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Baghdad University

Al-Khwarizmi College of Engineering

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Student Graduate Project for Awarding the B.Sc. Degree in Biomedical Engineering

2020 - 2021

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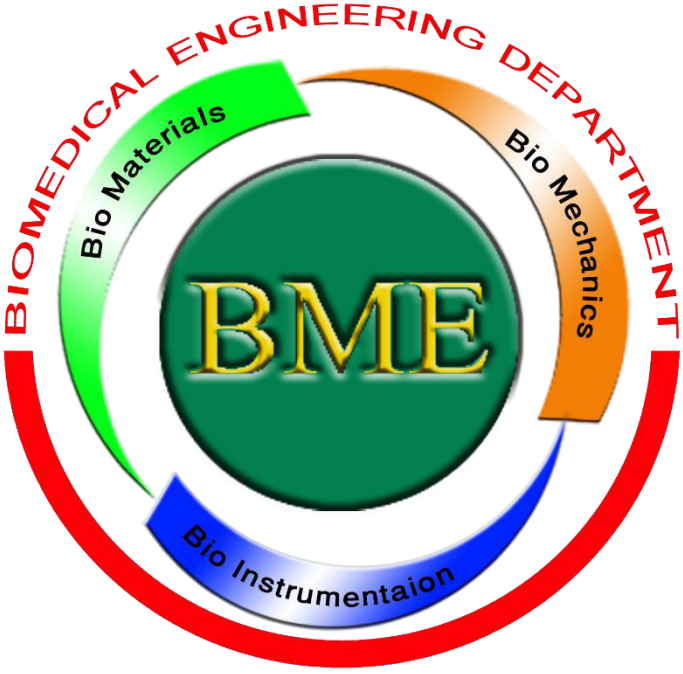
Biomedical Engineering Department



Student Graduate Project for Awarding the B.Sc. Degree in Biomedical Engineering

2020 - 2021

Student Graduate Project Abstract
2020 - 2021

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Graduate Projects for Students in 5th. Stage
2021 - 2020

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2	Smart Medication Pillbox	Dr. Ibrahim Amer Ibrahim Fadia Nouri (M.Sc.)	Asia Shihab Radhwan Suha Nadim Hussein Noor Al-huda Jaffar
3	Improved Control of Elbow Exoskeleton-II	Dr. Ali Hussien Ali	Maryam Hazim Zemrowd Safaa Zahraa Hayder
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Design of Eye-Tracking Based Wheelchair Control System

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 1
Project Name	**Design of eye-tracking based wheelchair control system**		
Student Name 1	**Sajad Mahmood Mohammed**		
Student Name 2	**Reem Bassam Hazem**		
Student Name 3	**Shahd Alaa Salman**		
Supervisor Name	**Dr. Ibrahim Amer Ibrahim**	**Electrical Engineering**	

Aims of The Work

The project aims to provide freedom of movement for those who have special needs (i.e. disabled) by designing a system that controls the hardware and software environments, that depends on eye tracking using image processing algorithms. Ultimately allowing the user to control his/her environment using only his/her eye movement.

Project Summary

The system consists of a digital camera (webcam) that is mounted on a head mount and is directed onto the eye. This camera takes snapshots of the eye and sends it to the Matlab software, which in turn applies image processing techniques to determine the position of the eye and then estimate the direction of eye movement. This data is formed into an encoded signal and sent to a microcontroller that decodes the signal and uses the information to determine the direction of rotation of the motors attached to the wheels of the wheelchair.

Discussion

Because of the current situation of the pandemic, social distancing practicing and the curfew being applied in many countries around the globe, it became hard to provide help to those who have special needs, so there was demand to provide a way that enables them to achieve their daily necessities without the need of help from other personnel.

Our suggested model is considered to be a basic solution for this problem. It being cheap and easy to implement in any available motorized wheelchair makes it a great system to those in dire need for it. The model proved its efficacy, since it was tested on multiple users and it showed results with high precision in tracking the position of the eye under ideal circumstances of lighting and proper positioning of the head mount.

Future Work

- Implementation of the system as an embedded system eliminating the need for a computer for image processing
- Design of a better head mount and light source which helps in achieve optimum image acquisition conditions
- Improve data transfer protocol which significantly decreases the response time of the system and thus increases its speed.

Smart Medication Pillbox

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 2
Project Name	**Smart medication pillbox**		
Student Name 1	**Asia Shihab Radhwan**		
Student Name 2	**Suha Nadim Hussein**		
Student Name 3	**Noor Al-huda Jaffar Ibrahim**		
Supervisor Name	**Dr. Ibrahim Amer Ibrahim**	**Electrical Engineering**	
Supervisor Name	**Fadia Nouri (M.Sc.)**	**Electrical Engineering**	

Aims of The Work

The aim of a Smart Pill Box for Medicine Reminder and Monitoring System. When the pill time has been set, the pillbox will remind patients to take pills utilizing sound.

Project Summary

Many medical errors are due to the fact that people in charge of patient or elder's medication have to deal with sorting huge amounts of pills each day, many deaths occur due to giving wrong medication on wrong timing, or forgetting to take the medicine. This project consists on the conception, design and creation of a pillbox prototype intended to solve this deficiency in the medical area as it we could sort out the pills easily, with this device being intended to be used by hospitals or retirement homes.

Discussion

The proposed system is suitable for all kinds of patients. We can control the time the patients take the medicine, speak out each pill's names, and record new ones if needed with the help of the ISD1820 record module as it can be used to record, repeat, and change the previous recordings easily. In addition, with the help of the IR sensor we could easily know whether the pill was taken from the box or not so it also reduces the ratio that the patient misses and delays taking medicine. With the help of each component integrating into the circuit carefully and with the software programming we programmed the smart pillbox to give reasonable output thus contributing to the best working of the unit. The design of the pillbox is small so it won’t take larger space and it’s appropriate for a limited number of pill.

Future Work

We see this system as the beginning of a larger project for improving health care. The proposed device may be developed further through the below proposed measures: For future development, the box is 3D-printed to connect the appropriate design to match the electrical circuit and components also Compression of the size of the box to be compatible and more flexible for usage. replace SG90 (servo motor 180) with servo motor 360. We hope that the smart medicine box will be connected to a system interface and an LCD screen will be added to display the details of the tablet, If possible, we hope that it could be linked to a smart phone by phone application to send a message to nurse or doctor that patient not take medicine.

