Model of Solar Hydrogen and Fuel Cells System

Musaed Saeed Alyazeedi

Renewable energy is more attractive now due to the needs of meeting the demand of energy in the future. Many challenges have appeared as a result of global warning resulting from increases in carbon dioxide emissions. High prices and a predicted depletion of oil are encouraging researchers to look at renewable energy sources. Hydrogen is a promising gas because of its abundance and its relationship with water. Hydrogen can be extracted from water and there are many ways most notably, electrolyzer, steam reform, thermochemical cycles, and partial oxidation.

This project presents a real model that aims to show how the elements of the photovoltaic system electrolyzer and fuel cells work to overcome and reform intermittent and fluctuating renewable energy. The challenges of PV are sun set, cloudy skies, snow and dust. These issues block sunlight captured via photovoltaic, so, electrolyzer produces and stores it via hydrogen tank. During a normal day, PV generates electricity to feed load, but if the sky is cloudy or raining we have a lack of generation. FC will generate power to feed the load directly, and this fuel will be the gases that were produced and stored via electrolyzer the previous day.

Keywords: Renewable energy, electrolyzer, photovoltaic, solar hydrogen

1 University of Bridgeport, alyazeedi65.com
Saliva Glucose Sensor

Anugnya Parvathgari

In this poster, the significance of salivary biomarker’s therapeutic application has been reported for screening upon focusing on the bio-sensing technology, a modeling tool COMSOL. Multiphysics is used to create a saliva glucose-sensor. Saliva, a diagnostic fluid of highest ease for monitoring the glucose levels by a procedure of analysis where the Gingival Cervicular Fluid plays a pioneer role in the detection of focus. The correlation between the gingival crevicular fluid and the capillary blood glucose levels. A biological sensing element (glucose oxidase enzyme) is placed in contact with an electrochemical transducer which converts into an electric signal. Here the enzyme is immobilized onto a gold film electrode to eliminate the oxygen level dependence. The geometry of the sensor consists of two electrodes 1. Working electrode, 2. counter electrode, where the redox and oxidation reactions occur. This cycle repeats and a proportionate electrical signal is generated. The glucose concentration present in a saliva sample is oxidized enzymatically and proportionate electric signal is generated at different periods of time is verified through COMSOL simulations.

1 University of Bridgeport, aparvath@my.bridgeport.edu
QKD INITIATED BY AUTHENTICATION OF EPR IN 3 WAY CHANNEL

Abdulbast Abushgra, Khaled Elleithy

Abstract-During tens of centuries, cryptography is the word that means the art of encoding and decoding messages. Recently, many of the scientists came up with new sparkling ideas that reflect using the quantum mechanics in security system. More precisely, the scientists have utilized the law of physics through sending a photon from side to another under the guarantee of non-cloning theory. In 1984, Bennett and Brassard announced the more interesting quantum key distribution (QKD) that based on submitting a photon randomly in four states. Each state has the code that represents the superposition of the submitted photon. For instance, the states should be measured by well-known bases, which the one basis shows the orthogonal of two states. Here, this research discusses a new scheme that focuses on the mechanism of creating a secret key between two illegitimate parties (Alice and Bob). The new scheme employs two quantum theories, which one of these is considered to follow the EPR Pairs theory and the other is BB84 protocol. EPR is related to Einstein–Podolsky–Rosen, who came up with this theory. Moreover, EPR spends 50% of the distributed bits on bases negotiation and uses another 50% of the shared bits to perform the random sampling public discussion for the eavesdropping check. Therefore, legitimate parts of the EPR protocol share only 25% of the distributed bits. Next, BB48 is the core of QKD where the majority of the recent QKD protocols were derived from this protocol. Then the new scheme extracts the advantages of each previous protocol and utilizes these features to be designated in new scheme. The new scheme supports the authentication as a first step before establishing the quantum communication. Later, if the authentication was approved, Alice and Bob can start the communication to create the secret key. Finally, Alice and Bob should have the enough information to exchange this information on classical channel.
Exploring Teaching Strategies in Workshop Sessions of BioSolid Mechanics Class

Alexander Kotelsky¹, Mark R. Buckley¹, Barbara Masi²

Students gain a greater understanding of course material when they are asked to actively participate in class. Recent studies have demonstrated that active learning increases examination scores, whereas lack of active learning leads to higher failure rates in STEM classes. In this study, we focused on the design of workshops for an upper level biomedical engineering class. A novel approach was used where two types of workshops were alternated: one promoting convergent thinking (CT) by providing students with challenging problems and another requiring students to construct their own problem set, thus promoting divergent thinking (DT). It was hoped that these workshops would force students to think about concept application in different ways as the course progressed. The overall goal of the project was to establish the framework of this dual approach and begin the process of optimizing its implementation. This dual approach also enabled comparison between the types of workshop with regard to performance, level of engagement, confidence in material and overall satisfaction. In addition, we examined the challenges and opportunities for improvement of learning in a dual workshop course design.

Based on the reported data, 15 students preferred CT workshops, 5 students preferred DT workshops and 5 students preferred both workshops. All the students preferred to have workshops as opposed to not having the workshops at all. The interviewed students noted that they were occasionally confused by flawed solutions of other students, thereby influencing their satisfaction with the DT workshops and confidence levels in course material. Class observation during the workshops showed that students were more attentive and more engaged in DT workshops. The differences in academic performance and confidence in material were not significant. According to the instructor, the course was greatly improved by incorporation of the workshops. The workshops helped the students understand the course material better and promoted participation in class discussions.

This novel model of alternating workshop types offered a new opportunity for students to think differently and learn material in an active learning – based course design. This design promotes peer mediated teaching and potentially “revolutionizes engineering education.”

Keywords: workshop design, convergent thinking, divergent thinking, biomedical engineering

¹ Dept. of Biomedical Engineering, University of Rochester, Robert B Goergen Hall Box 270168, Rochester, NY 14627, akotelsk@u.rochester.edu, mark.buckley@rochester.edu
² AS&E, University of Rochester, Lattimore 213A, Rochester, NY, barbara.masi@rochester.edu

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Poster Abstract

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Wearable ECG for Long Term Monitoring

Mashal Alenazi¹, and Hassan Bajwa²

Electrocardiography (ECG) is a diagnostic tool or test that measures and records the electrical activity of the heart. According to CDC, about 5.1 million people in the United States have heart failure. One in 9 deaths in 2009 included heart failure as contributing cause. Also, heart failure costs the nation an estimated $32 billion each year. For many people, early warning signs appear in the months, weeks, or days before a full-blown heart attack. Many people think a heart attack is sudden but the truth is that many heart attacks start slowly and develop slowly, over hours, days, and even weeks before a heart attack occurs. Conventional ECG machine have 12 leads that are attached in twelve different angles to record heart rate. This type of machine is not designed for long term monitoring. In addition, doesn’t attach to the patient for long term monitoring or during a normal activates outside the healthcare facilities. The use of real time ECG mentoring is important to save lives because the doctor or healthcare provide can reach the patient during the “golden hour”. Wearable ECG monitoring that we have designed can monitor and record heart rate for the long term. This design has three leads or electrodes that placed on patient’s right arm, left arm, and right leg to detect the heart rate, then send the data to the healthcare provider continuously. The system uses an Arduino kit to process the ECG signal. Sound wires are connected between the electrodes and Arduino kit. The tricky point here is the long term electrodes. The electrodes have to last long term for weeks or even for a month. Therefore, a solid gel electrode is a good choice even though it won’t last for weeks or months. The proposal design has two belts that can be paced on the top of the electrodes to gain advantages. These belts are reduced to reduce the artifact. The artifact is a central concern for the wearable ECG monitor because the ECG signal has to detect and record signals every moment. So, when the patient moves or is working out, the artifact will increase. By using the proposal belts, the artifact will minimize. Moreover, these belts are working to keep the moisture and sweat on the skin to increase the electrodes lifetime. That means the electrodes can last for long term. In addition, using these belts, we assure the electrodes will not pull out when the patient is working or walking around. The instrumentation amplifier and operational amplifier are connected with other electronics side by side with the Arduino kit to process and display the signal on an oscilloscope or computer. This design can be integrated into a T-shirt or sweater to be easily worn. The proposed design has been built and demonstrates good results. Also, a (PQRST) signal has been detected, so the heart rate will be shown as well as ECG signal diagram. This design will save many lives by detecting heart rate abnormality earlier.

Keywords: ECG, Wearable, Monitoring, Long Term

¹ University of Bridgeport, malenazi@my.bridgeport.edu
² University of Bridgeport, hbajwa@bridgeport.edu
Remote Patient Monitoring using Safe and Secure WBAN technology

Neeraj Joshi¹, Syed Zain Hassan Zaidi, Mohamed Ben Haj Frej

In recent years a tremendous growth and development in products related to health monitoring and sensors had opened new dimensions in various academia and research fields. Major Companies like Apple, Fitbit are involved in production of BAN (Body Area Network) devices. To implement BAN transmission techniques like electric field communication, electric current communication and electromagnetic (radio wave) communication are used. In this poster we proposed an idea of WBAN (Wireless Body Area Network), which is safe and secure enough to transmit/view confidential data related to patient. In order to improve overall security of WBAN, Authentication is an important factor to be considered. This poster concludes some of the major work done on biometric authentication mechanism by different researches and their results shown in tabular form. After going through all these various biometric schemes for securing WBAN authentication phase, one of the appropriate technique would be to utilize multimodal biometric authentication proposed by Manjunathswamy B E et al. This poster can act as a simple but effective guide for design and development of health monitoring devices.

¹ University of Bridgeport, Department of Electrical Engineering, njoshi@my.bridgeport.edu
Neurobiological Based Navigation Maps Created During the SLAM Process of a Mobile Robot

Peter Zeno

Abstract
In theory, an autonomous mobile robot’s ability to navigate with greater intelligence and flexibility in a dynamic environment would be possible if its navigation system was modeled after that of biological creatures. More specifically, to create an agent that mimics neurobiological navigation cells and neural network connections as found in the hippocampus and entorhinal cortex of rodent brains. To date, however, there has been very little measurable success in this area of research and prototype development. This is mainly due to the fact that only a very small portion of the brain’s functionality in the neural navigation circuitry is vaguely understood (as is true for the rest of the brain). However, using what is known about the situations that cause firing of the specialized navigation and spatial awareness cells in the hippocampus and entorhinal cortex of rodents (i.e., place cells, direction cells, border cells and grid cells), this paper proposes a unique, neurobiological based solution to the map storage of navigational data which will allow for a simplified, cognitive path planning algorithm to be used on these truly cognitive maps. The mobile robot platform used in this study is named ratbot.

Keywords: Neuron, Spatial Awareness, Hippocampus, Path Integration, Cognitive Map

1 Robotics, Intelligent Sensing & Control (RISC) Lab, School of Engineering, University of Bridgeport, Bridgeport, CT 06601 pzeno@my.bridgeport.edu
Electrospun Separators for Structural Battery Applications

Wisawat Keaswejjareansuk, Jianyu Liang and Xiang Wang

Lithium-ion battery (LIB) has been utilized in variety applications as energy source. Structural battery is a new approach that employs multifunctional material concept to use LIB with load-bearing capability for structural applications. LIB usually consists of cathode, polymeric separator, and anode. The separator has been known as the weakest part of the cell. This work aims at creating electrospun polymer membranes with nanostructures as next generation LIB separator with improved mechanical properties. Electrospinning (ES) employs the electrostatic force to control the production of nanofibers from polymer solutions. Process parameters, such as type of polymer, concentration of polymer solution, ES voltage, and ES duration, have been studied to achieve the desirable membrane property. Many characteristics of electrospun polymer membrane would affect the performance of it as the separator in LIB, including surface morphology, microstructure, mechanical property, electrochemical performance, and thermal stability. In this study scanning electron microscopy, electrochemical testing, mechanical testing, and dynamic mechanical analysis have been used to characterize the electrospun membranes and to optimize the process parameters for an improved separator for structural batteries.

