to learn how to deal with the difficulties of delivery. In this paper, a breech delivery case is focused on that is a transverse lie (the fetus is placed horizontally over the uterus). This manikin will depict this complication of delivery and the normal delivery process.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Determination of the pattern of chewing Using flex sensor and logic gates through a bite counter

Moiz Wali Khan, Hamza Bin Khadim, Maida Nadeem, Fizza Zaheer, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Biting and chewing are the primary essential steps for digestion. These actions form the basis of a healthy man and hence can be affected deeply by any and all complications and deficiencies in the facial muscles and nerves that control these movements. The aim of our work is to incorporate and subsume our knowledge of digital logics and incorporate the physiological aspects to construct a device that is a direct attestation of the said knowledge.

The framework of the bite counter will comprise of a flex sensor to distinguish the chewing and biting movement which will then be worked on by logic gates and displayed on two seven segment displays, permitting the number count to reach ninety-nine as its highest value. The assembly of a bite counter will allow us to observe any significant musculoskeletal and nervous conditions which may be causing a hindrance in the normal function of the facial and oral region.

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Key Words

Bite counter, Flex sensor.

Acknowledgment:

This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Electrooculogram (EOG) of a person with normal eyesight and with refractive disorder

Ahsan Naveed, Kahab Abdullah, Abdur Rehman, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Electrooculogram (EOG) signal is one of the bioelectric signals acquired from the human body to study the movements of eyes and also to design and develop assistive devices. This study shows the data of different electrical activity of eye movements of subjects while they were pursuing a fast-moving target and slow moving target and the EOG wave pattern was recorded. This data was compared to the person with normal eyesight and of a person with a refractive disorder i.e., Myopia or Hyperopia. The data significantly showed the different pattern of alpha and beta waves due to the activity of the muscles of eye and the image formation on the retina of the eye either behind the retina or in front of retina and the results verified why there is a difference of electrical activity of eye of a normal person's eyesight and that of defective eyesight.

Key Words

Electrooculogram, Myopia

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Study of ECoG signal acquisition and processing system

Eeman Tariq, Shan e Muhammad, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Electrocorticography (ECoG), is an electrophysiological signal that is recorded directly from exposed surface of brain to check electrical activity of the cerebral cortex. This study presents the generation and simulation of ECoG signal on LABVIEW, its real time data analysis and the filtration and processing of this signal using hardware design of ECoG amplification system. The ECoG Simulator on LABVIEW gives a representative model of human ECoG signal as the process of recording ECoG signal from the brain surface is difficult. We use DAQ card to feed the designed signal to the ECoG filtration circuit which uses high pass, low pass, notch filters and amplifiers to filter and amplify the ECoG signal. For further analysis this simulated ECOG signal can be used for testing and analyzing real-time ECoG signal for different applications.

Key Words

ECoG measurement, LABView.

Acknowledgment:
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A biomechanical study of the Vertical Jump Using a Force Plate and Goniometer

Sana Mahmood, Dawood Ahmed Waseem, Engr. Jamila Akhter

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Plyometrics are recommended for increasing strength and power as studies indicate that there is a significant and practical improvement in the vertical jump of the individuals who practice plyometric training (PT). The Vertical jump is used as a field test of performance capability, particularly in games like soccer, volleyball, basketball, high jump and gymnastics to test athleticism and ability to propel upwards. Sport scientists and strength practitioners commonly rely on tests of muscular performance to indirectly assess an athlete's performance state. In this paper, we have analyzed the pattern of a vertical jump to determine how the ground reaction force varies with subject's height and weight along with the variation of knee angle. For this study, nine subjects executed a vertical jump. The results were recorded using PASCO CAPSTONE software that can be used to assess training outcomes and by future researchers and specialists to analyse the lower body power.

Key Words

PASCO, Force Plates, Goniometer.

Acknowledgment:
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Differentiation between swallowing of solids and liquids through pharyngeal Electromyography

Maida Nadeem, Moiz Wali Khan, Hamza Khadim, Engr. Anum Rashid, Engr. Bilal Siddique

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Electromyography (EMG) is a recording of the electrical activity of skeletal muscles to diagnose disorders, analyze changes during different activities and differentiate which muscles work more during different activities. EMG can be acquired using both invasive and noninvasive electrodes, invasive methods focus more in the activity on tissue or cellular level whereas surface electrodes target muscles of a site. The work involves data acquisition of EMG signal of throat muscles during two different swallowing activities, eating and drinking, and using MATLAB for conditioning and manipulation of those signals to be able to classify the activity being performed by the muscles. Our approach is using non invasive EMG signals to analyze changes in muscular activity of throat muscles when swallowing food and when swallowing water. The EMG sensor would record and store data, this data is to be loaded on MATLAB and manipulated using signal conditioning to filter the extra frequencies and view the signal in a neater form. The data of each sample is then to be isolated from the other through MATLAB coding. In the end, we would be able to differentiate all the characteristics of the throat muscles(the amplitude, peaks, etc.) during swallowing of food and water and then classify the activity being performed.

Key Words

Stress Detection Application, Diabetes Mellitus, Stress analyzer, leptin and tryptophan in diabetic.

Acknowledgment:
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Modeling And Transient Fluid Analysis of Obstructed Ureter

Anusha Ishtiaq, Irum Fatima, Hadia Saleem, Engr. Nabeeha Ehsan

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

For future healthcare applications, which are increasingly moving towards out-of-hospital, the ability to model and simulate physiological conditions effectively are imperative. We know that Ureteral peristalsis is a series of waves on the ureteral wall, which transfers the urine along the ureter toward the bladder, but ureteral Stones affects the continuity of Urine flow through the tube. In order to overcome the problems faced during surgeries, pre studying the kinematics and dynamics of urine as well as blockages is preferred, that may be described using bio-fluids modelling in the ureter.