Improved Control of Elbow Exoskeleton-II

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 3
Project Name	**Improved control of elbow exoskeleton-II**		
Student Name 1	**Maryam Hazim**		
Student Name 2	**Zemrowd Safaa**		
Student Name 3	**Zahraa Hayder**		
Supervisor Name	**Dr. Ali Hussien Ali**	**Biomedical Engineering**	

Aims of The Work

Our motivation is to develop a device which will be able to unload the injured elbow, partial or fully compensate muscular effort required to bend the upper extremities and also restoration of the joints moving functions during the rehabilitation period. The main advantages of developed device are the improved functionality, low cost and availability since the majority of modern orthosis cost more than 1000$, and it is not available for every patient.

Project Summary

Patients suffering from stroke and other neuromuscular diseases usually lose their muscle functions. It is recommended that intensive occupational therapy in the early stages may provide a rehabilitation to affected limb. A portable elbow exoskeleton has been developed and tested to meet these requirements.

Discussion

The results demonstrated the ability of the developed exoskeleton device to perform physical therapy especially for stroke patients through its performance of the kinematic exercises similar to the exercises performed by the physiotherapist. From this, the device can work as a portable physiotherapist's assistant to ensure the treatment sessions with high quality, lower cost and shorter time to do the rehabilitation..

Future Work

Force sensor can be used to improve feedback control and monitor progress of therapy.

- Smart rehabilitation could be applied to improve physical therapy.
- Improve the design which can be adjusted and used for the left and right arm at the same time.
- Safety circuit to provide patient safety.
- Wireless (EMG sensor) can be utilized to control the exoskeleton arm by using the Myo armband.
- Providing a touch screen, that can be used to display the EMG signal of the patient and make it easier to set the threshold for each patient. Hence, making the device user friendly..

Developing M-Health App. for ML-Based Self-Management of Diabetes and Remote Monitoring Service

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 4
Project Name	**Developing M-Health App. for ML-Based Self-Management of Diabetes and Remote Monitoring Service**		
Student Name	**Karrar Falih Hadi**		
Supervisor Name 1	**Dr. Mohannad K. Sabir**	**Electrical Eng./ Computer & Control**	
Supervisor Name 2	**Rabab Alaa Hameed (M.Sc.)**	**Mac Computer Engineering**	

Aim of the work

Developing two apps, one for diabetes patients and the other for doctors. The patient app estimates the insulin doses that the patient needs and provides several features that improve the patient's health. The second app allow the doctor to remotely monitor the patients who are connected with him via the internet.

Project Summary

Diabetics must calculate their insulin doses precisely to avoid the short- and long-term negative consequences of poor blood glucose control. The amount of insulin doses varies from time to time depending on the daytime, amount and type of the consumed food, physical activity, sleep quality , psychological state, and hormonal changes inside the body. The proposed app forecasts the insulin doses for any time and any condition based on machine learning considering all the related parameters.

Discussion

M-Health apps help diabetic patients improve their glucose levels control. Patients in Iraq suffer from a lack of knowledge in managing diabetes due to the lack of an educational program for diabetic patients as well as the poor healthcare system. All participated patients showed a clear effectiveness in lowering glucose levels. The app learns from patient data and may adjust insulin doses based on the patient’s needs. Good results appear after two weeks of continuous use of the app..

Future work

- Connecting to a Continuous Blood Glucose sensor to get the blood glucose levels without input from the patient.
- An insulin pump can be connected to control the insulin delivery.
- It is also possible to allow the doctor to control certain parameters related to predicting insulin doses to fit the patient need..

Design of UV Trans-Illuminator with Camera Detection

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 5
Project Name	**Design of UV Trans-illuminator with camera detection**		
Student Name 1	**Hayder Talib Abdullah**		
Student Name 2	**Taha Omar Taha**		
Supervisor Name 1	**Dr. Nebras H. Ghaeb**	**Mechanical Engineering**	
Supervisor Name 2	**Mohammed Rasheed Mohamed (M.Sc.)**	**Biological Science**	

Aims of The Work

1- Improving the monitoring and controlling of the traditional UV Transilluminators.
2- Designing and implementing a software controlling system into a traditional UV Transilluminator.
3- Building a quick and accessible technique for many diagnosis methods, primarily at research laboratories or at the point of care units.
4- Using a UV-transilluminator or UV-photo documentation system, to optimize the risk of the UV emissions.
5- Building a low-cost DNA/RNA detection smart system of about 250$ capable of obtaining qualitative and semi-quantitative data from gel analysis..

Project Summary

The UV Trans illuminator is a laboratory instrument designed to produce a uniform source of UV light for the excitation of fluorescent dyes. This device is ideally suited for observation, analysis and photo imaging of stained electrophoresis gels that are positioned on the glass viewing surface, for example sizing a PCR product, purifying DNA segment after a restriction enzyme digest.

Discussion

Gel documentation technology has come a long way since the day's scientists used instant cameras mounted above a UV box. There is now a virtual arsenal of imaging systems, most of which operate with either a CCD camera or flatbed scanner. Both types have advantages as well as drawbacks, each of which was carefully considered prior to designing this system. Other things which posed problems while designing this low-cost gel documentation system were selection of filter and camera. During verification of filters, we found that local orange filters were not able to block UV rays completely and UV tubes were visible in the background thus interfering with the results. Similarly, a wide variety of cameras are available in the market differing in resolution and cost e.g. CCD camera, webcam, digital camera.

Future Work

1- One of the ideas that can be applied to the device so it can be more flexible to use, is to use a specific logarithmic software so it can measure and analyses the data transferred from the camera by it's on without the need to be measured by the biologist.
2- Adding touch screen in the front panel of the device so the manual controlling would be easier.
3- Adding a fan to the design of UV Trans illuminator so that the heat becomes more evenly distributed.

Upper Limb Rehabilitation with Exoskeleton Device

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 6
Project Name	**Upper limb rehabilitation with exoskeleton device**		
Student Name 1	**Saja Amer**		
Student Name 2	**Kawthar Jamal**		
Student Name 3	**Zahraa Nabeel**		
Supervisor Name	**Dr. Ali Hussien Ali**	**Biomedical Engineering**	

Aims of The Work

Design the appropriate wrist exoskeleton device for rehabilitation the patient with;

1- Spinal cord injury patients.
2- Upper limb disorder after stroke.
3- Spinal muscular atrophy.

Project Summary

The wrist exoskeleton Robot design is an external frame was printed by 3D printing. The developed exoskeleton for wrist rehabilitation has three active DOF, corresponding to pronation/supination, flexion/extension and adduction/abduction joints. used to enhance the biological capability and restore muscular function.

Discussion

The exoskeleton design has the following properties

- Offering 3-DOF for wrist-forearm rehabilitation
- Requiring little maintenance
- Support the home-based therapy service as it designed with compact size such making it portable and facilitate its transition
- Simple, comfortable while having a low-cost material.