Keywords: Electrospun membrane, structural lithium-ion battery, separator, characterization

1 Worcester Polytechnic Institute, 100 Institute Rd, Mechanical Engineering Department (Graduate Student), Worcester, MA 01609, keaswejjareansuk@wpi.edu
2 Worcester Polytechnic Institute, 100 Institute Rd, Material Science and Engineering, Washburn Shops, Worcester, MA 01609, jianyul@wpi.edu
3 Worcester Polytechnic Institute, 100 Institute Rd, Material Science and Engineering, Washburn Shops (Visiting Faculty), Worcester, MA 01609, xwang12@wpi.edu

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The Effects of Intermittent Solar Radiation in Off-grid Solar Power System A Case Study of Two Cities; Irbid and Abu Dhabi 'Worst Month' Method

Taleb Hussein Al-theanat¹, and Mhd Aymen Lpiza²

Many Photo-Voltaic (PV) Engineers design the PV system based on the annual average solar irradiation values of the installation area. This design is adequate if the weather of the installation area provides a small variation between the maximum and minimum solar irradiation values. This study illustrates the impact of the solar radiation by comparing the design of two off grid PV systems installed in two different locations have same annual average solar irradiation values. The case study selected the city of Irbid in Jordan and Abu Dhabi in UAE. The monthly average irradiation values in Irbid are very diverse where the minimum, average and maximum values are spaced compared with the values in Abu Dhabi which has no significant variation of solar irradiation from month to month. Comparing the Design of the two different systems will reflect the impact of the sporadic solar irradiation on the rating values for the components of each system, which is affecting PV system cost. The design assumes the same load based and the worst case scenario of the solar irradiation. Each system will consist of PV modules, charge controller, power inverter and batteries.

¹ University of Bridgeport, talthean@my.bridgeport.edu
² University of Bridgeport, mlpiza@bridgeport.edu
The Access Control System Design

Author Zheng Duan

Advisor: Navarun Gupta

Access control system are widely used in recent years and they are one of the high-tech and safety features that has become an intelligent sign of modern architecture and homes. Access control systems allow the exit and entrance to access a building. Access control systems are developed on the basis of the traditional locks (Entrance Guard/Access Control).

Entrance guard control systems consist of a PC, entrance guard control equipment, wireless transmission platform, card reader, electronic locks, AC - DC Power supply, card, management software, and other parts. Entrance guard system hardware is mainly composed of entrance guard controller based on STC12C5A60S2 microcontroller, lock system, card reader, non-contact IC card, RF radio frequency wireless transmission equipment, power supply and other peripheral equipment. Entrance guard controller: This is the core component of the entrance guard system, in charge of the whole system of the input, output, information processing, storage, and control. Its tests and verifies the reliability of entrance guard card reader input information, and according to the rules of access, judges its effectiveness. Entrance guard controller performance can affect the stability of the system and directly affects the customer's life and property safety. Nowadays we usually use non-contact IC cards, because of its operation without contact prevents wear out, saves chip packages inside the card, and prevents corrosion. Reader: with non-contact IC card control part of the data exchange. With radio transmitting antenna, when close with non-contact IC card, can provide the energy for non-contact IC card, and access to non-contact IC returned data. To confirm the validity of the card reader analysis, and to transfer the results to the controller. Electric control lock: the implementation of entrance guard system parts, electric control lock when the power is on, in accordance with the requirements of the safety regulations. RF radio frequency transmission equipment: entrance guard system of wireless transmission platform. It uses RF radio frequency microwave as a carrier of wireless transmission, using the single chip microcomputer and PC communications.

Entrance guard systems are used beyond simple doorways and key management. They have gradually developed into a set of complete access management systems. Using high security, microcomputers allows for a record of the door activity, and can perform two-way control. It creates a safe environment, and effective personnel attendance management.

Keywords: Entrance Controller, Reader Lock, Access control

1 Zheng Duan, University of Bridgeport

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Poster Abstract

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Automatic Guided Robot

Miss. Ketki Taware¹, Dr. Navarun Gupta²

In production industries and chemical plants there are some repetitive and tedious jobs that require a lot of monotonous actions, like picking something from one conveyor belt and placing it to another or transporting the objects or cargos between fixed places. Repetitive tasks require an automated solution tailored specifically for industrial needs. In such situations the industry needs more flexible options. These activities are time bound which cannot be managed by humans alone. Therefore, the ‘Automatic Guided Robot (AGR)’ can be a good solution for this issue and make the tedious and mundane activities more convenient.

The basic idea behind this project was to make the robot move and sense the required object and after identifying the correct object deliver it to the desired location. Hence, AGR is divided into two major parts i.e. Image Processing and Controller. Image Processing is used to identify the correct object and Controller is programmed to move the robot and to identify the source and destination while moving. Supporting components are camera, RF transmitter and receiver, path chart, sensors, wheels and robotic loop arm. Here the robot is a line tracer therefore, IR sensors are used to identify the source, destination and starting point. Camera is used to click the picture of the object and RF device to communicate with the computer. Image processing plays a major role in identifying and denying the objects by processing the images received from camera. Robot has a loop attached to it which plays the role of an arm in this project and this loop drags the object from one place to another.

AGR is built using wheels, loop arm and sensors with a camera and RF device mounted on it. The line tracing path with six sources (S1 to S6) and two destinations (D1 & D2) and one starting point is used to guide the robot. Working of the final product goes like this: Robot will receive a command from computer for required product then it will move from the starting point. It will approach the source. When it reaches the first object, wireless camera mounted on robot will capture the image and send it to the computer. Computer compares the received image with the required product if it matches then robot carries the identified object and take shortest path to reach the destination D1 or D2. If the image does not match, then robot moves further and the process continues till the robot finds correct product.

Automatic Guided Robot system is a reprogrammable robot which will be able to identify objects on its own and it will carry the identified object to its destination. This project is more useful in huge industries where multiple object moving tasks can be made automatic. Second, place where AGR can play important role is the chemical industry, where there are many hazardous chemicals which can cause humans to suffer from health issues. In this case AGR can be used to carry these harmful chemicals.

Keywords: AGR, Robot, Automation, Image processing
1 MS in EE, University of Bridgeport, 325 Lafayette street, 5101, Bridgeport, CT-06604, ktaware@my.bridgeport.edu
2 Chair and Associate Professor, University of Bridgeport, 126 Park Avenue, Bridgeport, CT-06604, navarung@bridgeport.edu
Energy Efficient Hidden Node Detection for improving the Quality of Service in Wireless Multimedia Sensor Networks

Adwan Alanazi¹, and Khaled Elleithy²

Abstract: In wireless multimedia sensor networks (WMSNs), node connection is subjected to change due to disruptions in wireless communication, power changes in transmission, or loss of synchronization between neighboring nodes. A sensor should constantly be aware of its immediate neighbors, through a process called continuous neighbor discovery. In this poster, we introduce an energy efficient hidden node detection (EEHND) algorithm for continuous neighbor discovery process in the (WMSNs). We focus on the continuous neighbor discovery process and regard it as a combined task of all the nodes in every connected segment. Each sensor is entered as a coordinate in an effort in order to reduce the time to detect hidden sensors. Based on the simulation results, we demonstrated that the protocol detected the hidden nodes in the network.

Keywords: wireless multimedia sensor networks, neighbor discovery, hidden nodes, and energy efficiency

¹ Computer Science and Engineering Department, University of Bridgeport, Bridgeport USA, aalanazi@my.bridgeport.edu
² Computer Science and Engineering Department, University of Bridgeport, Bridgeport USA, elleithy@bridgeport.edu
Fuzzy Logic Control for Autonomous Mobile Robots in Static and Dynamic Environments

Marwah Almasri\textsuperscript{1}, Khaled Elleithy\textsuperscript{2}, and Abrar Alajlan\textsuperscript{3}

Abstract

Autonomous mobile robots have been widely used in many researches and applications. Mobile robots can be programmed to do specific tasks such as collision avoidance and trajectory planning. Various types of sensors and actuators are mounted on these robots for sensing the surrounding environment and making decisions accordingly. However, these sensors are in different types and thus have different accuracies and features. Some of them might be robust against external environmental factors such as high temperature and pressure while others might be affected which result in reducing the efficiency and reliability of these sensors. Consequently, multiple homogeneous or heterogeneous sensors are needed in designing an efficient autonomous mobile robotic system. Therefore, using data fusion to combine different types of sensors to obtain more accurate results is highly beneficial in many applications.

In addition, collision avoidance and path planning are the most essential tasks needed when designing a mobile robot navigational system. Therefore, integrating the data fusion will increase the reliability and accuracy of the system. In this poster we design collision avoidance and line following mechanisms for a mobile robot in static and dynamic environments with the integration of data fusion to improve the efficiency and the robustness of the navigation system. For the collision avoidance technique, eight proximity sensors are used to detect static and dynamic obstacles. Furthermore, three ground sensors which are infrared sensors are used to detect the line. The proposed fuzzy logic for the line following mechanism consists of one input and two outputs. The input is the difference between right and left ground sensors values whereas the outputs are the left and right speeds to steer the mobile robot. Several membership functions and fuzzy rules are designed. Proximity sensors readings, ground sensors readings, and left and right motor speeds are displayed. The proposed method has been successfully tested in Webots Pro simulator and in in real time experiment. Both validate the effectiveness and the robustness of the proposed method in static and dynamic environments.

Keywords: Fuzzy Logic controller, collision avoidance, line following, mobile robots, data fusion.

\textsuperscript{1} University of Bridgeport, 221 University Avenue, Tech 229, Bridgeport, CT 06604, maalmasr@my.bridgeport.edu.
\textsuperscript{2} University of Bridgeport, 221 University Avenue, Tech 229, Bridgeport, CT 06604, elleithy@bridgeport.edu.
\textsuperscript{3} University of Bridgeport, 221 University Avenue, Tech 229, Bridgeport, CT 06604, aalajlan@my.bridgeport.edu.
SAnalyze MapReduce and HiveQL on Amazon Cluster EC2

Utkarsh S. Parekh

Big Data, data that has increased exponentially from the last several years from sensor networks, smartphones, and social networks. Hadoop provides many solutions for Big Data problems over legacy systems which were expensive to store large data.

In this paper, the large scale data set using the Hadoop system are analyzed. The queries are solved, using a MapReduce (MR) and the Hive QL code to explore the Movie Lens data set and understand the relationships between users’ ratings and different movies. There are two queries solved in this paper: 1.) Average Ratings Count of the each movie, 2.) Movie – Based collaborative filtering, using Hive QL. Moreover, the above queries are tested, executed and compare the results, on AWS EC2 cluster instances.

This study analyzes Movielens Datasets using the Hadoop system. Movie Lens Datasets contain 100,000 ratings from 943 users for 1,682 movies. The movie ratings range from one to five with one being the worst and five being excellent. In this poster, the study discusses two different queries implemented in MapReduce and Hive QL (Hive Query Language) respectively. This study also measures the performance of a JOIN operation in a HiveQL query at AWS EC2 cluster.

Keywords: MapReduce, Hive QL, AWS EC2 cluster

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1 Department of Computer Science, University of Bridgeport, "Utkarsh S Parekh"
<utkarsh.s.parekh@gmail.com>
Quantum Mutual Authentication Scheme Based on Bell State Measurement

Muneer Alshowkan¹, and Khaled Elleithy²

Authentication is one of the security services that ensure sufficient security of the system by identification and verification. Also, it assures the identity of the communicating party to be that the claimed one. To build a quantum channel between two unauthenticated to each other users, a trusted authority is needed to establish a mutual authentication with each. Using Bell measurement and entanglement swapping, we present a protocol that mutually authenticates the identity of the sender and the receiver. Then, it constructs between them a quantum channel based on Bell basis. The sender and the receiver use the quantum channel to communicate using entanglement-assisted quantum communication protocols. Additionally, after authentication process the protocol renews the shared secret key between the trusted authority and each user. The protocol provides the necessary authentication and key distribution to create a quantum channel between the sender and receiver.