Acknowledgment:
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Research study of Factors affecting Range of Motion across knee joint including Height, Weight, and Gender

Um e Sumia, Zafran Tahir, Engr. Jamila Akhter

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

This research study presents the findings of experiments conducted to measure the range of motion across knee joints by analyzing the factors comparatively including age, height, weight, and gender. We have used a goniometer attached with an angle sensor and processing using Capstone PASCO software. Then the analysis of the result is done to interpret the maximum range of motion across the knee joint, detect pain, and access the tissue limiting the range of motion. In this analysis, we have observed that while analyzing female data, by keeping height constant the maximum range of motion increases with an increase in weight but in males, by keeping height constant, maximum ROM is inversely related to weight. Similarly, when we keep weight constant, in female subjects' Maximum ROM increases with a decrease in height while in males the maximum ROM increases with an increase in height as it is an indicator of flexibility as one age.

Key Words

ROM (range of motion), knee joint active motion.

Acknowledgment:
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Relationship between smoking and blood pressure

Noor ul Ain, Anum Faisal, Laiba Idrees Kayani, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

A study has been done by obtaining data of blood pressure collected from 15 subjects of variable demographics. The experiment included 10 males and 5 females ranging from age between 19 to 52, having variable smoking periods. An acute Blood Pressure rise was observed in new smokers, light smokers, and smokers having a lesser smoking period. Oddly enough, a minute Blood Pressure decrease was observed in long term smokers. Data collected from new smokers showed the highest average elevation in Blood Pressure. We also observed that the female average blood pressure increase was higher than that of their male counterparts. This variation in Blood Pressure changes and its association with the extent of smoking exposure, age, and gender can be used to study the long-term as well as short-term effects of nicotine and other carcinogens present in cigarettes on the male and female bodies. The study is limited due to resources such as the lack of variation in BMI, less gender variation, and other physiological uncertainties.

Key Words

Blood pressure, effect of nicotine

Acknowledgment:
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The Grip Force Experiment Using Electromyography

Aliza Ranash, Manahil Fatima, Sarah Zareen, Hira Bint e Usman, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Electromyography (EMG), the diagnostic procedure, is used to assess the health of muscles and nerve cells that control motor neurons. This technique is basically used to diagnose patient with any pathology related to muscle or nerve (muscle/nerve dysfunction). The research is based on exploring muscle activity and on examining muscle fatigue with dominant and non-dominant arms of subjects with no workout routine. The purpose of our study is to record the readings of dominant forearm's muscle strength (both triceps and biceps) in pre and post workout conditions. A grip force transducer (hand dynamometer) along with EMG cable and electrodes was used in this case of getting data (muscle strength) and the record (EMG signals) was acquired via Power Lab (BIOPAC). Four exercises were performed including measuring intensity and force in dominant / non-dominant arm and measuring intensity and fatigue in dominant/ non-dominant arm in both pre workout and post workout states, all for biceps and triceps separately. For triceps, the muscle strength was increased in post workout condition. For biceps, it decreased in post workout scenario. Hence, we infer from the EMG signals obtained, triceps strength increases, and biceps strength decreases in post workout states for a normal person.

Key Words

Electromyography (EMG), Dynamometer

Acknowledgment:
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Arrhythmia Detection and Differentiating using MATLAB

Hadia Nadeem, Fizza Zaheer, Malaika Fazal Khan, Zeeshan Nauman, Engr. Anum Rashid

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

This project covers the study of behavior of ECG signal undergoing the disease tachycardia(arrhythmia with heart rate escalating above 100 Bpm) and bradycardia(arrhythmia with heart rate below 60 Bpm) respectively by using MATLAB tools and techniques for data analysis. Bio pac was used for data acquisition. Analysis through MATLAB includes simulation of both signals leading to detection of R waves by applying peak detection. It detects all the R waves and after that we have applied some formulas to calculate heart rate and beats per minutes. In last we applied the condition on the basis of bpm and differentiate the signals as tachycardia (if bpm greater than 100), bradycardia (if bpm less than 60), normal (if bpm lies between 60 and 100).

Key Words

Stress Detection Application, Diabetes Mellitus, Stress analyzer, leptin and.

Acknowledgment:
This study acknowledges the funding support of the National Center of Robotics & Automation (NCRA) under Grant# RF-NCRA-037 & National Center of Artificial Intelligence (NCAI) under Grant# RF-NCAI-064

Study of effects of caffeine on ECG signal

Manal Haider, Mahnoor Jabeen, Muhammad Arslan, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

Human body is integrated and responds differently to nature of food that is taken. Caffeine is a stimulant that is frequently taken in our daily life. ECG whose acronym is Electrocardiography clearly reveals functioning ability of system and pace of heart. In this study we focused on the effect of caffeine on heart rate and ECG signal. Due to its high intake, a sudden change in heart rate and the electrocardiograph is expected. We performed this experiment using ECG's 03 lead system on different subjects. An ECG signal was observed before and after the intake of caffeine. The result manifests a clear difference between both the states; high dose of caffeine increased the heart rate and abrupt the signal. After observing these changes, it was quite obvious to conclude that caffeine is a potent stimulator and is rich in antioxidants that activates the body, increases the heart rate and dilates the pupils. Thus, our hypothesis seemed to be true. Moreover, we will broaden our spectrum to work further on this project.

Key Words

ECG, caffeine.

Acknowledgment:
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Disclosing the locale of membrane proteins by SVM

Mehwish Faiz, Saad Jawaid Khan, Fahad Azim, Daniyal Alvi, Sumaya Abid. Areej Ahmed

Department of Biomedical Engineering, Ziauddin University, Karachi

ABSTRACT

The bio-membrane of various cell organelles comprises distinct membrane proteins, the specific location of these proteins within the cell exemplifies their functionality. Thus, it is essential to uncover the locale of these proteins in the cell. Dealing with an enormous amount of proteins, the machine learning approach is preferred to retrieve time and cost. We employed a Support Vector Machine (SVM) for multiclass segregation of 3000 membrane proteins. The data is trained and tested after feature extraction, resulting in an overall accuracy of 78 percent. The results are shown using a Graphical User Interface (GUI), which reveals the membrane proteins category based on the cell location.

Key Words

bio-membrane, cell organelles, Support Vector Machine (SVM) , Graphical User Interface (GUI).