Future Work

- The EMG myoware sensors can be used to get signal from muscle.
- The push buttons and LCD included in such a device can be replaced with a touch screen.
- The mechanical design of the exoskeleton can be changed according to the patient need such that the forearm-wrist structure can be separated from the base of the exoskeleton so the patient can do his/her exercises at different statues.

Detection of Bacterial Infection By Using Gas Sensor

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 7
Project Name	**Detection of Bacterial Infection By Using Gas Sensor**		
Student Name 1	**Ali Hamodi Abd_AlHussien**		
Student Name 2	**Maryam Khalid Shalan**		
Supervisor Name 1	**Dr. Mohannad K. Sabir**	**Electrical Eng./ Computer & Control**	
Supervisor Name 2	**Dr. Muntaha Razaq**	**Biotechnology**	

Aims of The Work

The Aim of the Project (Detection of bacterial infection by using gas sensor) to design an electronic nose (snefer) that can distinguish between five types of bacteria that affect gynecological infections, intestine, stomach, throat by smelling the gases emitted from bacteria.

The electronic nose considered a diagnostic device that shortens time of showing results in a period not exceeding one minute.

Project Summary

In this project, we used five types of sensors (MQ2, MQ3, MQ4, MQ8, MQ135), each of which specializes in one or two specific gases such as methane, carbon dioxide, hydrogen and other gases that are considered excretory products of bacteria, that infects the vagina, stomach, or pharynx and causes its inflammation, the gases emitted from them were calculated by taking different samples of bacteria from different patients, cultivating them, tracking their growth, recording the proportions of gases at each age stage in which bacteria grow during their life cycle. In this way, we will be sensitive to Presence of bacteria and identification of their type.

A microprocessor (Arduino) used to connect the sensors so that the data can be collected after you provide it with a fixed voltage source of 5 volts, a fan that works to draw the air loaded with gases emitted by bacteria and deliver it to the sensors installed in the middle of a tight and closed design that prevents air from leaking to the outside only after passing through the sensors.

Discussion

Different bacteria are classified using three classification methods, the first (SVM) is the best method that can be used in this device to distinguish between different types of bacteria, as the percentage of excellence in them is 98%, the second (RANDOM FOREST) was the percentage of excellence 86%, while the third method (LOGISTIC REGRESSION) its percentage is 78%.

These percentages show how accurately the device can distinguish between different types of bacteria if they are all present in the sample or patient.

Future Work

1- Writing a program that can be downloaded to the device so that it can collect and analyze data from the patient and distinguish between bacteria automatically without the need for human intervention.
2- Can be developed by determine the appropriate type of treatment for the patient according to the quantity of bacteria present in the inflamed area whose presence can be sensed through the gases emitted from them.
3- Developed by expanding the scope in which he works and making his work outside the medical field, for example, the military and security services, where security men can benefit from it and use it in sensing the percentage of alcohol in drunk people by providing the device with sensors that sense the levels of alcohol in the air and fixing its values and pre-calibrated.

Adaptive Enhancement on Noise Modeling in ECG-Based Signal Processing

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 8
Project Name	**Adaptive Enhancement on Noise Modeling in ECG-Based Signal Processing**		
Student Name 1	**Maryam Salah Subhi**		
Student Name 2	**Aisha Their Shihab**		
Student Name 3	**Ali Abdulla Hieal**		
Supervisor Name	**Dr. Noor Kamal Al-Qazzaz**	**Biomedical Engineering**	

Aim of the work

1- To Develop different noise sources that are artificially modeled. Such as Power line interference(PLI), Baseline Wander (BW), Electromyogram (EMG) Noise, White Gaussians noise (WGN), Electrode Contact Noise (ECN).
2- To Add the artificially modeled noise to the normal ECG signal.
3- To Filter the generated noisy ECG signals using several denoising methods that should allow us recreate the clean ECG signal.

Project Summary

The electrocardiogram (ECG) is the recording of the electrical potential of the heart versus time. The analysis of ECG signals has been widely used in cardiac pathology to detect heart disease. The ECG non-stationary signals are often contaminated by different types of noises from diverse sources. In this study, simulated noise models were created for the power-line interference (PLI), electromyogram (EMG) noise, base line wander (BW), white Gaussian noise (WGN) and composite noise. For suppressing noises and extracting the efficient morphology of an electrocardiogram signal, various processing techniques have been recently proposed.

Discussion

In this project, ECG signal subjected to four main types of noises (PLI, EMG, BW and WGN) which are artificially modeled through using MATLB Program to get noisy ECG After signal and see how the shape of the normal ECG signal changed due to the applied .get noisy Electrocardiogram (ECG) signal we use Wavelet thresholding technique for signal enhancement and get results that the suitable mother wavelet function was Sym9 from Symlet group for de-noising and enhancement our noisy ECG signal with PLI, EMG and composed noise (summation of the four types mentioned above) also for BW and WGN we use Sym9, all this process with soft threshold technique and functions (sqtwolog rigrsure, heursure). Through these steps we get clean ECG signal as much as possible and using Graphical User Interface to show the final results..

Future work

This study will help medical doctors, clinicians, physicians and technicians to eliminate different types of noise. Moreover, the project could be crucial for the process of automatic diagnosis of different heart disease.

Pupillary Distance Measurement Based on Image Processing

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 9
Project Name	**Pupillary distance measurement based on image processing**		
Student Name 1	**Zahraa Raad Hashim**		
Student Name 2	**Lubab Dhiaa Ibrahim**		
Supervisor Name 1	**Dr. Nebras H. Ghaeb**	**Mechanical Engineering**	
Supervisor Name 2	**Osamah Ayad (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

1. To determine and measure the distance between both pupils.
2. Measuring the distance between eyes to ensure that pupils match up with the optical center of lenses.

Project Summary

This is a system whose main objective is to determine the appropriate distance between the pupils in the eye that is used when manufacturing eyeglasses, which depends in its structure on the Matlab language and without the need for a medical device that can be expensive or unavailable.

Discussion

This projects aims to calculate the PD, which is the distance between two pupil measured in mm; with the lowest errors as possible as we can, because the clinical importance of PD is to facilitate the correct positioning of ophthalmic lenses before the eyes to eliminate unwanted strain on the eyes, so that we ensure the best PD number delivered to a technician who makes the most suitable glasses for that patient and also to ensure that the pupils remain in the center of the glasses.

This project explores the application of a MATLAB algorithm and Image processing in order to determine the distance between the two pupils measured.

The computed values of PD by the Autoreflex device at al-khwarizmi lab, and measured values by the matlab code are almost very similar. The research has concluded that it can replicate the results from the traditional method of using the autoreflex or manual method includes the usage of a ruler measuring Pupillary Distance.