Consider a network of $n$ users $u_i$ where $i$ is the user identification number $u_i \in U = \{u_1,u_2, ..., u_n\}$. Each user shares a secret key $k_{Tu}^{2m} \in K = \{k_{Tu1}^1, k_{Tu}^2, ..., k_{Tu}^{2m}\}$ of size $2m$ where $k_{Tu}^{2m} = \{k_{Tu1}^m + k_{Tu2}^m\}$ with the trusted user Trent. If Alice wishes to communicate with Bob, then she contacts Trent who knows every user in the network. At the beginning, Trent and Alice need to build mutual authentication by identification and verification of each other’s identity. They use the shared secret key $k_{TA}^{2m} = \{k_{TA1}^m + k_{TA2}^m\}$ to derive the encoding bases $b_{TA}^{2m} = \{b_{TA1}^m + b_{TA2}^m\}$ from the bases $Bz = \{|0\rangle, |1\rangle\}$ and the bases $Bx = \{|+\rangle, |−\rangle\}$. For each bit in the secret key, they make the bits “0” and “1” correspond to bases $Bz$ and $Bx$ respectively. After, Trent and Alice each generate a random sequence $S_{TA}$ and $S_{AT}$ respectively of size $m$, then encoded it by the bases $b_{TA1}^m$. Next, Trent and Alice exchange then verify the encoded sequences through the classical channel. So, the legitimate Trent and Alice must be able to derive the decoding bases $b_{TA1}^m$ from the secret key $k_{TA1}^m$ then decode each other’s sequence for verification. Trent and Alice continue if they received the correct sequences and they become mutually authenticated. If one of them received the wrong sequence then, they abandon the channel. After that, Trent contacts Bob and performs the same authentication process.

Trent builds the quantum channel after he created the mutual authentication between him and each of Alice and Bob. For each user, Trent prepares $L$ random Bell basis.

¹ Department of Computer Science and Engineering, University of Bridgeport, Bridgeport, CT 06604, malshowk@my.bridgeport.edu
² Department of Computer Science and Engineering, University of Bridgeport, Bridgeport, CT 06604, elleithy@bridgeport.edu
\[ |Y(L)\rangle_{Tu} = \{ |Y(1)\rangle_{Tu}, |Y(2)\rangle_{Tu}, \ldots, |Y(L)\rangle_{Tu} \} \text{ where } |Y\rangle \in \{ |\Psi^-, \Psi^+, \Phi^-, \Phi^+ \} \text{ then shares them with the users. Also, let } i \text{ and } j \text{ be the indexes of Alice and Bob states respectively where } i = j = t + q + p = L. \text{ For each user, Trent shares the entangled pairs } |Y(i, j)\rangle_{Tu} \text{ by keeping the first particle of } |Y(i, j)\rangle_T \text{ and sending the second particle } |Y(i, j)\rangle_u \text{ to the user.} \]

After, Trent asks each party to choose randomly \((t + q)/2\) inconsecutive states of the entanglement with him \(|Y(L)\rangle_{Tu}\) then performs Bell measurement on the state \(|Y(i, j)\rangle_{Tu} \otimes |Y(i, j + 1)\rangle_{Tu}\). Each measurement result will in one of the states \(\{|\Phi^+\rangle_{14}|\Phi^+\rangle_{23}\},\ \{|\Phi^+\rangle_{14}|\Phi^-\rangle_{23}\},\ \{|\Psi^+\rangle_{14}|\Psi^+\rangle_{23}\},\ \text{or } |\Psi^-\rangle_{14}|\Psi^-\rangle_{23}\) each occurs with a probability of \(1/4\). For each measurement result, Alice will represent the states \(|\Phi\rangle\) and \(|\Psi\rangle\) by the bits "0" and "1" respectively Fig. 1. In the same manner, she represents the phase of the states " + " and " - " by the bits "0" and "1" respectively. For error detection, Alice meets with Trent on the classical channel to inform him of the \(t/2\) chosen pairs and the measurement result of each pair for verification. Similarly, Trent verifies Bob’s measurement. If Trent finds the results do not satisfy Bell measurement then, the channel is compromised and they abandon the channel. However, if the results satisfy Bell measurement for entanglement swapping then, Trent and they users represent the remaining \(q/2\) pairs in bits and consider them as an initial secret key \(r\). Trent with each party applies a universal hashing function on \(r\) to derive a final key.

![Figure 1](image_url)

**Figure 1** The representation of the states using classical bits.

For communication, Trent reorders the \(p\) remaining entangled pairs between him and each user \(|Y(i)\rangle_{Tu} = \{|Y(1)\rangle_{Tu}, |Y(2)\rangle_{Tu} \ldots, |Y(p)\rangle_{Tu}\}. Then, Trent performs entanglement swapping to create entanglement state between Alice and Bob. Trent performs entanglement swapping process using \(|Y(i)\rangle_{TA} \otimes |Y(j)\rangle_{TB}\). Trent informs Alice and Bob about which state they share using two classical bits. Therefore, Alice and Bob will have their \(i\) and \(j\) states respectively entangled in one of Bell states each occurring with probability of \(1/4\). Alice and Bob use their entangled pairs to communicate using quantum communication protocols such as teleportation, Ekert 91, or remote state preparation.

**Keywords**: Quantum, entanglement, authentication, bell measurement, bell basis
Graphene Oxide-Polypyrrole Scaffolds To Promote Differentiation Of Embryonic Stem Cells Into Dopaminergic Neurons

Osama Alturkistani¹, Ashish Aphale, PhD. Isaac Macwan, PhD. Prabir Patra, PhD.

Background:
Deterioration or death of dopamine releasing neurons in the substantia nigra, a region of the midbrain, is believed to be the cause of motor symptoms of Parkinson’s disease. The ability to selectively promote differentiation of stem cells into dopaminergic neurons proves to be a promising candidate for slowing down the progression of the disease. Studies have shown that the addition of graphene oxide nanoparticles to stem cells differentiated by stromal cell-derived inducing activity (SDIA) significantly improves the number of differentiated dopaminergic neurons and increases the firing rate of these neurons when compared to controls. We set out to study the effects that a physical scaffold made up of graphene oxide and polypyrrole, which is a conducting polymer, would have on stem cell differentiation using SDIA.

Method:
Synthesis of GO-PPy scaffolds was done by coelectrodeposition using cyclic voltammetry in 0.1M KCl solution containing [Fe(CN)₆]³⁻/⁴⁻. Electrochemical impedance spectroscopy (EIS) was performed with frequency range of 100kHz to 0.1Hz. Surface morphology of scaffolds was analyzed using scanning electron microscopy (SEM).

Results:
CV graphs for GO-PPy scaffold have shown faster charging/discharging processes compared to PPy. GO-PPy scaffold has better stability and retained 70% of its initial stability after 800 cycles, which is much higher than PPy (45%). SEM images have shown successful uniform incorporation of GO in between layers of polypyrrole. Nyquist plots obtained via EIS demonstrated that GO-PPy has much faster charge transfer rates than PPy.

Conclusion/Implications:
The doping of GO in PPy greatly improved the conductivity and stability of the scaffolds. We hypothesize that the improved electrochemical properties of GO-PPy scaffolds would better guide growing axons to reach the synaptic junction of nearby neurons during neurogenesis. Further studies are being performed to determine the effects of the GO-PPy scaffolds on stem cell differentiation.

Keywords: GO-PPy, stem cells, dopaminergic, neurons, SDIA

¹ Department of Biomedical Engineering. University of Bridgeport, Bridgeport, CT 06440
oalturki@my.bridgeport.edu
Misuse Wireless Intrusion Detection System Based on Voting Technique

Bandar Alotaibi, and Khaled Elleithy

This poster presents a misuse Wireless Intrusion Detection System. Wireless networks have dominated recently over the wired networks that have been dominant for several years. Currently, Wireless Local Area Networks (WLANs) are the preferred option for local area connectivity because of the mobility and the low cost that they afford. Unfortunately, the low cost and the mobility come with controversial security. Some researchers suggest enhancing the WLANs security, however this necessitates either standards/protocols modification, or updates to existing devices such as Access Points (APs). External solutions that do not require standards and protocols modification such as Intrusion Detection Systems (IDSs) have gained attention for several years due to the immediate response to threats and the possibility of eliminating attackers. Some of the IDSs are established using predefined signatures of known attacks, which are kept on the database. The captured frames are compared with the predefined signatures. If the match is found, the alert is triggered immediately. On the other hand, machine learning IDSs have an advantage because they do not require predetermined static signatures of familiar attacks. Therefore, it can be done automatically via classification or clustering algorithms. There are two known Intrusion Detection techniques which are anomaly detection and misuse detection. Anomaly intrusion detection techniques recognize suspicious activities through deviation from the normal behavior, by the devices that produce these activities. Misuse intrusion detection techniques identify intrusions based on matching the patterns of previous known attacks. Anomaly detection approaches are more likely to identify unknown intrusions and have a high false positive rate (FPR). On the other hand, the false positive rate of the misuse detection techniques is low, but they fail to detect unknown attacks. Furthermore, this poster aims to find significant fields in Media Access Control (MAC) layer frame to detect rogue devices. Feature selection is an important initiative to build IDSs, the machine-learning-based IDSs in particular. The number of features is well-defined because it depends on the MAC frame fields, many other features can be added artificially to the physical layer metadata when capturing the frames. However, only some fields are vital to identifying the intruders. Some data mining techniques are hypersensitive to the number of features. Choosing the substantial features enhances the performance of the IDS and reduces time. Among several machine learning algorithms tested on a public dataset, we found some promising machine learning algorithms that could improve the performance and reduce the computation time. Extra Trees, Random Forests, and Bagging are the best performing algorithms. Bagging outperforms previous results (about 96.25 %). We then used a voting

1 University of Bridgeport, 126 Park Ave, Bridgeport, CT 06604, balotaib@my.bridgeport.edu
2 University of Bridgeport, 126 Park Ave, Bridgeport, CT 06604, elleithy@bridgeport.edu
technique to improve the performance on the best performing algorithms and achieved better results (about 96.32 %) when we used the whole feature set. Then, we applied a data mining technique (based on Extra Trees ensemble method) to reduce the features in order to decrease the computation time and improve the accuracy. After applying the data mining technique, all the algorithms have improved in term of accuracy and the computation time have been decreased.

Keywords: WIDS, WLAN, Attacks, Machine learning
Intelligent Docent Quadcopter

Smit Doshi¹, Advisor: Dr. Sarosh Patel²

In the field of robotics, quadcopters are the latest area of popularity. In recent years, quadcopters have attracted a great degree of interest from an academic, industry and research perspective. Major firms are investing heavily in design and development of quadcopters as they see their future usability in various areas. In this poster we describe and outline the steps for designing a quadcopter with a dynamic intelligence to describe about the images captured by quadcopter. We also discuss some advance features that have been implemented in this quadcopter such as information projection for requested objects. This can serve as a new method of advertising in different events and can serve as a guideline to those who wish to build swarm tour guide quadcopters. Our quadcopter design is a scalable product for consumers.

Keywords: Robotics, quadcopter, image projection, dynamic Intelligence

¹ University of Bridgeport, CT, 06610, U.S.A, smdoshi@my.bridgeport.edu
² University of Bridgeport, CT, 06610, U.S.A, RISC LAB
LOW COST, PORTABLE NON-INVASIVE BLOOD SUGAR DETECTION

Abhishek Krishna¹, Chandrasekhar Babu², Xingguo Xiong³

This poster reports some initial work aiming at developing a low cost, portable and easy-to-use non-invasive kit for blood sugar detection. The main principle of this test is to convert the glucose in urine/saliva sample to gluconic acid using glucose oxidase reagent and further convert the acid to a Quinoneimine dye using Phenol and 4-Aminoantipyrine (4-AAP). The reactions can be showed as:

\[
\text{Glucose} + \text{O}_2 + \text{H}_2\text{O} \rightarrow \text{Gluconic acid} + \text{H}_2\text{O}_2
\]

\[
\text{H}_2\text{O} + \text{Phenol} + 4\text{-AAP} \rightarrow \text{Quinoneimine dye} + \text{H}_2\text{O}
\]

The resulted Quinoneimine dye will then be detected with some chemical sensor so that the level of glucose in the sample can be derived. For the portability of this kit, MEMS devices including micropump, microvalves and microsensors used. The MEMS devices will pre-treat the sample and prepare it for the glucose sensing. The readout from the microsensor will be finally displayed on LED screen for the user. The microvalve takes instructions from the control circuit and releases the chemicals according to the need of the reaction. The device can be used to sense minute concentrations of glucose in human serum (saliva and urine). The lab-on-a-chip system is designed and simulated in COMSOL. Some theoretical analysis on the lab-on-a-chip system is also analyzed. Compared to the traditional finger-prick blood testing for glucose reading, non-invasive glucose sensing does not cause pain or lead to cross-infection of patients. It is cheap, efficient, and hygienic, requires minimum processing steps to detect the blood sugar concentration. This research focuses on developing a complete lab-on-a-chip system for the sample collection, preparation and transportation so that the glucose level in the biological sample can be sensed and read out for LED display.