Smart infant foot sleeve to prevent sudden infant death syndrome

Muhammad Daniyal Maqsood Alvi[1], S.M Faizan Raza Shah Zaidi[3], Hareem Jaffery[2], Hira Qamar Siddiqui[2], Mehwish Faiz[1], Saad Jawaid Khan[1]

Department of Biomedical Engineering, Ziauddin University FESTM[1], Sir Syed University of Engineering and Technology[2], Department of Software and Web Development Mutex Systems Pvt. Ltd[3], Karachi

ABSTRACT

Smart infant foot sleeve is an infant monitoring equipment which is basically a sensor worn on the foot of an infant to transmit information about infant's heart rate, oxygen levels and temperature based off of pulse oximetry. It is designed to alert parents/guardian via phone if the reading goes out of normal range. Several monitoring equipment have been designed and researches are conducted all over the world for the wellbeing of infants especially while they are sleeping such as wireless intercom and baby monitor. This device is basically designed that can help prevent Sudden Infant Death Syndrome (SIDS) which is the most frequent cause of infant mortality. The Smart infant foot sleeve can continuously and non-invasively monitor and infant's vital parameters i.e., heart rate, oxygen saturation and temperature, transmit it wirelessly via Bluetooth/GSM to any connected cell phone and indicate an alarm if the processed readings specify a health inclination that falls outside of a particular threshold. It basically comprises of a sensing module within a wearable object. A portion of the module consists of processing unit using AVR that receives and process the readings. Besides preventing SIDS, other main benefit that this device provides is low cost, portable i.e. very easy to carry anywhere and is operated at low power battery.

Key Words

Pulse oximetry; SpO2 sensor; AVR processing; GSM module; Bluetooth; PCB.

Design and Fabrication of TELEMEDRONE: A drone to wirelessly Transmit Vital Signs

Sarfaraz Khan, Saad Jawaid Khan, Muhmmad Daniyal Maqsood Alvi

Department of Biomedical Engineering, Ziauddin University, Karachi

ABSTRACT

Majority of the population around the world is inhabited in areas where poor or no medical facility is available. TELEMEDRONE, carrying forward the principal of Unmanned Aerial Systems (UASs) is bridging the gap between patients and healthcare professionals without the need of physical presence of either one at that place. This system is automated using GPS system to navigate, a high quality camera, a Telemetry unit, a durable battery support and biosensors to pick and transmit vital signs of a person to the nearby healthcare unit. Our goal was to develop a flexible, mobile and user-friendly system that comprises of widely available components merged together. Our prototype comprised of a quadcopter with an Arduino based telemetry unit that could measure and transmit pictures, temperature, pulse rate and oxygen saturation of a remote patient wirelessly.

Key Words

Vital Signs, drone transimission

Non-Invasive Blood Sugar Measurement Methods

Moazzam Ali Khan[1], Ammar Tariq[1], Myra Aslam Qureshi[1], Ansharah Hasib[1], Choudhary Sobhan Shakeel[1], Hareem Aslam Qureshi[4], Mohsin Ali, Khan[2] Muhammad Daniyal Maqsood Alvi[1], Syed Muhammad Faizan Raza Shah[3]

Department of Biomedical Engineering, Ziauddin University[1], NED University[2], Mutex Systems Suit 716,7th Floor Park Avenue PECHS[3], Dow University[4], Karachi

ABSTRACT

As per the World Health Organization (WHO), as a result of the rise in diabetes cases around the world, which is leading to an increase in the number of people with diabetes, intrusive nature of commercial glucose meters is known to be one of the main causes of rising number of people discomfort and infections. Many individuals with type 2 diabetes are interested in knowing about the non-invasive blood glucose monitoring technology and how it works. The approach has potential applications in a wide range of fields, including medicine, materials science, optics, and electromagnetic waves, among others. For the purpose of examining probable future advancements, the benefits and limitations of non-invasive electrochemical glucose sensing devices in continuous monitoring, point-of-care, and clinical contexts are discussed in recent research. Noninvasive blood glucose monitoring is becoming more efficient, affordable, robust, and competitive than it has ever been due to wearable technologies and transdermal biosensors.

Key Words

Diabetes; non-invasive; glucose biosensor; optics; near infrared radiation (NIR).

Fabrication of cheap conductive Ink for wearable sensors using Graphite and Carbon

Amna Jawed, Engr. Tooba Khan

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

As the technology of today's world is advancing at a fast pace, redeveloping medical devices into compact, wireless, and wearable gadgets is the need of today's healthcare industry. Conductive ink can be utilized for flexible and wearable devices. In this research, cost effective conductive inks were fabricated using carbon and graphite and were proved to be effective and flexible due to them having low resistance. Commercially produced conductive ink is usually made with silver particles or graphene which can be costly, hence this research focuses on using carbon and graphite to create inexpensive conductive powders that are soluble in water. The carbon powder is obtained from dry cell battery and graphite is obtained via pencil. The powder is then mixed with water in the 1:1 proportion to make conductive ink. The fabricated conductive ink is then utilized to make flexible piezoresistive sensors and the change in resistance is observed using digital multimeter. The designed piezoresistive sensors using fabricated conductive ink is compared with the commercially available piezoresistive sensor. Results indicate that the flexible sensor designed using fabricated ink is almost similar to the commercial sensor. Developing such low-cost conductive ink can immensely help in low-scale and non-funded research and since it is pocket friendly, it can be used in the manufacturing of wireless and flexible diagnostic devices, and can even be screen-printed like commercial conductive inks to make stretchable wireless circuits.

Key Words

Conductive ink, graphite conductive ink, carbon conductive ink, piezoresistive, flexible sensors.

Comparative study on effect of range of motion on daily life style by using PASCO interfaced Goniometer

Saba Fatima, Engr. Tooba Khan, Engr. Hassan Ali

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

The aim of this study is to investigate the comparative study of Range of Motion in daily life, with respect to different attributes such as gender, Body mass Index & Age. This has been achieved by using the PASCO Interfaced electric Goniometer which measures and record the angular velocity and angular acceleration of every joint. The study was conducted in Salim Habib University into the time period of five consecutive days from 10 February 2022 - 15 February 2022. A total of 60 students volunteered as the subject for the investigation in which 30 Males (Mean Age ± S.D, 20.92 ± 1.46) and 30 Females (mean age ± S.D, 20.81 ± 2.20) participated. Two joints were investigated during this and the landmarks for the placement of Goniometer were the Tibia Femoral joint of the Knee & the Humeroulnar joint of the Elbow. For the determination of the angular velocity & angular acceleration, each subject was in a fully supported right angled positioned seated on an examination stool and the by using the Velcro Straps of the Goniometer placed on the upper and lower part of the concerned joint, the measurements were taken utilizing the PASCO interface Software and were statically analyzed on the IBM SPSS Statistics Software. This comparative study can be very effective to analyze the emerging diseases in Pakistan, which is still a developing country dealing with issues that leads to a low standard of living (Incurable Disease and nutritional deficiencies).