Future Work

As future development , an automatic system using a hybrid algorithm for the segmentation could be implemented. Moreover, increasing the number of the dataset would enhance the results, also, reduce some of the limitations in our projects.

It is also possible to use another programming language and turn it into an application on the phone.

Design of Warning System Module for Abnormal Heart Rate Detection

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 10
Project Name	**Design of warning system module for abnormal heart rate detection**		
Student Name 1	**Abbas Sabri Migta'a**		
Student Name 2	**Hussein Majeed**		
Student Name 3	**Mohammed Amer**		
Supervisor Name 1	**Yassir Salam (M.Sc.)**	**Biomedical Engineering**	
Supervisor Name 2	**Israa Safaa (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

1- Monitoring of heart rate and know the times of tachycardia and bradycardia to prevent cardiovascular disease.
2- Helping people who do not have a guardian by monitoring them from afar via Io T system.
3- Connecting Io T technology in the field of medical devices.
4- Link some social media programs, such as the Telegram application for health monitoring.
5- The device is small in size and easy to use for all age groups.
6- Assist the doctor in diagnosis to know the patient's record and pre-recorded readings.

Project Summary

Warning System Model (WSM), a medical device that monitors heart rate using a sensor and alerts the user when any abnormal heart rate occurs via the Internet. The medical device consists of two main parts: the first part (hardware), which consists of a microprocessor (ESP32), which is equipped with a WiFi system for transmitting and a heart rate sensor (MAX30100) and two power sources for the device (AC & DC), as well as contains a screen (LCD) to display the sensor readings. And the second part (Software), a Telegram program that was programmed with the ESP32 processor to send warning messages.

Discussion

When the device is turned on, the ESP32 processor searches for the Internet, and when connected to it, a welcome message is sent to the user by Telegram Bot. After applying the device to a group of people of different ages and genders, and comparing the results with accurate devices. It was concluded from the results recorded by WSM that the heart rate does not differ between genders as well as for ages, but when doing exercise, the heart rate is lower as the age increases. From the recorded results, it was found that the heart rate for ages (50- 60) years is 99.05 less than the heart rate for ages (20-30) years, which is 114.1 BPM when doing some moderate exercises..

Future Work

1- In future more health parameters are find patient and monitor in single device is implemented, so the time is save and identify more problems in patient health.
2- This proposed system is implemented in the minimizing of the PCB space is very useful to wear the sensor in patient body.
3- Minimizing the size of the device and making it in smart watch design with a small screen.
4- Enhance the warning system module by recording the heart beat continuously.

Design and Implementation of Digital FIR Filter Using FPGA

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 11
Project Name	**Design and implementation of digital FIR filter using FPGA**		
Student Name 1	**Ahmed Mohammed Deyaa**		
Student Name 2	**Ahmed Lutfi Youssef**		
Supervisor Name	**Khulood Eskander (M.Sc.)**	**Control System Engineering**	

Aims of The Work

The project is for designing & implementation FIR filter(band stop type) using a sufficient numbers of bands (tapes) And using it in filtration of biomedical signals (ECG,EMG,EEG) from any specific noise like 50HZ power line noise. And this FIR filter made by using FPGA technique.

Project Summary

In this project we designed FIR filter with 100 taps and then we implemented this design on the "vertex" FPGA family. This filter designed to removes and doing "band stop" for the "50HZ power line noise" that conjugated with the biomedical signals. As a case study we used ECG signal that we got it from "MIT" website. We built the structure of the 100 tap FIR filter type "band stop" on "xilinx" soft microprocessor that is related to the FPGA board. The resulted signal after filtration (with100 taps filter) was very clean and devoid of the 50HZ noise. In practical part we designed a 3 taps FIR filter and burnt it on the FPGA board type "spartan 3e", the resulted signal in FPGA and in the simulation was identical for the clean signal.

The design summary for 100 TAP FIR: Selected 7Device: 7vx485tffg1157-3, Slice Logic Utilization, Number of Slice Registers: 3202 out of ,%0 607200Number of Slice LUTs:9935 out of 303600 3%, Number used as Logic:9935 out of ,%3 303600Slice Logic Distribution: Number of LUT Flip Flop pairs used: 13137, Number with an unused Flip Flop: 9935 out of 13137 75%, Number with an unused LUT: 3202 out of 13137 24%.

Design Summary for 3TAP FIR: Selected Device: 3s500efg320-4, Number of errors: 0, Number of warnings: 0, Logic Utilization: Number of Slice Flip Flops: 520 out of 9,312 5%, Number of 4 input LUTs: 793 out of 9,312 8%, Logic Distribution, Number of occupied Slices: 721 out of 4,656 15%, Number of Slices containing only related logic: 721 out of 721 100%, Number of Slices containing unrelated logic: 0 out of 721 0% , Number of fully used LUT-FF pairs: 0 out of 13137 0%, Number of unique control sets: 3.

Discussion

In the design, in order to filter the signal, we need to use a number of taps, more taps means more clean and non-noisy signal. On the practical side the 100 taps need bigger hardware, so we had to implement it on a virtex board. If fewer taps are used, the signal will be less clean but less hardware.

Future Work

Design & implementation of IIR filter by FPGA.

Upper Limb Exoskeleton Design and Control

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 12
Project Name	**Upper limb exoskeleton design and control**		
Student Name 1	**Noor Fadhel Abbas**		
Student Name 2	**Zahraa Mohammed Taher**		
Supervisor Name 1	**Dr. Mahmoud I. AL-Kadi**	**Electrical Engineering**	
Supervisor Name 2	**Ali Kamil (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

The ultimate aim of our efforts is to design a helpful upper limb exoskeleton to support people with upper limb weaknesses in order to maximize their function and independence. This exoskeleton will be able to help in the flexion and extension motion of the elbow and shoulder during daily activities.

Project Summary

Mobile arm supports (MASs) are mechanical devices that support the weight of the arm and provide assistance to shoulder and elbow motions. Our Design demonstrates the usage of Poly Lactic Acid (PLA) in order to minimize the external weight on the arm. Furthermore, a servo motor with an EMG sensor and servo motor that is in connection with Arduino has been used to control the mobile arm support and to compensate for the remaining function. A load cell feedback system is used to sense the weight of the carried objects and specify the angle of the elbow joint. Additional linear DC motor with Arduino is used to support the shoulder motion.

Discussion

The upper limb exoskeleton was implemented and tested based on a 3D printed design by using a solid work program. Poly Lactic Acid (PLA) is used in order to minimize the external weight on the arm. The weight of the arm and shoulder is being supported also the shoulder and elbow motions are provide.