Keywords: Non-invasive blood sugar detection, Microelectromechanical Systems (MEMS), diabetes diagnosis, Lab-on-a-chip (LoC).

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¹ Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: abkrishn@bridgeport.edu
² Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: ckaminen@my.bridgeport.edu
³ Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu
COMSOL Simulation of Fluid-structure Interaction of a Four-blade Active Microfluidic Mixer

Ting Li\textsuperscript{1}, Xingguo Xiong\textsuperscript{2}, Prabir Patra\textsuperscript{3}

Abstract—Microfluidic mixer is a key component used in various biomedical diagnostic devices. Microfluid is generally laminar flow and the mixing is very challenging. During sample processing, it is often desirable to have multifarious miscible liquors or gases mixed in lab-on-a-chip device. The purpose of mixing is for the sake of further detection and diagnosis. To improve the mixing efficiency of different microfluidic flows, various microfluidic mixers have been reported. In this research, the design of a piezoelectric four-blade active microfluidic mixer device is proposed. The four blades are arranged in a differential pattern so that they can be activated to vibrate in-phase, out-of-phase or 90° phase difference to each other. This introduces more turbulence to the system and lead to better mixing efficiency. While the four blades are vibrating, they interact with the microfluid and introduce turbulence. To better understand the mixing mechanism, COMSOL is used to simulate the fluid-structure interaction between the blades and the microfluid. The mixing efficiency of different vibration schemes of the beams are compared to find the optimum actuation strategy. The relationship between the mixing efficiency and the vibration frequency is also studied. The proposed micromixer can be used to mix two different microfluidic flow for better mixing efficiency.

Keywords: Microfluidic mixer, Laminar flow, Electrostatic Actuation, Microelectromechanical Systems (MEMS), Mixing index.

\textsuperscript{1} Department of Biomedical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: liting@my.bridgeport.edu
\textsuperscript{2} Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu
\textsuperscript{3} Department of Biomedical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: ppatra@bridgeport.edu
Low-cost Infant-Incubator for the Developing World

Arwa Balobaid¹, Praveena Mareedu², Ramya Sripati³

Background: Regulated temperature is the most important factor that affects premature infants’ lives. Premature infants lose their body heat due to the large skin surface associated with their body mass index. Many premature infants can have long-term health problems that can affect their lives if they don’t receive appropriate care immediately following birth. These problems include apnea, respiratory distress syndrome (RDS), jaundice, anemia, and susceptibility to infections. This has motivated us to design a low-cost incubator for a subset of premature infants. The unit operates on both solar and electric power to provide and maintain a temperature of 37°C. Our intent is to develop an easily maintainable and sustainable system. Presently, there exists several low-cost products that serves this market, but those devices have significant drawbacks. The WeCare incubator design has taken these issues into consideration and offers an inexpensive and improved alternative to save premature infants’ lives.

Method: The incubator components consist primarily of commercial off-the-shelf components (COTS), which makes the incubator less expensive, easy to manufacture, and readily maintainable. The critical components of the incubator are a container, heater, solar panel, battery, and battery charger. The unit was designed to raise the temperature from 25°C (room temperature) to 37°C in the volume of the incubator chamber.

Result: This project is a work in progress. We anticipate completing the effort by May 1. The cost for the production incubator design should be well under $300 and the sell price should be around $500, which makes this unit an affordable premature infant incubator for use in developing countries.

Future growth and upgrades: Future growth areas include the following:

1. Addition of a humidifier adjustment to maintain the humidity inside the chamber at an appropriate level,
2. Add an alarm to indicate if the temperature inside the chamber goes out of the range limits (37°C +/- 1°C)
3. Consider the possible addition of light therapy (phototherapy) that is used to treat newborn jaundice.
4. Develop an improved power system to operate the system on solar energy for 24 hours in areas that have adequate sun.
5. Determine how best to remove heat from the incubator in areas where the temperature goes above 37°C.

¹ Arwa Balobaid, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, arwa.balobaid@student.fairfield.edu
² Praveena Mareedu, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, praveenam69@gmail.com
³ Ramya Sripati, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, sripatiramya90@gmail.com
Fourier transform infrared spectroscopy to assess molecular-level changes of bacteria exposed to silver nanoparticles

Fatemeh Faghihzadeh¹, Nelson M. Anaya², Laura A. Schifman³ and Vinka Oyanedel-Craver⁴

Background and Objective: Fourier transform infrared (FTIR) is a spectroscopy technique that can identify variations in the total composition of microorganisms through the determination of changes of functional groups in biomolecules. FTIR measures the vibration and rotation of molecules influenced by infrared radiation at a specific wavelength. This technique allows the identification of structural changes of the molecular binding between microorganisms and metal atoms, which can provide information about the nature of their interactions.

Method: In this study, FTIR was used to assess bacterial interaction in response to exposure to silver nanoparticles (AgNPs). Microplates with six wells with LB media were used to grow bacteria until the log phase in the microplate reader, measuring the optical density at 600 nm (OD600) for 15 minutes each. After 7.5 hours of bacterial growth, suspensions of AgNPs in deionized water were injected to achieve a concentration of 15 mg/L inside of the exposed condition (media plus bacteria+ AgNPs). Controls wells were included to detect contamination (media with no bacteria), and comparison between the non-exposed condition (media plus bacteria) and exposed condition. After that, plates were run for 7.5 additional hours to assess AgNPs toxicity at 2.5 hours, 5 hours, and 7.5 hours. Culture media from each well was removed through centrifugation and re-suspended in PBS 10%. Liquid samples were prepared for ATR-FTIR analysis by fixing the optical density (OD600) to 0.8. Following this, bacteria were centrifuged and the pellets were suspended in 10 μL of PBS 10%, and the suspension of bacteria with AgNPs was directly transferred onto the crystal surface. Spectra were the result of 256 scans with a resolution of 4 cm⁻¹ in the 4000–3500 cm⁻¹ spectral range. The data was provided by Omnic software (Thermo Scientific) and processed using Matlab (Mathworks Software).

Result: The results showed that the AgNPs-induced structural changes in the peptide and amino acids region may lead to alterations of conformation and/or composition of Amid B and Amid III. These results showed that the bacteria developed resistance toward AgNPs and resulted in changes in the genotype and expression in the phenotype. Here, ATR–FTIR provided the evidence of the AgNPs cytotoxicity induced intracellular level alterations in bacteria.

Conclusion: FTIR has uniform applicability to various bacteria and a high specificity for differentiating toxic effects at intracellular levels. The spectral range in this method could assist in rapidly evaluating

¹ Department of Civil and Environmental Engineering, University of Rhode Island, faghizadeh@uri.edu
² Department of Civil and Environmental Engineering, University of Rhode Island
³ Department of Civil and Environmental Engineering, University of Rhode Island
⁴ Department of Civil and Environmental Engineering, University of Rhode Island
the toxicity level of nanoparticles as well as characterizing time-dependent toxicity impacts of nanoparticles in bacteria.

**Keywords:** Fourier transform infrared spectroscopy, nanoparticles
Plastic to Fuel Conversion Pyrolysis Reactor Kit

Manasa Bhaskararayuni¹, Soumya Jahagirdar², Aashish Kulkarni³, Norman Tremblay⁴

Mission - Create an easy to assemble, low cost, pyrolysis reactor kit that can be used to convert plastic waste into useable fuel.

Background - Pollution by waste plastic is a major source of environmental pollution. There are 50 billion water bottles consumed every year. It takes 500-1,000 years for plastic to degrade. This project makes use of waste plastic to generate usable fuel. This will not only help to reduce pollution caused by plastic but it will also provide people (especially in developing countries) a way to heat their homes or cook their food as well as assist them with an entrepreneurial method to earn a living by selling excess fuel recovered from the plastic.

Method - This project works on the pyrolysis principle, which involves heating waste plastic to a temperature of 700 °F and melting it to a liquid/gaseous state. This kit contains a reactor chamber, a condensation tube and a glass container. The gas that is emitted in the heating process is condensed through a condenser and collected in the form of bubbles in a glass container filled with water. The technique designed to separate the condensed fuel from water. The glass container is then chilled to separate the fuel from water. The system is intended to be easily assembled by a non-technical person. It will be designed so that no special training will be required to operate the equipment. The prototype consists of commercial off the shelf equipment. It will require an electric power source requiring less than 250 Watts.

Results - This project is in the implementation phase. The design for the kit has been completed using Catia software and the material required for the kit has been purchased. Construction and assembly of the kit is in progress. After the completion of the assembly the kit will be operationally tested for safety and durability.

Conclusions / Implications - Both developing and developed countries today are facing the problem of unrecycled plastic. The "Plastic to Fuel Conversion Kit" is designed to re-use plastic waste by converting waste plastic to fuel. This project is mainly focused on households and very

¹ Manasa Bhaskararayuni, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, manasa.bhaskararayuni@student.fairfield.edu
² Soumya Jahagirdar, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, soumya.jahagirdar@student.fairfield.edu
³ Aashish Kulkarni, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, aashish.kulkarni@student.fairfield.edu
⁴ Norman Tremblay, Engineering Department, Bannow Science Center, Fairfield University, North Benson Road, Fairfield, CT 06824, norman.tremblay@student.fairfield.edu
small-scale industries where a high percentage of plastic waste is generated, i.e., from packaging etc. The product is a Do-It-Yourself based idea, which will assist a consumer to easily build and use the system. The target sell price for this equipment is less than $2000.
Impact of TCP Throughput and Loss behavior on Multi hop Wireless Network

Neha Panuganti\textsuperscript{1}, Yeqing Chen\textsuperscript{2}, Neeraj Ram Motaparthy\textsuperscript{3}, Andre Robert Dusabirane\textsuperscript{4}, Gudhi Srinivas Praveen\textsuperscript{5}, Omar Abuzaghleh\textsuperscript{6}

In our research paper, we take a holistic approach of throughput and loss in multi-hop wireless network. Packet loss within a WAN can occur for many reasons, including network congestion or protection events such as route convergence and network misconfigurations. Different network problems occur while requesting loss of packets. Our current theory integrates three problems: retransmission of lost packets, rearranging out-of-order packets, and running congestion control mechanisms to reduce the occurrence of network congestion. TCP performance in multi-hop ad-hoc network is not only dependent on MAC protocol, but also on other protocols such as routing. Consecutive failures in accessing the channel at the MAC layer resulted in false routing failures even in the static topology for TCP throughput. We investigated the interaction between TCP and MAC layer in a wireless multi-hop network.

The first is the conflict between TCP data packets and TCP acknowledgements, which causes performance to degrade for window sizes greater than 1 packet. CSMA, FAMA suffer from the hidden terminal losses. Thus, loss recovery must be provided by a layer above MAC, either the link layer or the transport layer. Then we embedded the acknowledgements in MACAW and in IEEE 802.3 standard. Precisely, by considering single TCP connection that has variable number of hops, from 1 to 7. TCP window (w) is kept fixed to value 1460B, 32 KB for single TCP connection and 1460 B in ring topology, string topology. FAMA is slightly lower than CSMA, because overhead in RTS and show lowest throughput among the other three protocols due to control frames added. MACAW works well with larger TCP windows. Maximum throughput achieved in ring when 4Mbps when considered 2.5 mbps. In contrast MACAW is fair when compared to MAC protocols, there each connection gets approximately 170kbps throughput. Our analysis and simulations show that, given a specific network topology and flow patterns, there exists a TCP window size W at which TCP achieves best throughput via improved spatial channel reuse. However, TCP does not operate around W and typically grows its average window size much larger; this leads to decreased throughput and increased packet loss. Our results show that network overload is mainly signified by wireless link contention in multi-hop wireless networks. TCP suffers from reduced throughput due to reduced spatial reuse. The unnecessary window reduction caused by lost packets due to link errors is avoided since packet losses due to buffer overflow are not allowed to invoke congestion control. This analysis gives a closed form expression for TCP throughput under the simplifying assumptions. The assumptions imposed on the system imply that we have relaxed two constraints of ad-hoc networks, (i) dynamic routing owing to mobility/failure of nodes and, (ii) multiple simultaneous transmissions in the network Mainly damaging the multi-hop TCP connections has a heavy loss rate on the links and the recovery lacks in the links. Inequality due to capture proves that even at this low level of interactive traffic. Single TCP flow interference with one another when they
move down the flow stream towards the destination, which results in the packet drops and link layer contention. By analyzing TCP throughput and loss, we are able to apply the standard technique to compute the average throughput achieved by a single TCP session.