Key Words

Body mass Index, goniometer, obesity, underweight, overweight, normal weight, extension, flexion, knee, elbow, males, females, weight, angles.

A non-Invasive Blood Group Detector

Sumayya Hameed, Nida Abdullah, Qandeel Zahra, Maryam Furqan, Zaiba Muhammad, Engr. Hassan Ali

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

The blood group identification is essential for the medical-care sector for all kind of blood related treatments. The appearance or non-appearance of the four crucial blood groups is determined by the presence of the two antigens that are A and B on the surface of red blood cells (AB, A, B and O). Presently, blood type and rhesus tests are conducted by healthcare physicians that anticipate completely on their eyes and real-time observation of the agglutination reaction. The collected data that is inaccurate is a result of eye weariness and saturation. For the digital displaying of the information about the human blood type and rhesus, a detection device is designed. This study provides a non-invasive technique for classifying different blood types based on the optical characteristics of blood. Light from laser emitter acts as a source and a light dependent resistor detects the voltage when optical signals are permitted to pass through the subject's finger, the voltage are received by the Arduino Nano which displays the result in the form of the analog readings. Human blood has various optical characteristics, the voltage value obtained relies on the type of antigen that is present on the red blood cells. Data has been collected from 30 subjects aged between 20 to 45 years who had medically tested blood group reports, on the basis of the collected and measured analog readings, the blood group analysis is conducted. The outcomes are compared and the accuracy percentage of the analysis is more than seventy percent.

Key Words

Blood group, Antigens, Laser emitter, Light dependent resistor, Optical characteristics, Voltage, Analog readings

Designing of cost- effective smart Shoes for Visually Impaired/ Blind people

M. Ahsan Mirza, Naqi chatta, Waheed Sultan, Engr. Tooba Khan, Engr. Hassan Ali

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

The most important sense is sight, and the blind are looked down on by others. With the aid of technology, blind people can interact with their surroundings and share information quickly. The assistance previously provided to the blind included hardware-specific devices such as speaking OCR products, color recognition, barcode scanners; this hardware is expensive and its capabilities are limited due to the rapid development of hardware. The challenges people with disabilities/blind people face in their daily lives are not well understood. In this research we have designed cost effective smart shoes for visually impaired people. In this shoe we have used HC-SR04 Ultrasonic sensor for the detection of obstacles. The sensor is placed on the top of the shoe which can detect any obstacle come in front of it within the range of 2-4 meters and ring the alarm which alert the blind person that some obstacle is in front of it. The device is tested on multiple people with their eyes closed and have shown effective results in detecting obstacles.

Key Words

Blind, obstacle, smart shoes, ultrasonic sensor, visually impaired

Posturector (The Posture Corrector)

Mirza Areeb Baig, Zarish Majid Shaikh

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

In this study, we have designed a smart and cost-effective device to solve the problem of poor posture (Slouching) in adults and children. According to a study by the American Chiropractic Association, over 31 million Americans suffer from poor posture at any time. Bad posture is one of the leading cause of back pain and can lead to various other health-related problems like Spinal dysfunction and joint degeneration etc. we have designed a smart device that not only detect but notify the user via vibrations and application installed in the phone and also using biofeedback mechanism it can correct posture if a user does not correct it. The device is wearable on the back and will keep a record of the posture in an application. In Pakistan, only simple posture supporting belts are available but this smart device will correct the posture itself and is portable.

Key Words

Biofeedback mechanism, Posture corrector, posture detector, slouching corrector, smart belt, smart device

Li Fi- Transfer of data through light

Mirza Areeb Baig, Zarish Majid Shaikh

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

This study aims to transform wireless communication from radio waves (Wi-Fi) to visible light waves with the least hazardous environment and cost efficiency. Li-Fi (Light fidelity) is a transmission of data through LED lights, which provides wireless communication faster than WiFi. For many years Dr. Povey and Dr. Harald with their colleagues is working on communication through the light at the University of Edinburgh. In our project, we demonstrated the possible transmission of the audio signals using LEDs (transmission end) from the phone, and on the receiver end photodiode received and converted the flickering (on/off) into digital signals, connected with a speaker that processed and decoded it. When LEDs were ON and OFF the digital signals 1 and 0 were transmitted respectively. The results show a broad bandwidth, 10,000 times more than radio waves. Li-Fi transmits data at the speed of light and is costefficient. The Visible light faces no interference from radio waves so communication occurs without interruptions and ensures maximum security. It is applicable in traffic signal lights, making them communicate with vehicles to avoid accidents. Used in airplanes and operation theater as it does not interfere with radio waves. It can provide communication underwater where Wi-Fi fails, beneficial for navigation or the military. It can also be used in homes and offices. All the nearby light sources can act as Li-Fi hotspots.