Flexion and extension are the main movements of the arm and shoulder that the patient will make while using the Exoskeleton which will be implemented either by using an EMG signal which is a voluntary movement of a muscle (Active mode) or movement that does not relate with muscle force, therefore there is no effect to muscle signal EMG (Passive mode). EMG signal acquisition by MyoWare sensor as input control for exoskeleton arm and observes the change which occurs in the threshold of amplitude, will improve our vision of the patient's progress in the rehabilitation process. A load cell feedback system is used to sense the weight of the carried objects and specify the angle of the elbow joint. Additional linear DC motor with Arduino is used to support the shoulder motion.

Future Work

The servo motor and the linear actuator motor will be replaced with a more suitable, lightweight, and stronger one to ensure the full mechanism work continuously.

Arduino and Bluetooth shield the system device will be placed to provide wireless control for the system of the device.

Increase the number of the used sensors (load cell sensors and Myoware muscle sensor) to increase the sensitivity and the accuracy of the device also make both parts of the device work more Synchronize.

A good acceptable appearance will be reached also the prototype will be designed that has a place for the device circuit and the batteries to make the device as compact as possible.

Design and Construction Model of Artificial Larynx

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 13
Project Name	**Design and Construction Model of Artificial Larynx**		
Student Name 1	**Zainab Ahmed Sultan**		
Student Name 2	**Wiaam Basim Mohy**		
Supervisor Name	**Dr. Waleed Jassim**	**Mechanical Application Eng.**	

Aims of the Work

Restoration of the voice and speech ability for patients suffering from removal of the vocal cords or the entire larynx due to laryngeal cancers or serious neck injuries.

Project Summary

The project is a hands-free electro larynx using a sound transducer controlled by an EMG signal obtained from the stern hyoid muscle in the neck. The EMG signal acts as a control for initiation and pitch control for the device to meet with individual preferences for male/female voices. The device depends on saw tooth electrical wave converted to a mechanical wave through the sound transducer that transmits sound and vibrations to inner tissues, then the patient can manipulate the speech produced by the mouth, tongue and teeth.

Discussion

The device consists of three main parts: the power unit that includes the batteries needed for the device to operate, the control unit for the electronic circuit, the control of the generated sound and its frequency, as well as the control of turning the device on and off, and the last unit which includes the sound transducer fixated on the patient's neck. Due to the pandemic of COVID-19 and safety reasons, it was not possible to test the device on actual patients suffering from total or partial removal of the larynx, but the device was tested on the students of the project, where we trained on the correct location to detect the EMG signal from the neck and the methods of controlling the sound's frequencies generated and experimenting with some sentences and questions to verify the efficiency of the device.

Future Work

The prototype of the artificial larynx device can be improved by manufacturing a compact integrated circuit that includes all electronic components to ensure a smaller size and the use of rechargeable batteries instead of single-use batteries with an internal transformer supplying the required power according to the specifications of each component.

One of the development proposals is to use an air pressure sensor or a high-efficiency microphone for word detection of silent speech, then process the signal, amplify it and display it through an external speaker. Another proposal that can be implemented is to generate speech through an external speaker that uses prerecorded sentences with the voice of a healthy subject stored in a database. The database includes several common sentences and the accompanying electrical signal obtained from the neck, and the pronunciation of the sentence in the voice of a healthy person under the supervision of speech and communication therapists. The last proposal may be used for research and case studies only and not for daily use because it is difficult to implement.

Design and Implantation of PID Controller for Insulin Pump Using FPGA

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 14
Project Name	**Design and implantation of PID controller for insulin pump using FPGA**		
Student Name 1	**Rafal Shamel**		
Student Name 2	**Alyaa Mazin**		
Student Name 3	**Ali Ihsan**		
Supervisor Name 1	**khulood Eskander Dagher (M.Sc.)**	**Control System Engineering**	
Supervisor Name 2	**Dr. Muntaha Razaq**	**Biotechnology**	

Aims of The Work

Design the PID controller for the insulin pump which calculates the insulin deliver to the human body for people who suffer from diabetes using Field Programmable Gate Array (FPGA) , These systems monitor blood sugar levels and deliver an appropriate dose of insulin when required.

Project Summary

Diabetes is a chronic metabolic disorder affecting 422 millions of people worldwide .The pancreas of those people either unable to produce insulin or do not produce enough insulin. When this occurs, blood glucose stays in the blood and cells cannot absorb as well as can not convert the sugars into energy. This disorder will lead to death especially people living in low-and middle-income countries;1.6 million deaths are directly attributed to diabetes each year. In order to reduce number of death and help patients the insulin pump is used (a medical device used for the administration of insulin in the treatment of diabetes mellitus) . This project presents the design and the implementation of Proportional –Integral- Derivative PID controller by using Field Program Gate Array FPGA for the insulin pump system.

The controller gains Kp , Ki and Kd was founded by using trial and error method .These gains are responsible for generating the required insulin that keep the glucose within acceptable level .

Twenty bit was used to represent the data of system as a singed two's complement fixed point number. the Device (3s500efg320-4) is selected to hard ware implementation and the proposed design summary as follows : Number of Slices (305 out of 4656 6%), Number of Slice Flip Flops (62 out of 9312 0%), Number of 4 input LUTs (217 out of 9312 2%) ,Number of IOs (102) and Number of bonded IOBs (0 out of 232 0%) .The FPGA hardware implementation results was verified with the MATLAB simulation result and they were approximately identical.

Discussion

The FPGA response approximately match with the Simulink response the mild error is due to the quantization error which consider acceptable and can deal with it and the controller can used according to the patient need which determined by doctor.

Future Work

1- Take the disturbance in the design consideration which will be as a meal or exercise.
2- Use different transform method such as bilinear in finding the digital PID model.
3- Use intelligent auto tune method to tune the PID..

Wearable System for Detecting Abnormal Gate Behavior

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 15
Project Name	**Wearable system for detecting abnormal gate behavior**		
Student Name 1	**Alaa Mohammed Jassem**		
Student Name 2	**Sinaa khalil Muhsin**		
Supervisor Name	**Dr. Hussam kadhem**	**Mechanical Engineering**	

Aims of The Work

Quantitative gait analysis (QGA) is the systematic study of human walking, in terms of kinematics, kinetics, energy expenditure and spatiotemporal parameters useful for the characterization of human movement. Gait analysis is applied in several fields of study for different purposes, such as the assessment of gait pathologies and identification of gait abnormalities.

Project Summary

Our system have four main modules:

1- the first module has two sensitized insole each insole consist of two kinds of sensors: The force-sensitive resistors (FSRs) to measure foot planter pressure and the inertial measurement unit (IMU) to measure foot angles while walking.
2- The second module is microcontroller to acquisition data from the sensors.
3- Third module is (NRF) work us transmitter for row data.
4- Fourth module is (NRF) receiver to receive row data for reprocessing it in computer programs.