**Keywords:** Multi-hop Network, Wireless, TCP Throughput, Loss, TCP Performances

1 Neha Panuganti, Department of Computer Science, University of Bridgeport, npanugan@my.bridgeport.edu

2 Yeqing Chen, Department of Computer Science, University of Bridgeport, yeqchen@my.bridgeport.edu

3 Neeraj Ram Motaparthy, Department of Electrical Engineering, University of Bridgeport, neerajramchowdary@gmail.com

4 Andre Robert Dusabirane, Department of Computer Science, University of Bridgeport, adusabir@my.bridgeport.edu

5 Gudhi Srinivas Praveen, Department of Computer Science, University of Bridgeport, sgudhi@my.bridgeport.edu

6 Adjunct Professor, Department of Computer Science and Engineering, University of Bridgeport, oabuzagh@bridgeport.edu
Energy-Efficient Dynamic Motion Control for Wheeled Mobile Robots Using Low Cost Resources

Abrar Alajlan¹, Khaled Elleithy² and Marwah Almasri³

Mobile robotic systems have significant growth in human welfare, where they represent such a complex interaction of high computational processes, outstanding mechanical design, and exceptional hardware. Majority of mobile robot applications are developed to perform some operations that require an extended level of autonomy such as security and exploration, search and rescue, inspection, etc. These mobile robotic applications are normally subject to the collaboration with the dynamic environment that can be described by its challenging properties. Thus, mobile robots should have the ability to model and communicate with the surroundings in order to achieve safe motions and reliable systems.

The total energy consumption of mobile robotic applications is one of the most important issues that has not been adequately considered. Moreover, the total energy consumption of mobile robot includes all energy required to keeps the robot in motion as well as the energy consumed by all modules used to perform a specific operation. Hence, the total energy consumption of mobile robot can be minimized by enhancing the energy efficiency of motor drives and the modules installed on the robot.

In this work, a dynamic motion planning is proposed that aimed to minimized the energy consumption for battery-powered mobile robots. Moreover, the total energy consumption is evaluated in multiple directions: at different speed levels, for different distances, and for different duty cycles. Thus, the parameters that can affect on reduction of the consumed energy can be optimized in order to economize the energy consumption. The total energy consumption is evaluated in multiple directions where both motion energy and operation energy are considered while the robot is moving in dynamic environments and avoiding collisions. The experimental results demonstrate that more energy can be conserved by regulating the speed, distance, motors duty cycles, and sensing frequency.

Keywords: power consumption, mobile robot, dynamic control, energy efficiency, multisensory system.

¹ Computer Science and Engineering Department, University of Bridgeport, Bridgeport CT 06604, USA, aalajlan@my.bridgeport.edu
² Computer Science and Engineering Department, University of Bridgeport, Bridgeport CT 06604, USA, elleithy@bridgeport.edu
³ Computer Science and Engineering Department, University of Bridgeport, Bridgeport CT 06604, USA, maalmasr@bridgeport.edu
Hybrid Evolutionary Framework for Designing and Implementing Autonomous Modular Robotics

Reem Alattas¹, and Tarek Sobh²

This paper proposes a novel framework for automatically designing feasible robots that are made up of various heterogeneous modules and raw materials already existing in the surrounding environment. Moreover, it highlights the interrelationship between the robot’s morphology, control, and environment by analyzing the coevolution of morphology and control in robots and allowing the initial set of robots to use the available units in the environment to self-assemble, self-reconfigure, and self-repair. In addition, digital fabrication technologies such as 3D printing are utilized to produce new units if needed and available.

A new constructive evolutionary algorithm is contemplated to address the challenges of co-evolving the robot’s control and morphology. Then, genetic algorithm is applied to simulate the survival of the fittest individual behavior that can be transferred to a real robot that can self-assemble using the considered modules or self-reconfigure or even make another robot to adapt to the environmental changes and undertake the target task efficiently.

Two benchmark problems in modular robotics are considered to evaluate our newly proposed framework. The first one is a walking task where the robot has to move, while the second is a painting task where the robot has to detect and paint a wall. In each case, the initial set of robots start by scanning the surrounding environment to perceive information about the available modules and raw materials that can be used to accomplish each task. For each task, we have defined specific fitness functions that can be used to guide the evolutionary process.

Keywords: evolutionary, modularity, robots, self-assembly, self-reconfigurable.

¹ University of Bridgeport, Bridgeport, CT, reem.alataas@my.bridgeport.edu
² University of Bridgeport, Bridgeport, CT, sobh@bridgeport.edu
Prediction of stock price and its return is an exceedingly intricate and hard problem because of various factors that may influence stock prices. An accurate prediction of the movement direction of the stock index is decisive for investors to make active market trading tactics. However, because of the high nonlinearity of the stock market, it is challenge to reveal the inside law by the traditional forecast methods. It reacts in this problematic condition, data mining techniques have been acquainted with and applied for this financial prediction. In this paper, we apply sentiment analysis and machine learning principles to discover the correlation between “public sentiment” and “market sentiment.” We employ twitter data to predict public mood and use the predicted mood and previous days’ NASDAQ values to predict the stock market movements. Furthermore, we principally inspect the efficiency of numerous machine learning techniques on providing blend sentiments on a tweet corpus. We foremost look for the correlation between twitter sentiment and stock prices. Secondly, we determine which words in tweets correlate with changes in stock prices by doing a post analysis of price change and tweets. In addition, we discover the relationship between tweets of the vital Twitter user and the corresponding one stock price behavior. We achieved this by mining tweets using Twitter’s search API and subsequently processing them for analysis using Sentimental Analysis. For the task of determining sentiment, we test the effectiveness of three data mining techniques: Naive Bayes classification, Decision Tree, and Support Vector Machines. Using the given data mining techniques, we hypothesis a model, approximation and its accuracy, and put it to the test on real market data using a mock portfolio. Our consequences indicate that the model is successful in predicting the stock price and with that generating additional profit using the techniques.

Corresponding Author: Umang Patel, umapatel@my.bridgeport.edu
Use of data mining techniques for the analysis of consumer’s electricity consumption

Swapnil Krishnachandra Savale

Data mining techniques are used to discover electricity consumption pattern at regional level in a city and used to extract knowledge concerning to the electricity consumption with respect to atmospheric temperature and physical distance from geographic features. In order to form the different clusters of temperature and consumers based on the basis of electricity consumption, k-means clustering algorithm is applied. WEKA software for data analysis will be used for the collected data. Association rule analysis will be carried out to form association rules on electricity consumption to describe the result of physical distance between natural geographic objects and various regions. The work includes preprocessing of data, application of data mining algorithms and the interpretation of the discovered knowledge. The information will be taken form government website of energy information administration. Preprocessing includes data gathering and data cleaning such as after analyzing the gathered information, the inconsistent data will be removed for further evaluation. The demand for electricity keeps on increasing almost every year and almost in every region. Installing and developing such a new electricity generation plants is practically impossible due to environmental preservation awareness and pollution control policies of government. To deal with such situation, one needs to find the optional ways for handling and management electricity loads in future with current capacity of electricity generation.

Keywords: Mining, WEKA, electricity, consumption, cleaning.

1 University of Bridgeport, 126 Park avenue 06604 ssavale@my.bridgeport.edu
Movie Management System Using ArangoDB

Umang Patel¹

The relational database has been the leading approach for unifying data into correctly organized tables for various years. Lately, with an enormous amount of data being generated from various social media, new data, geological data and several different types of data, a new type of database called NoSQL “Not Only SQL” has arisen. NoSQL pursues to incredulous the drawbacks of SQL, such as fixed schemas, JOIN processes, and addresses the scalability glitches. With the appearance of the NoSQL, sundry NoSQL databases got evolved. Non-relational databases are classified according to its model of persistence, and they are divided into documents, key-value, graphs, tabular, columnar, memory etc. Multi-purpose databases work with more than one model of persistence, permitting greater flexibility in each project. ArangoDB is a multi-model mostly-memory database with a flexible data model for key-value, documents and graphs. It is designed as a “general purpose database”, contributing all the features you typically essential for modern web applications. Fenced with ArangoDB you get “Foxx”. Foxx is an integrated application framework ideal for lean back-ends and single page JavaScript applications (SPA). ArangoDB’s query language AQL—it makes querying powerful and convenient. The ArangoDB query language (AQL) can be used to retrieve and modify data that are stored in ArangoDB. ArangoDB comes with a built-in web interface for an administration which makes it unique from all other Multi-Model databases. We tried to implement ArangoDB database using Movie Management Application. As these days, Movies are the major source of entertainment. Using the NodeJS and ASP.Net as front end and Foxx as middle tier application, with ArangoDB as a database. Using graph we were successfully able to recommend a movie, whereas using Key Value and Document model we were able to manipulate the movies by its genre and other attributes like the actor, director, etc.

¹ Department of Computer Science, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604
MarkLogic DB – NoSQL Database

Aashi Rastogi¹, Sanket V Patel²

With advancement in technology, data is growing at a staggering rate, storage is declining and more data is stored online. Therefore, handling those databases is of great need. NoSQL database can handle this unstructured data. NoSQL means non-SQL or non-relational databases which provides a mechanism to store and retrieve the data. MarkLogic DB is one of the Enterprise NoSQL databases that supports multiple-model database design. It is optimized for structured and unstructured data that allows to store, manage, query and search across JSON, XML, RDF (Triplestore), can handle data with schema free and leads to faster time-to-results by providing handling of different types of data. It provides ACID Transactions using MVCC (multi-version concurrency control). One of the important key feature of MarkLogic is its Bitemporal behaviour by providing data at every point in time. Due to its shared-nothing architecture it is highly available and easily and massively scalable with no single point of failure making structured data integration easier. It also has incremental backup means to only backup the updated data. MarkLogic provides Hadoop integration and Hadoop is designed to store large amount of data in Hadoop Distributed File System (HDFS) and works better with the transactional applications and many other future advancement applications.

¹ Department of Computer Science, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: faashira@my.bridgeport.edu

² Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: sanpatel@my.bridgeport.edu
A New Approach for Detecting of Selective Forwarding Attack over WSN

Naser M. Alajmi\(^1\), and Khaled Elleithy\(^2\)

Abstract- Wireless sensor networks (WSNs) are prone to most security attacks. These attacks are such as wormhole attack, sinkhole attack, selective forwarding attack, and Sybil attack. So, each layers in WSNs has some security attacks. Sensor nodes are easily susceptible to security attacks, since deployed these nodes are unattended and unprotected. Also, limited capacity of sensor nodes accounts for the security attacks on WSNs. Sensor nodes use communication to transfer packets from the source to base station by using multi-hop. Applications such as military surveillance, traffic surveillance, healthcare, and environmental monitoring are impacted by security attacks. Hence, researchers have created various types of detection approaches against such attacks. Selective forwarding attack is one of an attack that is not easily detected in the networks layer. In selective forwarding attack, malicious nodes function in the same way as other nodes in the networks. However, it attempts to delete or modify the sensitive information prior to transferring the packet to other node. Malicious nodes work in the same manner such as other nodes in the network field. However, these malicious nodes attempt to find sensitive messages and drop them before sending the entire packets to the next nodes. The attacker makes sensor network rely on the redundancy forwarding by using broadcast for data to spread in network. Based on researchers, limited power and low memory are obstacles that make conventional security measures inappropriate for WSNs. In this poster, we proposed an approach for monitoring this type attack in wireless sensor networks. We designed three layers including MAC pool IDs layer, rule-based processing layer, and anomaly detection layer. They maintain the safety of data transmission between a source node and base station while detecting selective forwarding attacks. Furthermore. We demonstrate the performance of the protocol by creating a military base scenario. There are some assumptions to detect the selective forwarding attack within certain applications. We assume that all nodes are the same specification. All nodes in the network are having the same energy at starting point and having maximum energy. As well as, we assume that nodes are uniformly distributed in network in a random manner. Malicious nodes should not drop any packets before launching a selective forwarding attack, and an adversary cannot attack nodes during their deployment.