Key Words

Data transmission through light, future of data transmission, high speed transmission, light emitting diodes, light fidelity, wireless transmission, communication

Fabrication and Comparative Analysis of Bone Implant Using Calcium Sulfate Hemihydrate and Epoxy Resin

Sadia Arshad, Muhammad Rizwan, Hafsa Aijaz, Engr. Tooba Khan, Engr. Hassan Ali, Dr. M. Zeeshan Ul Haque

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

This research proposes an alternative bone implant material fabricated utilizing calcium-sulfate hemihydrate (CaSO4.1 2 H2O) and epoxy resin. Traditional bone implants were created using materials such as Allograft and polymethyl-methacrylate (PMMA), that are expensive. Many underdeveloped and developing countries have to import these materials which further increases the cost of making artificial bone, and subsequent implant procedures. The aforementioned materials are readily available, even in developing countries at affordable prices. Research suggests that both materials are biologically inert and compatible for implants, hence, are separately being used as bone adhesives and bone grafting materials. This research proposes an innovation to combine calcium-sulfate hemihydrate (CaSO4.1 2 H2O) and epoxy resin. The materials are mixed in different proportions to prepare three separate specimens. The fabricated specimens were tested for their hardness using the HBRV-187.5 Hardness Tester. A comparative study was carried out to compare the hardness properties of the fabricated specimens with the hardness of real bone. The results showed that specimen 1; having CaSO4.1 2 H2O to epoxy resin in the ratio of 0.5, was closest substitute to natural bone, having hardness value of 30.5 ± 2.50 HV compared to that of a human bone, i.e. 33.3 HV ± 5.17.

Key Words

Biocompatible, biomaterial, bone grafting, bone implant, calcium sulfate hemihydrate, CaSO4.1 2 H2O, epoxy resin, hardness testing, HBRV-187.5, PASCO compression test

Developing a glove controlled robotic arm using cost effective flex sensors

Shanzae Zubair, Zuraiz Baig, Saad Imtiaz, Amna Wagley, Engr. Hasan Ali, Engr. Tooba Khan

Department of Biomedical Engineering, Salim Habib University, Karachi

ABSTRACT

The aim of this project is to develop an efficient and user-friendly robotic arm using flex sensors, which can be step towards a cost-effective solution to the problems for many upper limb amputees facing difficulties in performing day to day tasks and cannot afford most of the solutions that are currently present in the market. This cost device can be further developed into prosthetics or prostheses keeping in mind the need of the hour. To achieve this outcome the design comprises of an electrical and a mechanical unit. The electrical unit is composed of a 5-6 v power source, a micro controller i.e., Arduino uno, a filter circuit, servo motors and Flex sensors. While the mechanical unit is designed by the used of recyclable modeling tools, keeping in mind the anatomical and physiological features of a hand where strings and springs are used to mimic the functions of joints and muscles. The whole, model works by the synchronization of these two units where the central focus are the flex sensors which are again made with recyclable materials to make this project ecofriendly and cost-effective. This project is a highly efficient prototype of a prosthetic arm, which can be used for therapeutic and rehabilitative purposes in the future. the project can be further developed by adding a wireless modality which can transform this project into an e-health device. And the servo motors can also be replaced by the rotor motors to increase the R.O.M(Range of motion).

Key Words

Amputees, prosthesis, prosthetics, cost-effective, eco-friendly, prototype, R.O.M, recyclable, servomotors, microcontroller, e health, flex sensors, therapeutic, rehabilitative.

Design and Development of Oscillometric Digital Blood Pressure Monitor

Syed Uzair Iftikhar, Qamar Ud Din, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Hypertension is the most common preventable cause of cardiovascular diseases, digital blood pressure measurement allows individuals in self-monitoring and managing as advised by major guidelines. It is a non-invasive method capable of accurately determining instantaneous blood pressure which can mean the difference between life and death in some cases. Pressure sensorbased blood digital blood pressure monitor enables patients with white coat diagnosed hypertension to better manage their condition in an easier and cheaper way. The technology includes an inflatable cuff wrapped all around the arm enables a more accurate and reliable method of blood pressure measurement enabling individuals to self-manage and better control their condition and perform adequate measures if and when needed as prescribed by the doctor. Oscillatory blood pressure in contrast to conventional blood pressure measuring devices are less prone to error and provide an environmental friendly solution to the problem, this method uses fuzzy logic in determining the cut off pressure for the arterial blood (about 20mm higher than systolic pressure) when pressure is gradually lower and reaches the point below systolic pressure the influx of blood exerts pressure on the arterial wall which produces oscillations in the cuff which can be measure using high sensitivity pressure sensor, the value of which is displayed onto the output console.

Designing an IOT Based Assistive Device Using Force Sensing of Grip for Hand Motor Rehabilitation

Shifa Maryam, Sania Khan, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Presently grasping movements of grip strength used in rehabilitation of hand are really instinctive, which makes the results of the treatment very prompt and swift. They are generally based on what the physiotherapists opine. It alters the core subject of the study with interposition of several forms of delusions in the perception which then often leads to misdiagnosis; over diagnosis, under diagnosis. For this purpose such an assistive device is required keep a record of the grip strength, which would help in keeping a track of patient's recovery over time and suggest if the treatment followed by the physiotherapist is successful or not based on patient's improvement level. To assist all such stumbling blocks in rehabilitation, a device has been developed. It has been designed to quantify the force applied by the subject in grasping an object. It is commenced by grasping the object and computing the grip strength. This information is then stored in a database. The stored data is then displayed on an LCD display. To further facilitate completely debilitated patients the data will be remotely sent to the physiotherapist in order to handle the patient over a long distance. For this reason IOT will be introduced to the system. Force exerted on the grip handle system quantifies the changes in grip force. The data gets displayed on the screen for both the patient the physiotherapist. It will monitor the results of hand motor rehabilitation and will ease the process of rehabilitation for the patient and the physiotherapist as well. The record of the recovery process will ease to obtain the success rate of a treatment followed and will also tend to increase the success of the treatment.

Application of FSR and DHT11 based smart device in healthcare

Rehan Tariq, Natasha Mohsin Butt, Khadija Khan, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Sensors based smart devices play vital role in healthcare. These devices are the need of hour to make advancements, assist doctors and nurses to track health of serious patients and upgradation towards healthcare. Paralysis is the medical condition in which patient loose the ability to move some or all of the body parts. Tracking the needs of totally paralyzed patients, whose eye-tracking isn't possible, unable to lift hand and point towards objects, unable to speak out needs, become quite challenging for the attendants. It is also challenging for the doctor to track the improvements such patient makes on daily basis by merely lifting the fingers once or twice in the day. Many devices are already available to assist the paralyzed patients but those perform single function and are not efficient. The device proposed in this study is based on force sensors and DHT (Digital Humidity and temperature)11 module which can be placed beneath the patient's fingers. Such device not only detect the slight press but also monitor the room temperature effectively. The proposed sensors-based device would be recording even the slight movements which not only helps the nurse in tracking needs of patient but also assist the doctor in perceiving the health progress of the patient. Alarm in the device fires up whenever patient lifts the finger indicating the need of patient. DHT11 module serves the purpose of monitoring temperature in the room and if temperature exceeds any upper and lower limit, notification will be sent to the nurse or alarm fires up. This smart dual purpose device integrated force sensitive resistors and temperature module continuously monitors the temperature, the needs of patient and records health progress of paralyzed patients. This study demonstrates how the FSR sensor helps in tracking the needs and the health of the paralyzed patients. Future intentions are to use Bluetooth/Wi-Fi Module and send the data sensed by device wirelessly to the doctor/nurse chamber.