Discussion

A prototype of wireless wearable sensor system was evaluated in simultaneous measurement of foot angles, stride length and pressures distributed through different parts of the foot. The system could measure joint angles of the lower limb of healthy subjects with stable and reasonable accuracy. we find the system is encouraging and show that is feasible to be recommended both for research and clinical applications outside a typical gait laboratory after add more features on the system.

Future work

Future work should capitalize on the results of this work to explore efficient algorithms for recognizing gait disturbances based on real time foot planter pressure distribution and foot angles to detect the gait parameters such as stride length and cadence data provided by these wearable's. Time series analyses of the entire stride should also be considered in future efforts to explore the full functionality of the wearable in supporting everyday gait monitoring to detect normal and abnormal behavior of gait cycle in easy way. We can add Wi-Fi shield to the microcontroller to send the data to the far places. We can add audible alarm to alert the subject if there are any problem or wrong movement that it useful in sport applications.

Electric Activity Level Detection for Diabetic Neuropathy Using EMG Signal Processing Part II

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 16
Project Name	**Electric activity level detection for diabetic neuropathy using EMG signal processing part II**		
Student Name 1	**Hiba Adnan**		
Student Name 2	**Dhuha Haleem**		
Student Name 3	**Ghasaq Khalid**		
Supervisor Name	**Dr. Mahmoud I. AL-Kadi**	**Electrical Engineering**	

Aims of The Work

To detect the effect of diabetes on the biceps muscle by comparing the recorded EMG signals for diabetic patients with the EMO signals obtained from normal cases after processing and filtration.

Project Summary

We recorded about 20 EMG signals of cases (10 signals, 5 males and 5 females for normal cases and 10 signals. 5 males and 5 females for diabetes patients) after choosing one muscle in the upper limb which is the (BICEPS) each case apply two tests (before lifting a 2Kg weight and after, each test for two minute) to know when the muscle effected greatly in which test and when the fatigue occur. These signal as known effected with many external factors at environment thus it can't extract features from noisy signal so the signals was been processed by MATLAB using filters, Conventional Digital Filters like notch filter to reduce the electrical effect and band pass filter to limit the signal according to the EMG frequencies (O_ 450hz) to eliminate the interface of other signals and Discrete Wavelet also used to eliminate the further unwanted signals. After filtering, taking extraction features that can show the differences between normal and patient signals, the mean, standard deviation, sample entropy and Shannon entropy, AU these features proofing the variance between control muscles and patient muscles in size and power.

Discussion

After observation of all results, it is clear that the diabetes mellitus has a significant impact on skeletal muscles and it causes loss or damage as a result to the lack of insulin in the muscles which increases the level of sugar that lead to gradually damage of the muscle then losing the ability to move. As a comparison between the signals obtained from diabetic and normal cases we can clearly observe how the EMG signals of diabetic subject has a small amplitude and power compared to the signals obtained from normal subjects, as well as the extracted features after filtration and signal processing also showed a significant difference between the EMG signals of diabetic and normal subjects..

Future Work

There are many ideas we can suggest to develop this project, the first one is to take more subjects and record the EMG signal for them this can give us more signals therefore the results and the final decision made to identify the effect of diabetes can be more accurate, in addition we can also extract more features beside the features we extracted which must be suitable for our analysis, in addition to that we can take subjects with type II DM beside the type I DM subjects we focused on to get better results that could let us precisely decide the effect of DM. Lastly, the procedure of recording signals to processing and feature extraction can be developed to diagnose the diabetes mellitus in subjects even if they are not previously diagnosed.

Design and Construction Model of A Mechanical Ventilator

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 17
Project Name	**Design and construction model of a mechanical ventilator**		
Student Name 1	**Mariem Emad Khudhaier**		
Student Name 2	**Noor Jaafar Abd-Alkareem**		
Supervisor Name	**Dr. Waleed Jassim**	**Mechanical Application Eng.**	

Aims of The Work

After going through the Corona pandemic, at a time when hospitals are full of patients with poor breathing and as a result of efforts to help all those infected with the Corona virus to breathe and survive when there are not enough beds and care in the hospital, it was necessary to design low-cost a ventilator for home use with simple system-use interface. The main objective of this device is to Relief the collapsing of the lungs infected with covid-19.

Project Summary

Preserves the life of the covid-19 infected person while the patient is still at home and without the need to go to hospitals overwhelmed with infected people by using low-cost parts to push air and oxygen into the patient's lung and control them by this integrated mechanical-electronical system, the device function is done by pushing controlled amounts of air volume , pressure, and flow to the lungs using a system consists of PVM and a PEEP valve (that keeps positive pressure inside lungs which lead to never collapse again when exhaled ensure).

Discussion

The project generally consists of two parts, the mechanical part includes integrated system to push air into the patient's lung, and the electronical part that will drive the mechanical pat and views its results. The device takes power from (AC) power source then modifies the signal by input power controlling unit ,the input power will operate the device then the user must set the desired speed and time of pushing air until reaching the desired air flow, volume, and pressure that will be showed on the screen.

Future Work

1- Add moving wheels to the frame to make it easier for the user to use it.
2- Use a servo motor with higher torque to provide more efficient air pushing
3- Connect the device to an UPS to avoid problems that may be caused by the AC power source.
4- A suitable length of tube should be placed between the holder and the ambulatory bag so that it is easy for the patient to use it.
5- It is necessary to set an alarm for the device to alert the user if any problem with the device such as a leak.
6- The software of the device must be developed by considering the values of pressure, flow and volume as an input to the device instead of using speed and time.

Robust EEG Markers to Improve BCI-Based Stroke Patient Rehabilitation

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 18
Project Name	**Robust EEG markers to improve BCI-based stroke patient rehabilitation**		
Student Name 1	**Aysha Mohammed**		
Student Name 2	**Qoutaiba Sabah**		
Supervisor Name 1	**Dr. Noor Kamal Al-Qazzaz**	**Biomedical Engineering**	
Supervisor Name 2	**Alaa A. Aldoori (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

1. To identify the effects of the MI-based BCI therapy by investigating sensorimotor areas using frequency and time domain features to allow anatomically specific voluntary regulation for stroke patient.
2. To detect imagined movements that are typically required within conventional rehabilitation therapy with good identification accuracies.
3. To select particular methods that help in enhancing the MI-based BCI systems for stroke patients using EEG signal processing.