**Keywords**— Wireless Sensor Networks (WSNs) and Selective Forwarding Attacks.

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\(^1\) University of Bridgeport/Computer Science and Engineering Department, Bridgeport, CT, USA, nalajmi@my.bridgeport.edu

\(^2\) University of Bridgeport/Computer Science and Engineering Department, Bridgeport, CT, USA, elleithy@bridgeport.edu
Working On Bills of Materials for Automobile Company Using Cortexdb as NoSQL Database

Swapnil Krishnachandra Savale

The CortexDB is a multi-model NoSQL database software package which provides a mechanism for storage and retrieval of data as well but it is different from regular tabular formats which is usually called as relational database. CortexDB is a universal application and a set of tools. Developers and users rely so very easy and fast to data analysis, new ideas and other requirements. Managing bills of materials (BOM), in particular recursive structures from various systems sets up many challenges, i.e. data dependencies describe possible combinations of parts for each configuration and country; different bills of material come from construction, logistics and manufacturing and have to be harmonized and synchronized; some parts have different names and numbers; high volume of very complex data (typically, construction assigns parts to several hundred vehicle types, logistics orders parts, and production selects parts (for e.g. each vehicle configuration comprises +/- 5000 parts); data need to be transferred carefully causing a huge amount of manual work needed to harmonize data in tools like Excel. But given a production of several thousand cars per day; the time-window for generating BOMs is limited to a couple of hours. It has been studied that the internal tests on BOM explosion with conventional relational databases showed that it took up to 120 seconds. Compare that with CortexDB, which delivers the result of the same explosion in 50 milliseconds.

Keywords: CortexDB, NoSQL, Bills of Materials(BOM), complex, data dependencies

1 Department of Computer Science, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604, Email: ssavale@my.bridgeport.edu
Bedridden Patient Lift Assist Robot (BePLAR)

Bhawna Shiwan¹, Dikshya Swai², Nikhil Advani³

Researches have shown that manual patient handling is one of the primary causes for the high prevalence of lower back pain among caretakers. Hoyer lift was the widespread solution used for transferring patients from bed to wheelchair. But this is a tedious task and makes the patients feel uncomfortable. To overcome these complexities, we simulated a human motion inspired assistive robot that can lift patients in its arms and transfer them to a wheelchair, under the supervision of a caretaker. The assistive robot performs the tasks to help in normal human activities of daily living (ADLs) that would otherwise have to be performed by a caretaker. In the past, robots have been very successful in various sophisticated industrial applications. Assistive robotics is one such promising domain which has proven the role of technology in improvising the medical facilities.

Our main aim was to simulate a robot that can lift and transfer a patient from bed to wheelchair. To approach this problem, human motions of picking and placing were captured and used as guiding parameters. The motions were simplified by using minimum number of joints possible to execute the task. The link lengths and dimensions of the robot were considered based on the average dimensions of a human body. The link positions and the weight of the patient were assumed to be constant. The robot model was developed in Simulink and the trajectory planning, kinematics and dynamics calculations were performed in MATLAB. Simulation results for lifting a patient weighing 60kgs are presented in this poster.

As the robot has close interaction with the patient during the transferring process, trajectory planning plays an important role in this. The trajectory for positioning of the robot was computed using cubic polynomials. Once the patient was lifted, Linear Segments with Parabolic Blends (LSPB) trajectory planning was used to ensure constant velocity during joint motion. The system dynamics were computed using the Lagrangian method. The torques required at each joint were calculated as a function of joint angles, velocities and acceleration after a thorough analysis of the human motions. The dynamic equations of the robot were solved using both MATLAB and Simulink’s inbuilt torque sensing feature. The torque values computed by both methods were closely related, thus validating the model dynamics.

The usage of this robot is not only restricted in lifting patients in hospitals. It can also be operated in homes for reducing the physical dependencies of the bedridden people.

Keywords: Assistive Robotics, Robot Dynamics, Supervised Control

¹ Worcester Polytechnic Institute, 85 Prescott, Robotics Engineering Department, bshiwni@wpi.edu
² Worcester Polytechnic Institute, 85 Prescott, Robotics Engineering Department, dswain@wpi.edu
³ Worcester Polytechnic Institute, 85 Prescott, Robotics Engineering Department, nadvani@wpi.edu

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Direct Write of Micro-Circuitry via Capillary Focusing

Ryan Mocadlo

Micro-cold spray is a process which could achieve the solid state deposition of metal powders through capillary focusing. In this process, ultra-fine particles are accelerated using high pressure helium through a capillary nozzle to a substrate, where they impact and subsequently deposit. Finer feature sizes have been a long-standing aspiration of the cold spray community, but have remained elusive despite extensive efforts. The Department of Defense has shown interest in using this type of additive process to create robust conformal antennas, and electronic packaging with strong adhesion to withstand the extreme G forces experienced at projectile launch. In addition, the high fidelity of the capillary process, due to small line widths, opens the possibility of additive manufacturing of parts and prototypes.

The main obstacle to micro cold spray is the use of ultra-fine powders which exhibit poor flowability, under ambient conditions. These ultra-fine powders exhibit high cohesive forces, leading to the formation of many agglomerates. These agglomerates not only cause clogs in the system, but also puts a limitation on the size of the inner diameter of the capillary tube. In the past, several novel feeding systems have been unsuccessfully attempted. The first approach was the use of impact vibrational energy to feed copper powder out of a stainless steel feed tube. The energy and scale of these waves were not able to break the agglomerates of copper present in the feed tube, leading to clogging. In the next prototypes, a screw feeder and plunger feeder were used. Both unfortunately were not able to feed powder due to the powders cohesive nature, which lead to damage of the parts. This work describes an innovative system, utilizing ultrasonic vibrations, to feed powder in a controlled and consistent manner.

In this novel system a piezo ceramic material was used to produce progressive waves in a small capillary tube. These waves are able to provide a consistent forward driving force, to be used to meter out small amounts of powders. The amplitude and frequency of the wave are controlled by signal generator, and can be utilized to control feed rate. Preliminary tests have also shown that the ultrasonic waves, introduced by a piezo ring, are able to break agglomerates formed as the powder flows. In order to experience the advantages of capillary cold spray, these agglomerates must be small enough to not cause clogging within the system.

Once powder flow is consistent this system will be able to deposit lines with widths of less than 110 µm, as well as thicknesses in the 10s of microns. These small line width are a result of the fine inner diameter of the capillary tube, as well as focusing forces experienced in high pressure capillary flow. As control and consistency of the feeding system increase, there will be an accompanying reduction in line width as the inner diameter of capillary tube decreases. In the end this process could produce micro-circuitry with stronger bonds, without the use of harmful masks, and at a faster throughput than traditional processes.

1 WPI, mocad@wpi.edu
Keywords: Cold Spray, Additive Manufacturing, Solid State Metal Deposition, Thermal Spray
Is Chemostat or batch reactors the best tool to access inhibition of nanoparticles on E. coli?

Nelson M. Anaya¹, Fatemeh Faghihzadeh¹, Nasim Ganji², Geoff Bothun², Vinka Oyanedel-Craver¹*
¹ Department of Civil and Environmental Engineering, ² Department of Chemical Engineering
University of Rhode Island

Multiplex chemostat and batch reactors were used to study the response of bacteria to casein-coated silver nanoparticles (AgNPs) exposure on Escherichia coli (E. coli). The chemostat array consisted on six small vessels fed with LB medium. E. coli K-12 was grown for 12.5 hours in LB media at 37°C. After that bacteria were exposed to a range of AgNPs from 1 to 50 mg/L and maintained for 12.5 additional hours. Batch tests were run using a microplate at similar conditions than those used during the chemostat tests.

E. coli membrane extracts, membrane permeability and Langmuir film balance assays were used to determine integrity and changes in lipid composition in response to AgNPs exposure. Experiments were run in duplicate including several controls to detect contamination; compare growth rates between bacteria with and without exposure to nanoparticles; and study interaction of silver nanoparticles in LB medium.

Results showed that batch conditions were not appropriated for the tests due to the production of exopolymeric substances (EPS) during the growth phase. After 5 hours of contact between AgNPs and the used growth media containing EPS, the nanoparticles increased in size from 86nm to 282nm, reducing the stability thus limiting cell-nanoparticle interactions. Membrane extracts assays showed that at 1mg/L AgNPs had a higher change in area (-4.4cm²) on bacteria compared to 15mg/L (-4.0cm²). This area increment suggested that membrane disruption caused by AgNPs had a stabilizing/rigidifying effect where the cells responded by shifting their lipid composition to more unsaturated lipids to counteract membrane rigidification.

In chemostats, the constant inflow of fresh media and aeration resulted in less AgNPs aggregation, thus increased the AgNPs-bacteria interactions, in comparison to batch conditions. AgNPs Membrane extract exposed to 1mg/L, 15mg/L, and 50mg/L of AgNPs showed higher changes in area by -0.5cm², 2.7cm² and 3.6cm², respectively, indicating that the bacterial membranes were disrupted and bacteria responded by synthesizing lipids that stabilize or strengthen their membranes.

This study showed that the chemostat is more appropriate for the testing of nanotoxicological effects when testing bacteria at growing conditions.

Corresponding Author: craver@uri.edu
Transparent Touch Screen for Next-generation Interactive Display

Essa Alharbi¹, Matheus Lima², Ce Zheng³, and Xingguo Xiong⁴

Abstract — Ever since the invention of Apple’s smart phones, touch screen display has become extremely popular in our everyday life. Devices such as smart phones, tablet computers and ATM machines bring significant convenience for us to access information anytime anywhere. It combines both screen display and information input into a single device. Using the touchscreen, people can directly interact with electronic devices with their fingers. This eliminates the inconvenience of having to carry a mouse of physical keyboard for information input. As an important part of interactive electronic devices, touch screen technology is expected to keep evolving in the future. Traditional screen display can only be viewed from the front side, which allowing a maximum viewing angle of 180°. In this project, we aims at developing a transparent touch screen display, so that the users can watch the screen from both the front and the back sides of the display. It allows a viewing angle up to 360°. The users can view the display and input information from all different directions. This will bring great convenience to the users, and improve the users’ experience on interactive electronic devices. The system consists of a transparent glass display, a Microsoft Kinect sensor and a projector. Ubidisplays software is used to convert any surface into a convenient touch screen capable of haptic feedback. The projector sends the image to the screen, which is composed of plexiglass covered with projection adhesive. The Kinect sensor can detect hand position or gestures and send the information back to the computer. After the software processes this information, the device will turn the glass into a convenient touch screen. The transparent touch screen allows users to view the displayed content and input information from any direction. The technology may be used for next-generation smart phones, tablets or virtual reality applications.

Keywords: Touch screen, Transparent display, Microsoft Kinect, Ubidisplays.

¹ Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: ealharbi@my.bridgeport.edu
² Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: malima@my.bridgeport.edu
³ Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: cezheng@my.bridgeport.edu
⁴ Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu
THE TESTING OF A CARBON FOAM LEAD ACID BATTERY

Sai Praveen Kolli¹, Linfeng Zhang²,

There have been a lot of developments in the field of energy storage, in the form of batteries, of late. The lithium-ion batteries are facing a major makeshift. New technologies are coming into existence. The focus of this paper is one such battery- the carbon foam lead acid battery. These batteries are a result of the integration of advanced carbon materials into conventional lead-acid batteries. Firefly Microcell Carbon Foam (MCF) batteries tap into the vast new global market for energy storage. It is available commercially worldwide. They are cheap and a lot better in their performance compared to technologies such as Li-Ion, Lead Carbon and Ultra Capacitor batteries.

Caterpillar faced major issues using the conventional lead-acid batteries due to their failure while used in the company's heavy equipment. This led the R&D department of the company to look for alternative battery technologies. They successfully developed carbon foam grids and used them as plates in the existing lead acid batteries. The technology proved to be successful and potential, leading the company to obtain a patent for the technology.

For electricity energy management, the accurate and real-time estimation of the state of charge (SOC) is necessary, since it can not only protect battery from over-charging or over-discharging but also improve the battery utilization efficiency.

In this paper, an inductor is added to a normal RC model of a lead-acid battery and the time derivative of the current is considered. The parameters in the model are determined through experiments and the effects of the inductor and the derivative of the current are considered in the extended Kalman filter. The battery is tested dynamically to check the accuracy of the SOC estimation through this model.