Key Words

Smart device, FSR sensor, DHT.11 module, healthcare, paralyzed patients

Examining the risk of interstitial lung diseases by comparing the Respiratory Volumes and Respiratory Capacities in Men and Women before and after the exercises by using PASCO Spirometer

Engr. Maria Tahir, Hoor Arshad Khan

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Chronic interstitial lung diseases have become one of the most lethal cause of deaths in all over the world specially in low income and polluted country like Pakistan. Interstitial lung diseases mean “scarring” or “inflammation” of lung tissues, lung’s air sacs and air passage way due to which the difficulty in breathing occur. It can be genetic, caused by taking in harmful particles like tobacco smoke, coal dust etc. or may occur due to other health disorders. For diagnosing such restricted lung diseases, a noninvasive tool like spirometer, the lung functionality detector plays an important role. The aim of this paper is to examine the risk factor of interstitial lung diseases by comparing the Respiratory Volumes and Respiratory capacities in Males and Females before and after the exercises by using Pasco Spirometer. For this study, 100 subjects are selected with 50 men and 50 women. PASCO Spirometer setup is used in this experiment. Nose of the subject is closed with the help of a clip and instructions is provided before the study. Initially they are instructed to inhale and exhale normally twice (tidal volume), then to forcefully inhale (inspiratory volume), after which they are instructed to repeat the first step again (Tidal volume) twice time followed by forceful exhalation (expiratory volume). The first step is repeated twice which is followed by forceful inhalation and exhalation and lastly to inhale and exhale normally twice time. Whole procedure is performed simultaneously. These volumes are used to calculate capacities (inspiratory reserve (IRV), expiratory reserve (ERV), and residual volumes (RV), functional residual (FRV) and total lung capacity (TLC)) using ANOVA (Analysis of Variance). Vital capacity is important to study overall lung behavior. Results of this study will show that there is statistical difference between men and women lungs volume and capacities which will help to diagnose and cure the chronic interstitial lung diseases propagation and incasement with the passage of time.

Image Registration - An Image Processing Technique on Medical Images

Fahad Shakeel, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Medical image processing is the most expanding field nowadays. Its use has been widely increased in the areas of disease diagnosis, planning treatment, guiding treatment and disease progression monitoring. The term 'medical image' covers a great variety of different image types that have different underlying physical principles and applications. While dealing with these medical images, it is seldom important to compare the images obtained from a group of patients. There is also a possibility that the radiological image of a patient captured at one area may differs from the radiological image captured at some other area. Such images need to be aligned geometrically in order to obtain better results from the analysis. Image registration is a computerized technique which aligns the images by mapping points from one image to the corresponding points of the other image. There are different methods of image registration. The basic steps of most of the image registration methods comprise of feature detection, feature matching, transform model estimation, and image resampling and transformation. It is important to note that all of the image registration methods consider the assessment of registration accuracy as an important parameter. In this research, the 2D radiological images, i.e., of brain, are aligned with the help of MATLAB based algorithm. The method involves reading the MRI dataset frames as reference images. This was followed by performing Projective Transformation and constructing the input images. Both the reference and input images were compared in order to implement the image registration technique. Results showed that the MATLAB algorithm registered the images efficiently such that the aligned images were very close to the reference images. Using the proposed algorithm, it is therefore possible to align different medical images. The input images after transformation were similar, however, not truly identical to the reference images.

Key Words

Medical Image Processing, Medical Image, Image Registration, Projective Transformation, MATLAB

Identification of respiratory parameter that helps in primary diagnosis of Asthma

Asmna Mazhar, Shahzadi Arzak Semab, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

The predominance of asthma has been augmented since late 20th century. Millions of people have been affected by asthma worldwide. Asthma is the tenderness of airways, induced in response to allergens when antibodies attack them. The death prevalence of asthmatics is usually not because of asthma itself but owing to the measures performed during diagnosis and treatment of asthma for instance endoscopic biopsy and resection of lungs. The pre-diagnosis of asthma would be as certain as obliging means in the treatment of asthma. For investigating the factor that will help in pre-diagnosis of asthma; a pulmonary function tests (PFTs) which is performed among 3 groups. The first group comprises of healthy subjects, the second contains those individuals who are more prone to seasonal allergies i.e. pollen and dust allergy, and the third group contains asthmatic subjects. The FEV1 (Forced expiratory volume in one second), FVC (Forced vital capacity) and FEV1/FVC of subjects have been chronicled using spirometer. The data acquired is further proceeded to statistical analysis in order to find out the variance amid the groups. The data acquired validates that there is a statistically significant difference between the groups and average FEV1 of asthmatics is quite handier to Allergic ones. The observations obtained illustrates that the analysis of FEV1 can be used in primary diagnosis of asthma. It has been concluded that allergic subjects can be regarded as Pre-Asthmatic.