Project Summary

Stroke is the second largest cause of death worldwide and one of the most common causes of disability. However, several approaches have been proposed to deal with stroke patient rehabilitation like robotic devices and virtual reality systems, researchers have found that the brain-computer interfaces (BCI) approaches can provide better results. In this study, the electroencephalography (EEG) dataset from post-stroke patients were investigated to identify the effects of the motor imagery (MI)-based BCI therapy by investigating sensorimotor areas using frequency and time domain features and to select particular methods that help in enhancing the MI-based BCI systems for stroke patients using EEG signal processing. Therefore, to detect the imagined movements that are typically required within conventional rehabilitation therapy with good identification accuracies, the conventional filters and wavelet transform (WT) denoising technique were used in the first stage. Next, attributes from frequency and entropy domains were computed. Finally, support vector machine (SVM) classification technique were utilized to test the motor imagery (MI)-based BCI rehabilitation. The results demonstrate the capability of the WT denoising technique together with the used features and SVM classifier to discriminate the tested classes of left hand, right hand and foot MI-based BCI rehabilitation. This study will help medical doctors, clinicians, physicians and technicians to introduce a good rehabilitation program for post-stroke patients.

Discussion

In this project, the effects of the MI-based BCI therapy by investigating sensorimotor areas using frequency and time domain features have been investigated to allow anatomically specific voluntary regulation for stroke patient. Moreover, the imagined movements that are typically required within conventional rehabilitation therapy with good identification accuracies have been identified. Furthermore, a particular methods using WT denoising technique, features μ, β, and μ/β from frequency domain and TsEn from time domain and SVM classifier to help in enhancing the MI-based BCI systems for stroke patients using EEG signal processing. All these results are promising and may help in obtaining reliable markers for stroke patient rehabilitation to provide suitable treatment programs.

Future Work

- More features can be extracted such as approximation entropy (ApEn) and sample entropy (SampE)
- Another possible research direction is the application of Empirical Mode Decomposition method (EMD) as a denoising technique.
- Other classifiers can be considered to compare the classification performance like k-nearest neighbors (kNN).
- The classification stage can be extended to next phase, namely, actuation and control of external devices through motor imagery based BCI.

Design of Air Purifier System in The Room of Patients

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 19
Project Name	**Design of air purifier system in the room of patients**		
Student Name 1	**Fatima Akram Noori**		
Student Name 2	**Zahraa Ali Ahmed**		
Supervisor Name	**Yasser Salam (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

Measuring the temperature,CO2 and humidity hospitals rooms , to protect the patient from cases of suffocation or dry skin, skin diseases, or be a suitable medium for the growth of bacteria and parasites.

Project Summary

We are taking measurements of air purity in several different rooms in hospitals such as the intensive care unit, surgery room, children's rooms and doctors rooms. Then we compare these readings with optimum health values and see if they match or differ from them.

Discussion

The aim of this study is to design a device that measures air purity (temperature, humidity and CO2 value) in the hospital and compare it with the optimum values , as we explained previously. The temperature control in the hospital is directly related to the patient's comfort, as cold and hot temperatures can be a big problem for patients, especially for patients such as the elderly or children in the maternity ward, the appropriate temperature in the patient room is close to 20 to 24 degrees Celsius and humidity range between (40-60%), as health safety depends on a large factor in proper temperature control, because bacteria and diseases multiply in very hot conditions, and bacteria will spread quickly in rooms that are not equipped with ideal ventilation, and that Carefully monitoring the temperature and humidity in patient rooms, will help reduce the risk of the spread of airborne diseases significantly. Also low humidity causes dryness of the skin , the CO2 value throughout the hospital is less than 1000 ppm, and if the value reaches 1400 ppm, the system will trigger an alarm, because the high percentage of CO2 causes cases of suffocation for patients and the medical staff in the hospital. It is important to note that the concentration of CO2 in the atmosphere depends mainly on the number of people present and their activities. Also, a significant decrease in the value of CO2 is relatively dangerous because it is considered a safe antimicrobial, and has important medical applications, as it acts as an antioxidant, anti-inflammatory and immune system stimulator, and researchers believe that it may be effective against the emerging corona virus.

Future Work

1. Use arduino (uno).
2. Using a heat sensor (DHT22).
3. Use a Humidity sensor (DHT22).
4. Use of a carbon dioxide sensor (Telaire 6613).
5. RTC.
6. Design an alarm system (audio or visual or both) to alert when the specified range values.

Design And Fabrication of Lumber Region Passive Spine Exoskeleton

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 20
Project Name	**Partial Han Design And Fabrication of Lumber Region Passive Spine Exoskeletond**		
Student Name 1	**Mohammad Firas Azmi**		
Student Name 2	**Mohammad Hussain Adnan**		
Student Name 3	**Ali Thamer Sadiq**		
Supervisor Name 1	**Dr. Iyden Kamel**	**Zoology**	
Supervisor Name 2	**Usama Fadhel (M.Sc.)**	**Mechanical Engineering**	

Aims of The Work

The main objective of exoskeletons for low-back is to avoid injury while keeping worker movements adaptability during forward-bending jobs. Exoskeletons are designed to decrease the workload on the lumbar region by taking over four parts of the back muscle activities needed to counterbalance moments because to gravitation on the upper part of the body and load carried, with mechanical loading still being the major risk factor for LBP .

In passive exoskeletons, passive spring acts as the components that are used to produce an extension moment while bending forward.

Project Summary

This research focuses on designing a device that helps in the reduction of back pain affecting the spine, specifically lower back pain impacting the lumbar vertebrae. Modern methods were adopted during the design. Initially, the design is created on the computer using software such as AutoCAD and Solid Works. Then the device details are simulated using the Open Sim program with prior data representing the human body, spine, lower back, and the loads imposed on it. After conducting the simulation, the areas of high loads and stresses will be identified, and the design will be modified based on the new data. The initial design was reached and implemented in reality, after several experiments in the simulator. To determine the device's efficiency, tests were performed both with and without the device. The angle was measured and through which the velocity and acceleration were known. EMG was recorded for the muscles surrounding the lumbar vertebrae . Finally, after completing the tests, the data was analyzed and defects were identified in the initial design, and then the initial model was modified to reach a final model.

Discussion

The EMG test results demonstrate that lifting duties could decrease muscle activity in the lumbar region and upper arms. It had a larger helpful impact on upper arm muscles than lumbar region muscles. That's in accordance with the user's feedback. It would make lifting the box much easier if someone wore it. Muscle fatigue in the lumbar region and upper arms is predicted to be decreased when workers utilize it when lifting and bending over. When workers do handling duties, shoulder and thorax belts are aimed at reducing the stress on their arm muscles. However, this form puts a lot of pressure on the shoulders and thorax. Exoskeleton design is commonly used to eliminate discomfort by dispersing pressure across a wide region. A skin injury can also be avoided by adding soft padding to the exoskeleton. As a result, efforts to widen the belt and add soft padding should be included in the development plan.