The battery tested is a new sealed lead acid rechargeable (AGM, Power Patrol SLA1116) with a nominal voltage as 12V and capacity, 18Ah. The testing setup includes a LCZ meter (HP 4276A), a programmable DC electronic load (TEKPower 3711A), a programmable DC power supply (BK PRECISION 1788), and LabView programs developed for data acquisition and instrument control. All the experimental setup is in the Renewable Energy Research Lab at the University of Bridgeport. In order to measure the real capacity, the battery was fully charged first and given a 24-hour rest. Then the battery was discharged at 18A to 10.5V in 2,306s. Thus, the capacity at discharging current 18A is 11.53Ah. In addition, the state-estimation method is implemented as embedded Matlab Script with shift register to hold finite state variables in the previous time step. The battery is connected to the programmable DC power supply in charging and it is connected to the electronic load in discharging. In the battery dynamic testing, both electronic load and DC supply are connected to the battery and a designed current profile is followed to charge or discharge the battery. The experiments were done at room temperature 25 °C. The parameters in the model are obtained from the battery nominal values and the experiments.
The experimental results show that the error of the SOC estimation is less than 1% if the estimation starts from a fully charged battery and it is less than 2% if it starts from a battery with SOC less than 100%. This model can be extended to other types of rechargeable batteries.

Performance Highlights:

- More than four times cycle life compared to flooded, gel or AGM batteries at 50% DOD
- Beats other premium batteries – longer life even under Partial State Of Charge (PSOC)
- True high performance at a fraction of the cost of “Premium” batteries
- Lower cost per KWh delivered compared to “Premium” batteries
- Unmatched Partial State Of Charge (PSOC) operating life
- Through put efficiency greater than 90%
- Improved high/low temperature performance
- Available Battery Energy Management System (BEMS)
- Instantaneous Power (2 hours and faster run times)
- Fast recharge capability
- Recovery to full capacity after off-season storage
- Excellent cold temperature capacity utilization.

This paper provides the carbon foam lead acid batteries as a potential alternative for all the above listed reasons. It also provides details about the experimental analysis conducted to test the real-time state of charge (SOC) of the carbon foam lead-acid battery.

Keywords: Microcell Carbon Foam (MCF), state of charge (SOC), Kalman filter, embedded Matlab Script, Partial State of Charge (PSOC).

1 University of Bridgeport, 126 Park Avenue, Bridgeport, CT 06604, skolli@my.bridgeport.edu
2 University of Bridgeport, 126 Park Avenue, Bridgeport, CT 06604, lzhang@bridgeport.edu
Design and implementation of a dual-axis solar tracker

Elyas Alhazmi¹, Zhiyu Zhu², and Linfeng Zhang³

Abstract:

Today, electricity is the most vital component of our living. In order to protect our environment and improve the energy security, solar energy is the one important renewable energy resources. The aim of this project is to build a solar tracker. Thus, the output of the photovoltaic system can increase.

Solar trackers are devices used to make photovoltaic panels, reflectors, lenses or other optical devices to face the sun. Since the sun’s position in the sky changes with the seasons and the time of day, trackers are used to align the collection system to maximize energy production. Several factors must be considered in the design of a solar tracker: the trade-off between the accuracy and the system stability, the trade-off between the tracker performance and the cost.

In our design, there are five main parts: one Arduino UNO board as a microcontroller, one Dual H bridge stepper motor driver, one set of photosensors, two linear actuators, and a lead acid rechargeable battery. Our objective is to implement a complete tracker with these five parts for a stand-alone PV system.

Methodology:

The whole work involves the reading of different sensor values and then comparing them digitally to determine the exact position of the sun in east-west direction. Again the system is also given some predefined values based on the sun’s geographical location in the north-south direction. Overall the entire system can intelligently track the sun’s movement both in horizontal and vertical axis. In order to simplify the design and implementation process the whole system is divided into two parts.

These are as follows:

(A) Mechanical System Design. Assembling the mechanical system was the most challenging part of this system because the objective was to make an energy efficient solar tracking system which demanded intelligent operations of the tracking motors.

1 Graduate/University of Bridgeport, 126 Park Avenue, CT 06604, ealhazmi@my.bridgeport.edu
2 Graduate/ University of Bridgeport, 126 Park Avenue, CT 06604, zzhu@my.bridgeport.edu
3 Associate Professor/ University of Bridgeport, 126 Park Avenue, CT 06604, lزhang@bridgeport.edu
(B) Electrical Circuit Design. The whole electrical system is mainly divided into three units. These are sensor unit, control unit, and movement adjustment unit. Sensor unit senses three different parameters (light, time, and position) and converts it to appropriate electrical signals. Then the electrical signals from sensor unit are sent to control unit. Control unit determines the direction of the movement of the motors both in the horizontal and vertical axes. Finally, the movement adjustment unit adjusts the position of the solar module by receiving signal from the control unit.

Conclusion:

The design, implementation, and testing of a hybrid dual axis solar tracking system is presented in the study. The Performance of the developed system was experimented and compared with both the static and continuous dual axis solar tracking system. This work demonstrates that hybrid dual axis solar tracking system can assure higher power generation compared to static panel as well as less power consumption compared to continuous dual axis solar tracking system. The result shows that the hybrid dual axis tracking system has 25.62% more average power gain over static system while it has 4.2% less average power gain compared to continuous tracking system.

**Keywords:** Solar energy, solar cell, solar tracker, dual-axis solar tracker
Evaluation of the bacterial removal efficiency of several different silver nanoparticle species when used in conjunction with ceramic water filters

Ryan Sullivan¹, Vinka Oyanedel-Craver²

Ceramic water filters are simple and effective devices for point-of-use drinking water treatment. They are widely used in rural communities in developing countries that lack reliable access to an improved drinking water source. Several studies have incorporated silver nanoparticles, an effective antimicrobial agent, into ceramic water filters to improve their bacterial removal performance. Although previous published studies have investigated the bacterial removal performance of silver nanoparticle impregnated-ceramic water filters, there is still uncertainty as to how the performance of these filters is effected by variables in the manufacturing and usage of the ceramic water filters, including porosity, clay mineralogy and chemistry, nanoparticle synthesis techniques, and influent water chemistry conditions (varying ionic strength, pH, organic matter content) on the effectiveness of the filters.

This study aims to address the aforementioned knowledge gap; specifically the antimicrobial performance of three nanoparticles species synthesized using different techniques (Tollen’s method, Casein method, and a modified “green” Tollen’s) and the effect that varying clay mineralogy has on the performance of these filters in conjunction with each of the nanoparticle species. Using Escherichia coli as a model organism, the bacterial removal efficiency of various combinations of silver nanoparticles and ceramic water filters will be examined, and the silver species with the highest bacterial removal efficiency will be determined. This silver species will then be applied to ceramic water filters made from several types of clay, and the effects of clay mineralogy on bacterial removal efficiency will be examined.

¹ Department of Civil and Environmental Engineering, University of Rhode Island, rsullivan1016@uri.edu
² Department of Civil and Environmental Engineering, University of Rhode Island
Online Volunteer and Event Management System for Neighbors Link Stamford

Sameer Shaik\textsuperscript{1}, Akaash Raj Athikam\textsuperscript{2}, Praveen Alluri\textsuperscript{3}, and Phong Do\textsuperscript{4}

Online volunteer management system is developed by capstone software project team at Fairfield University for the Neighbors Link Stamford, a non-profit organization whose mission is to strengthen the whole community by actively enhancing the healthy integration of immigrants.

Volunteers are important members of the organization to support various events held by the organization. However, all information of volunteers and events were manually entered into the external database (Salesforce\textsuperscript{TM}) and this manual process was time consuming and error prone. To help the organization, extensive research was conducted by the capstone team on existing commercial-off-the-shelf (COTS) software and services from a third party vendors to manage events and volunteers. However, the existing systems in the market have too many complicated functionalities for non-technical staff members in the organization to handle and maintain. To solve this problem, Online Volunteer and Event Management system (OVEM) was developed using WordPress, PHP, and MySQL Database by the capstone project team to automate the manual paper-based process of the volunteer and event management into user-friendly online system.

The Volunteer Management System provides the features for the staff member of the organization to create, edit, and track down all events and volunteers. It provides a portal for volunteers to log into the system, check for new events available, volunteer for particular events of interest, enter their log hours, and edit their personal information. Using this system, the organization can easily maintain the detailed records of the all volunteers, events that each volunteer is volunteering, and generate reports accordingly.

OVEM was successfully developed and deployed as part of organization’s web site after staff training and providing user manual. The usability testing was conducted and its results are displayed and discussed in the poster.

Keywords: Online Web application, Volunteer and Event management, WordPress, PHP, MySQL

\textsuperscript{1} Fairfield University, 1073 N. Benson Rd, Fairfield, CT 06824, sameerahamed.shaik@student.fairfield.edu
\textsuperscript{2} Fairfield University, 1073 N. Benson Rd, Fairfield, CT 06824, akaashraj.athikam@student.fairfield.edu
\textsuperscript{3} Fairfield University, 1073 N. Benson Rd, Fairfield, CT 06824, praveen.alluri@student.fairfield.edu
\textsuperscript{4} Fairfield University, 1073 N. Benson Rd, Fairfield, CT 06824, phong.do@student.fairfield.edu
IICCONN Online Management System

Nurtai Lamiev\textsuperscript{1}, Sai Krishna Kolanupaka\textsuperscript{2}, Sohail Syed\textsuperscript{3}, Brian Sutton\textsuperscript{4}

The online management system is developed to automate the process of translation and interpretation services for the International Institute of Connecticut (IICCONN), a non-profit organization whose mission is to help new immigrants, asylum seekers, and refugees settle in the state of Connecticut. One of the major challenges that IICCONN is facing with these services is that most of the process is conducted manually through pen and paper. We migrated their translation and interpretation services to be available online for easier management.

IICCONN Online Management System (IOMS) offers critical features that are the main ingredients for a more streamlined and efficient process. These features include Manage Jobs (MJ) that handle Translation/Interpretation Job Creation Form for creating new jobs; Manage Accounts (MA) for updating and or creating user accounts; and Invoice Management Process (IMP) for managing invoices.

This project has been successfully developed using HTML5, CSS, JavaScript, JQuery, PHP, and MySQL. These are cross platform open source languages that were utilized for the development of the online management system. After a successful deployment, user manual was provided to the employees. The user manual guides employees how to utilize the system and work efficiently focusing on the task at hand (Translation/Interpretation jobs) rather than focusing on administrative duties and also utilize the new data structures in place to manage clients data in a more organized and easy way.

The results have shown greatly increased productivity from employees at IICCONN. Usability tests have shown a dramatic increase. The burden of communication has been heavily decreased because of automated emails that are generated by the system. Translators/Interpreters have said that this system is much better for finding work at their leisure.

Future enhancement for the project will be integration of payment system, document preview functionality, and mobile application. As IICCONN’s clientele expands rapidly, IICCONN is in need of these functionalities to meet the growing demands.

\textbf{Keywords:} Web Application, Online Interpretation and translation service, IICCONN, PHP, MySQL.

\textsuperscript{1} Fairfield University, 1073 N. Benson Rd, Fairfield, CT, nurtai.lamiev@student.fairfield.edu
\textsuperscript{2} Fairfield University, 1073 N. Benson Rd, Fairfield, CT, saikrishna.kolanupaka@student.fairfield.edu
\textsuperscript{3} Fairfield University, 1073 N. Benson Rd, Fairfield, CT, sohail.syed@student.fairfield.edu
\textsuperscript{4} Fairfield University, 1073 N. Benson Rd, Fairfield, CT, brian.sutton@student.fairfield.edu
Graphene Based Electrically-Stimulated Controllable Drug Delivery using PVA-Borax Hydrogel

Azeez Ojo¹, Kimiya Zafar¹

**Background**--The quest to understand drug delivery to a specific site, quantity, or time has led to various method of trying to control drug delivery. If controllable drug delivery is mastered managing and treating diseases will improve dramatically. Liposomes, microsomes and hydrogel are been used for these purpose. Hydrogels with three dimensional network of hydrophilic polymers are being considered because of their biocompatibility, minimal mechanical irritation, low cost, and ability to crosslink. Electro-responsive hydrogels are now been favored as to others such pH, temperature and light stimulated hydrogel because of the availability of the equipment, precise control on the magnitude of current, intervals and duration of electric pulses.