Key Words

Pulmonary function test (PFT)

Designing Artificial Cardiac Pacemaker using PID Controller for Heart Rate Stabilization

Natasha Mohsin Butt, Laiba Junaid, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Heart rate (HR) regulation in a dynamic environment requires effective and reliable cardiac pacemaker control to deliver life-saving control action. Various pacemakers with variably adjusted PID controllers (ProportionalIntegral-Controller) have been discovered, but each has its limits when it comes to handling the dynamic problem of HR regulation. Pacemaker without PID controller gives the unstable response and inefficient response. Two distinct approaches are presented in this study for fine-tuning the control settings to deliver reliable and effective performance. In terms of rising time, settling time, and percent overrun, the stable PID controller beat the unstable cardiac pacemaker system. However, the tuning process imposes limitations on the PID controller that was created in this work, making it less than ideal. Mathematical modeling of the Human heart is represented by the sinoatrial model and the transfer function of the heart and pacemaker are derived. Simulink models and Matlab coding for the designing of efficient PID for heart rate regulation for 65 beats per minute are discussed in detail. Response of Pacemaker with PID controller tuned with kp=1.17, ki=0.27, kd=0.199 for a heart rate of 65 beats per minute gives more efficient response with almost 1% overshoot and steady-state error and minimum settling time as compared to the other method of controlling Pacemaker with PID controller tuned with kp=0.428, ki=0.0607, kd=0.1011 for a heart rate of 65 beats per minute.

Key Words

Proportional-Integral-Derivative (PID) Controller, heart rate (HR), electro-stimulation, transfer function

Non-Anthropomorphic Hand for Multi-Purpose

Engr. Maria Tahir, Muhmmad Abrar Baig, Muhammad Hussain Haider, Laiba Junaid

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Globally, substantial research is being conducted into the design and development of robotic arms. Robotics is continually and thoroughly integrated into numerous lines of employment, surpassing human labor and fulfilling longterm duties. Robots that aid and interact with humans will inevitably be required to perform the duty of handing over objects properly. Robotics is classified according to its application, which includes industrial, (ii) domestic or household, (iii) medical, (iv) service, (v) military, and (vi) space. We investigate the concept of constructing non anthropomorphic multi-purpose robotic hands for tasks that mimic the motion of the human hand in this study. The primary goal of this project was to design, develop, and implement a competitively priced robot arm with enhanced control and low cost. therefore, this paper focuses on the mechanical design and electrical system idea, as well as the creation of a 6 DOF (degree of freedom) robotic arm capable of 'human-like' behaviors. As a result, these nonanthropomorphic traits are obtained by the capacity to operate the (i) elbow, (ii) wrist joints, and (iii) hand of robot.

Key Words

Multipurpose, non-anthropomorphic.

Simplified model of hand motion for picking objects

Khadija Khan, Engr. Maria Tahir, Aqsa Zahoor

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Visual input and motor reaction are involved in hand movements. When reaching for something with their hands, humans make conventional movements that nearly resemble a smooth trajectory. When manipulating an object, a person must have control over both the hand and the object's movements. The capability to synchronize the nervous system and the muscular system is referred to as stability in human motion. The primary requirement of every physiological system is stability. To prevent harmful repercussions, the intended response must be efficiently accomplished. Without stability, the body would collapse in all directions—forward, backward, and sideways—making it considerably harder to maintain motion. While modelling the hand motions for interacting objects, PID controller controls the plant and maintains the stability of the system The brain serves as a controller in the physiological system, directing all motions and actions. To keep the actual output from a process as close to the target or setpoint output as possible, PID control employs closed-loop control feedback. In this study, a simplified model of hand motion is presented, a circumstance where a person needs to touch an object with hand similar to how a robotic arm function. Any system integrated with the human body or based on its physiological system must be reliable. The findings suggest that PID controller with appropriate values of , , has the ability to stabilize any control system. Differential equations are used to determine the transfer functions for each organ. Robotic hands have a crucial component called the control system, which is responsible for most of the tasks and applications. In this research, the "minimum-jerk" paradigm for smooth reaching movements is demonstrated.

Key Words

Control system, mathematical modeling, PID controller, hand movement modeling, MATLAB

Accurate and feasible stress level estimation through Photoplethysmography sensor for healthcare

Khadija Khan, Engr. Maria Tahir, Hassan Imam, Aleena Arshad

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Stress is the serious risk factor leading to various complications. Stress worsens the conditions of obesity, blood pressure, gastrointestinal problems. It is cardinal to approximate stress level to acknowledge the health condition of a person. Blood is secreted with stress hormones which causes elevation in BP level. Stress leads to various physiological substitutions like change in aortic root blood flow, terminal resistance of vessels and PTT. Photoplethysmogram has proven to be a vital signal. Photoplethysmography is the optical technique which uses Infrared light to measure volumetric variations in the blood. Various parameters that can be used to access many underlying complications are extracted using Photoplethysmography. Moreover, PPG has been used extensively to determine heartrate, B.P in Patient health monitoring system in hospitals. Due to ease of use and reliability of the PPG measurement, PPG can be extended to measure stress. In order to derive stress from photoplethysmogram, changes that occur in PPG signal needs to be perceived by deriving various parameters. Upon observing changes in various parameters, variations in stress level can be investigated. Various factors have direct or indirect correlation with stress level, there are features too that do not correlate with stress. Many studies have been conducted on the cuff-less, non-invasive BP estimation using Photoplethysmography (PPG) signal but the stress estimation from PPG is not usual. Techniques for measuring stress from ECG signal compromise on accuracy and non-portable. PPG is the non-invasive optical method for measuring mechanical activity of heart. PPG can provide non-invasive real time stress assessment. The proposed method for estimating stress use strong PPG signal acquired from Index finger. Maximum number of relatable features can be extracted from Photoplethysmography (PPG) which are directly or indirectly related to stress. Before data is fed into an algorithm, it has to be cleansed thoroughly by removing motion artifacts and all type of noises. Each feature has different scaling, so it is the best idea to normalize the signal after filtering and before training the model. Once the relevant features are extracted, the most relevant features for stress estimation needs to be identified and appropriate algorithm capable for mapping different designed levels of stress is discussed in the proposed study. This would be the type of multi-class classification problem in which level 1 is of low stress, level 2 is classified as moderate stress and level 3 is classified as high stress level. Sorting of features concerning with estimation of Quantitative stress. Stress level estimation can efficiently assist in stress management and would contribute towards the advancements in healthcare.