It's worth mentioning that the study's small sample size is a drawback. The data acquisition of the users' forearm muscles, lower back, and abdomen were not performed at the same time due to the limitations of the EMG channels.

Future work

In the future using an 8-channel device. The device would be tested for a long duration and completed in the workshop after the design has been optimized. Many workers would be invited to utilize it during real lifting duties, allowing for a more accurate evaluation of the individual lifting assist device. Additionally, the belts' customizable range was too wide to accommodate users of various sizes. The devices of various sizes would be considered to adjust to various users. The pulley is replaced by a gearbox, thus providing an automatic back-return movement when bent. To avoid movement restriction and gearbox can be controlled according to user weight. The materials used in the manufacture of the device must be strong to bear weights and at the same time light in weight so as not to affect the user.

Velocity Field for a Closed Infant Incubator

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 21
Project Name	**Velocity field for a closed infant incubator**		
Student Name 1	**Dawood Jamal Dawood**		
Student Name 2	**Tamara Ali Abd Al - Ameer**		
Supervisor Name	**Taha Y. Khalaf (M.Sc.)**	**Chemical Engineering**	

Aims of The Work

Calculate the velocity field of the air that enters the closed infant incubator and control the temperature of the chamber with that air.

Project Summary

Design a prototype for the chamber of a closed infant incubator with a program called "SOLIDWORKS" and analyzing the velocity field of the air using a program called "ANSYS".

Discussion

The closed incubator is designed to improve the health of an infant who has problems with his biological systems or experiencing abnormal health conditions. So the warm air with a convenient with a convenient velocity with convenient type of flow and convenient temperature. The most common problem in the temperature is that the temperature goes upward progressively and goes downward progressively and it is difficult to control it. To control the temperature of the incubator using that air with the convenient temperature and provide convenient environment according to the situation of the patient infant.

Future Work

For the closed infant incubator there are many types that could be taken and developed but for our design the size of the inlets and outlets could be increased and the corner of the roof could be curved, impeller fan or compressor could be added to the design with pipes to pump and deliver the air.

Computational Fluid Dynamics Study of An Axial Blood Pump

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 22
Project Name	**Computational fluid dynamics study of an axial blood pump**		
Student Name 1	**Melad Raad**		
Student Name 2	**Shahad abd_alnabi**		
Supervisor Name	**Taha Y. Khalaf (M.Sc.)**	**Chemical Engineering**	

Aims of The Work

In this project, a new miniature axial blood pump has been designed and studied which can be easily implanted in the human body. In this design, the pump overall length decreased by a little increasing in the pump diameter, and new blade geometry is used to produce a streamlined, idealized, and non-obstructing blood flow path in the pump.

Project Summary

- We have researched the subject of blood pumps, its types and its dimensions.
- We draw the prototype by using solid work program.
- We have specified the inlet and outlet of the flow for the prototype.
- We start to analysis the prototype by using analysis program.

Discussion

As we display two cases (Axial pump with diameter of 24mm and velocity of 0.22m/sec, axial pump with diameter of 20mm and velocity of 0.16m/sec). Axial pump with diameter of 20mm and velocity of 0.16m/sec case is optimum performance because it shows)max velocity=0.88m/sec, max pressure=964.6pa, max shear stress=84pa(.In addition to these cases, we display another case with diameter=12mm, but the inlet velocity in this case =0.26m/sec and these value as inlet velocity is too high, so these case is the wrong case..

Future Work

A reason for the dissociation between maximal and submaximal performance may be that LVADs are able to provide sufficient support at rest and during submaximal work, but insufficient support during maximal performance, because of the constant pump speed. It has indeed already been shown, that exercise capacity with increasing pump speed can be improved compared with that at constant pump speed especially for patients with more preserved right ventricular function A reason for the dissociation between maximal and submaximal performance may be that LVADs are able to provide sufficient support at rest and during submaximal work, but insufficient support during maximal performance, because of the constant pump speed. It has indeed already been shown, that exercise capacity with increasing pump speed can be improved compared with that at constant pump speed especially for patients with more preserved right ventricular function.

EEG-Based Emotion Recognition Using Combined Feature Extraction Method

University of Baghdad	Al-Khwarizmi College of Engineering	Biomedical Engineering Depart.	Project No. 23
Project Name	**EEG-based emotion recognition using combined feature extraction method**		
Student Name 1	**Shams Qusay Khalil**		
Student Name 2	**Hajer Natik Fahal**		
Supervisor Name 1	**Reem J. Channo (M.Sc.)**	**Environmental Engineering**	
Supervisor Name 2	**Sedeem Nabeel (M.Sc.)**	**Biomedical Engineering**	

Aims of The Work

Emotions play an important role in the daily life of human beings, the necessity and importance of automatic emotion recognition has increased with increasing role of human computer interface applications. Emotions are extremely important for determining condition of mind. So, emotions recognition are needed in modern health care especially in interaction with patients suffering from stress or depression, in other medical cases in which patient have difficulties in describe their feelings and for children.

Project Summary

Human emotion plays an important and significant role in communication activities. Understanding and further recognizing emotions have become a key issue to construct Human-Computer Interaction (HCI) system.

EEG signal has been widely used in emotion recognition. However, too many channels and extracted features are used in the current EEG-based emotion recognition methods, yet computationally complex. In this project we will introduce a combined feature extraction technique that is computationally relatively easy, yet efficient to detect the emotional state of the volunteer under test.

Discussion

From the result, it is it is clear that there is difference in the alpha waves of positive and negative emotions. In positive emotions alpha is high, because alpha is the resting state for the brain. It seen in calmness, alertness, mind/body integration and learning. When person is happy he/she is very existed and full of energy. When people are happy and are relax and do not have any type of stress or very low stress then alpha waves are seen. For beta wave, it is activated higher in negative emotion. When the peoples are awake and alert, there brain is operating in the beta state. Beta brainwaves are important for effective functioning all of the day, but they also can translate the stress, anxiety and restlessness of person. The depression, which is also negative, has significant increase of beta wave.

Future Work

1. Improvement of the project by using classifiers to be used in training of BCI which can be useful in many applications.
2. In the future we expect advances in body sensors and head-mounted devices, this contributes to the development of emotional computing systems, we expect better machine learning and pattern recognition algorithms as well as improved accuracy and speed in BCI systems.
3. We can use more subjects to know their emotions and recognize it, this helps to improve performance and accuracy.
4. Future research can also be extended to design a means to avoid significantly negative emotions and induce patient desired emotional states to promote mental and emotional well-being of patients and achieve faster treatment.

5. We can also combine eye movement signals and EEG to identify feelings by achieving 60 eye movements related to emotions and identifying the intrinsic eye movement patterns for three emotional states (positive, neutral and negative). This combination leads to improved perception of feelings and better accuracy..