Key Words

Stress level, PPG, Real-time Assessment, Physiological Stress, PTT

Wearable device for continuous blood pressure and pulse rate monitoring via piezoelectric based-sensor properties

Nabeeha Nawab, Amina Bashir, Engr. Maria Tahir

Department of Biomedical Engineering, Riphah International University, Islamabad

ABSTRACT

Previous research has indicated that when an illness occurs, the non-invasive determination of blood pressure procedure relies on the oscillometric approach is unreliable. As a result, we present a highly sensitive piezoelectric sensor-based system capable of measuring the hemodynamic properties of the pulse wave and subsequently estimating blood pressure with pulse rate. When an arrhythmia arises, the hemodynamics of the pulse wave shift and the morphology of the pulse wave changes. Our suggested sensor has piezoelectric qualities, making it very sensitive to minor pressure changes and capable of converting them into electrical energy. This system can detect ectopic beats from the radial artery, and the detection algorithm can continually monitor the inaccuracy in blood pressure estimation caused by ectopic beat distortion when the pulse wave is detected. The goal of this research is to create an inexpensive wearable system for continuously measuring blood pressure and pulse rate measurement based on piezoelectric properties of sensor that may be utilized at home by the ordinary individual. The pressure variations in the radial artery were calculated using feature points of systolic and diastolic in the pulse wave and the sensor's sensitivity. It promoted a cheap-cost, high-precision piezoelectric based framework for estimating constant systolic and Di systolic blood pressure without different modifications, adjustments, and difficult relapse study. The framework may be appropriate for lasting, constant blood pressure and pulse-checking diagnostic uses.

Key Words

Piezoelectric sensor; continuous blood pressure; pulse rate; wearable device.

Measurement Muscular activity of Bicep with and without Hinge joint assisting device for Elbow movement

Syeda Iqra Naveen, Aroosha Irfan, Shanzay Nadeem, Engr. Alina Akhlaq

Department of Biomedical Engineering, Air University, Islamabad

ABSTRACT

The elbow assisting device is a device designed concerning requirements for elbow motion assistance (flexion and extension of the arm using biceps and triceps brachii). Dumbbell Preacher Curl (DPC) is one variation of the standard Dumbbell Biceps Curl, generally applied to optimize biceps brachii contribution for elbow flexion by fixing the shoulder at a specific angle. In this study, changes in the neuromuscular activity of the biceps brachii long head were identified for the DPC (without weight), DPC using a 2-kilogram weight, and DPC with the help of an elbow assisting device. This study aimed to determine whether the elbow assisting device is a good option for rehabilitation therapy. The changes in neuromuscular activities were measured using electromyography (EMG). Electrodes were connected to the subject's arm and voltage graphs were recorded for each exercise. It was determined that the voltage measured was 36.4% greater with weight than without and the voltage was 31.8% less when using the elbow assisting device on average among all subjects. These results showed significantly less load on the biceps brachii when using the device proving it to be the best option for rehabilitation therapy.

Key Words

Electromyography, Dumbbell Preacher Curl.

Acknowledgment:
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Differentiating between rapid and slow eye movement using filtration and peak detection in Matlab

Sabahat Khan, Engr. Anum Rashid

Department of Biomedical Engineering Air University, Islamabad

ABSTRACT

Many EOG based systems have been developed in order to assess criteria for the diagnoses of disease or to provide commands to another machine using eye movements. This study focuses on differentiating between normal eye movement and rapid eye movement in both vertical and horizontal channels of the EOG. This may be used as a parameter to detect drowsiness, intoxication and neurodegenerative disease. Data was acquired using Bio-Pac, the paradigm and conditions were the same for all the subjects. The data was filtered in Matlab using frequency analysis and a FIR low pass filter. The frequency of peaks was then examined for each subject during the rapid and non-rapid eye movement stage wherein the minimum peak distance was set to 3500.The number of Rapid eye movement data peaks were consistently higher than the peaks of normal eye movement data peaks providing a clear distinction between the two states of the same subject. The peak detection technique makes it easier to distinguish the frequency difference between two states easily without performing wavelet analysis and is thus a useful tool.

Key Words

Electrooculography.

Acknowledgment:
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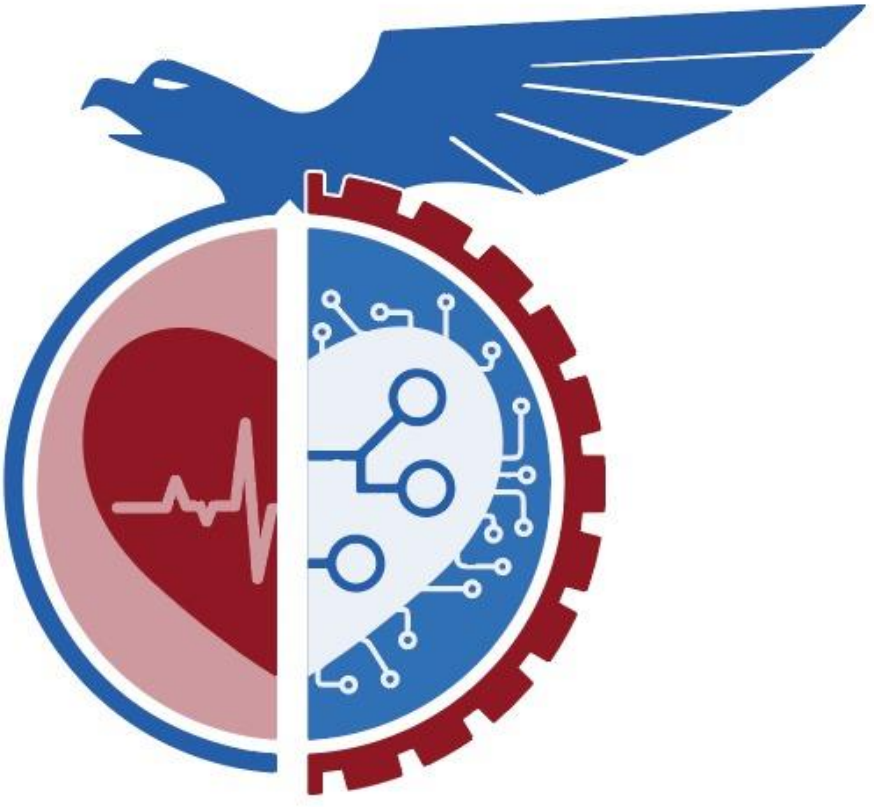

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