**Method**-A 6% PVA-Borax hydrogel was made. 0.25g of 16.6%w/v of 0.1% and 0.001% of Rhodamine B (drug model) was then loaded into the hydrogel. The two different percentage of Rhodamine B gels were then attached to either of the positive or negative electrode (reverse and forward bias). A voltage of 100mv and 200mv were then applied when the gels were attached to either electrodes. At 15mins interval, absorbance was taken to study the rate of release of Rhodamine B form the gel. The experiments were again repeated but with the addition of Graphene.

**Results**-It was seen that there was significant difference between the rate of release of the forward bias as compared to both reverse and positive control (gel contained Rhodamine with no voltage applied) which are not significantly different from one another. There was a significant difference when the negative control was compared to the positive control, reverse and forward bias. As with Graphene, it showed higher release when compared to no Graphene.

**Conclusion**-Electrically stimulated controlled drug delivery was tested and it was observed that the forward bias base controlled release of the dye works best. Future research will further enhance this controlled release, as well as test various drugs from ibuprofen to doxorubicin, a cancer drug. If controllable drug delivery is able to be mastered then the results would change medicine. This will have massive clinical applications but also need to undergo major clinical trials.

¹Department of Biomedical Engineering, University of Bridgeport, Bridgeport CT, 06604.
azeezojo@my.bridgeport.edu, kzafar@my.bridgeport.edu

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Office Automation System for LifeBridge Community Services

Jayanth Murukonda¹, Richard Paredes², Ravikiran Kondeti³, Spoorthi Raghunandan Pattaparla⁴

Office Automation System is developed by the capstone project team at Fairfield University to simplify the process of managing timesheets for LifeBridge Community Services, a nonprofit organization whose mission is to empower people in the Greater Bridgeport area.

LifeBridge Community Services provides programs and services that help strengthen individual capability, build skills, and direct people to economic self-sufficiency. It consists of more than 200 employees who are working in various departments and programs and they are following a tedious process of filling their timesheets, submitting and getting it approved by a supervisor. This process took a lot of time away from employees, supervisors, and even payroll manager, thus it was inefficient. Furthermore, one employee can work in more than one department or programs which makes it hard to keep track of payroll. Hence, the capstone team solved the problem by developing the Office Automation System in a customized way to fit Lifebridge’s specific needs and improve payroll operations.

This system gives employees the ability to complete and submit their timesheets, and supervisors to approve or reject them. Through the notification system, supervisors can send out alerts of missing timesheets as well as send feedback to rejected submissions. After finalizing all the employee timesheets, the supervisor creates a summary of all the employees’ timesheets and submits it to the payroll manager. The payroll manager is then able to quickly and efficiently view all submitted timesheets, review and even download them in selected formats. This system also provides an intuitive and informative dashboard which displays users with important information such as number of hours worked, paid days off, notifications. Through the use of PHP, MySql, JavaScript, HTML and CSS, the Office Automation System provided the solution for the ongoing in-office payroll-related operations. These operations provide a much simpler and faster way to complete the payroll process at Lifebridge.

The Office Automation System was successfully developed and hosted on the organization’s intranet and training, user manual were provided.

Keywords: Employees, Online Timesheets, Operational Efficiency, Payroll, Supervisor

¹ Fairfield University, 1073 N.Benson Rd, Fairfield, CT-06824, jayanth.murukonda@student.fairfield.edu
² Fairfield University, 1073 N.Benson Rd, Fairfield, CT-06824, richard.paredes@student.fairfield.edu
³ Fairfield University, 1073 N.Benson Rd, Fairfield, CT-06824, ravikiran.kodenti@student.fairfield.edu
⁴ Fairfield University, 1073 N.Benson Rd, Fairfield, CT-06824, spoorthiraghunandan.pattaparla@student.fairfield.edu
DIRECTED SELF-ASSEMBLY OF MAGNETITE THROUGH ELECTROSPINNING WITH POTENTIAL APPLICATIONS IN NANOPATTERNING

Kamila Aikebaier¹, Isaac Macwan² and Prabir Patra³

Background:
Electrospinning is a unique method for producing micro and nano sized polymeric nanofibers consisting of high surface area, porosity and flexibility. It can further be utilized for producing nano-patterns in applications such as biosensors, magnetic recording and bioelectronics. Magnetite (Fe₃O₄) from the spinel group is the most magnetically natural mineral found on earth and it has been successfully used as a catalyst for the growth of carbon nanotubes (CNTs). This work focuses on a consistent synthesis of magnetite nanopatterns for selective growth of CNTs for potential applications in bioelectronics.

Methodology:
Here we come up with a novel method of using magnetite crystals (~25nm) dispersed in acetic acid over an aluminum substrate fixed on a rotating disc collector spinning at 1500rpm. The nano-patterns obtained are for the electrospinning distances of 11cm, 13cm, 15cm, 17cm, 19cm, 21cm and 23cm. Each electrospinning trial was performed at the flowrate of 1.5ml/hr and 15kV for 2 hours.

Results:
It was found that distances between 15cm and 19cm are the optimum distances at which large evenly distributed individual magnetite crystals are obtained. It was also found that distances play a significant role (due to a variable electric field per unit area) in producing self-assembled magnetite films, which was confirmed through SEM and EDAX.

Conclusion:
In this research a novel technique using electrospinning of iron oxide nanoparticles has been investigated for creating controlled nanopatterns, where biologically sequestered magnetite nanoparticles are proposed. This technique can be used as a fine control of the nanofiber diameter, production of a defect-free or defect-controllable nanofiber surface as well as for the formation of continuous single nanofibers.

¹ Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, kaikebai@my.bridgeport.edu
² Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
³ Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Keywords: Magnetite, Electrospinning, Nanofibers
Graphene Semiconductor Field Effect Transistor

Manoj Kumar Manimaran¹, Isaac Macwan², and Prabir Patra³

Background:
The microelectronic industry has scaled the transistor feature size from 10µm in 1975 to almost 22nm in 2014 to improvise on cost, performance and power consumption. The semiconductor industry made major changes starting from BJTs to MOSFETs utilizing bulk CMOS planar technology and lately Silicon-on-insulator and FinFET being the current commercially available as the transistor scaling came down from 65nm to 22nm. Thus, a material compatible with the further scaling sizes in the sub-10nm regime would be of great interest that can preserve the MOSFET principles giving better performance and yet as small as theoretically calculations predict (~5nm). Graphene and graphene oxide being compatible with each other and can foresee transistor devices of the smallest possible dimensions. This work consists of simulations of the electrical characteristics of the bulk CMOS technology nodes from 90nm down to 22nm including traditional silicon material and comparing it with fully functional devices consisting of carbon allotropes such as graphene and graphene oxide (G/GO).

Method:
Simulation of the graphene-based transistor is performed using COMSOL Multiphysics software (semiconductor module) in which modeling of a 2D MOSFET device is performed giving a solution for the transistor DC characteristics, turn-on voltage, concentrations of electrons and holes and doping profiles. Finite element method was utilized for the physical calculations in correspondence with the initial and boundary conditions specified.

Results:
The turn-on voltages for 90nm and 65nm showed VGS=0.5V and 0.4Vin the resistive mode and a VDS of 0.4V for the saturation mode. The electron and hole concentration and the electron potential profiles provide the evidence with no tunneling of the current to the substrate.

Conclusions:
The simulation study performed with graphene as a component for the transistor gives a positive result with the electrical characteristics being analyzed. A further enhancement would be the study of FinFET and SOI with graphene as a component and then the ultimate goal is to fabricate the G/GO transistor comparing the simulated characteristics.

¹ Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, mmanimar@bridgeport.edu
² Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
³ Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Keywords: COMSOL, Transistor, Graphene, Graphene oxide, Silicon.
GOLD NANOPARTICLES AND SiRNA COMPLEX FOR TARGETED DRUG DELIVERY

Rupesh Srinivasalu1, Isaac Macwan2, and Prabir Patra3

Background:
Gold nanoparticles have been employed for in vitro, ex vivo and in vivo imaging applications but mainly for serving as scaffolds for therapeutic drug delivery systems. There is a dearth of information intertwined with drug delivery studies particularly the diffusion process through the membrane. Due to the various federal regulations, these experiments are not directly performed on live subjects and therefore there is a need for simulating the behavior of the processes. The information derived from the simulations can impact the drug delivery systems in a way that modifications can be done to produce better drug release and better specificity of the intended drug. From various wet lab research it is found that targeted drug delivery systems (TDDS) are more effective with the presence of SiRNA and AuNp complex.

Methodology:
In this study we examine the dynamics of the SiRNA/ gold nanoparticle (AuNp) complex with respect to the various parameters such as media, time and concentration. Due to the lack of information regarding the dynamics of the SiRNA and AuNp complex, optimization of the drug release and transfection efficiency is relatively low. This is mainly achieved by the “Transport of diluted species” module in COMSOL, where most of the drug delivery based simulations are carried out. Simulations are done by defining the physics of the complexes involved in the TDDS. The media is modeled as blood and the concentration variation of the complex along with time is studied and the stability is also analyzed with time as a variable. Since the physics of the entire media is defined by the user it is a very effective strategy in designing and modeling the diffusion behavior of such complexes within blood and through the cell membrane.

Results:
It is found that the stability of the complex is good for 15 seconds in the blood and through the outer membrane. When it reaches the inner membrane, the membrane electric field is strong

1 Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, rsriniva@my.bridgeport.edu
2 Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
3 Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
enough to dissociate the complex releasing the SiRNA into the inner membrane.

**Conclusion:** SiRNA/AuNP based drug delivery can be seen as an option for the TDDS with higher efficiency in transfection. Further studies are underway.

**Keywords:** SiRNA, Gold nanoparticles, COMSOL, TDDS
Comparative Study of Data Mining techniques to predict the credit card fraud detection

Utkarsh Parekh

The number of credit card holders, the use of credit cards, and credit card fraud has increased considerably. The fraud detection problem is always an emerging analytical problem for the financial institutions. In this research, fraud detection has been implemented using Logistic regression, Decision tree, and Random forest. The results from these different techniques will be compared to identify which one is better for the dataset. In this paper, we built a predictive model using the historical data for target variable “gt2”. This is a binary variable. Its value is equal to 0 for a good observation and is equal to 1 for fraud observation. The loan managers can make decisions based on an application’s socioeconomic and demographic profiles. This model will provide bank managers decisions such as whether the loan is approved or not for applicants.

Keywords: logistic regression, decision tree, random forest, credit card fraud

1 Dept. of Computer Science, University of Bridgeport, 221 University Avenue, Tech 229, Bridgeport, CT 06604, uparekh@my.bridgeport.edu
Autonomic Future Internet

Hitaishi Kasinath\textsuperscript{1}, Kislay Jha\textsuperscript{2}, Madhumi Gaat\textsuperscript{3}, Megha Thanvi Turlapati\textsuperscript{4}, Anudeep Gulla\textsuperscript{5}

The advances in the technology have increased tremendously and today’s internet can be considered as a revolutionary infrastructure connecting various computer systems through a network. The present internet which was designed many years ago is facing various emerging demands as every electronic device is connected to the internet. This connection to network requires privacy, security, mobility, access control and data management. This incorporates the transition to the Internet of things which evolves the internet to the next physical level by building smart ecosystems. Internet of Things (IoT) refers to an emerging paradigm which integrates a large number of smart objects with the internet. The IoT involves interactions take place between objects and computers, objects and humans and objects to other objects. The technologies that would enable implementing the internet of things are the RFID (Radio Frequency Identification) that would provide unique address to all these objects connected over the network. In order to automate these objects so that they could react to the changes in the environment or even sense them, a Wireless Sensor Node (WSN) technology is employed. These increases the complexity and challenges arises in various heterogeneous areas. One among such area of challenge is the addressing capability of the Internet Protocol (IP). This article emphasizes on the approaches towards future internet that include architecture principles and devoting the programmability to the infrastructure by software defined networking (SDN) capability.

Future predictions show that in coming years, the number of devices connected to the network will increase. So the addressing and the identification of those is needed that will be scheduled to come online and increase the overhead burden on the existing internet protocol which is IPv4. When deploying the connected devices to the network, the major challenge which we need to tackle is the addressing. In this research paper, the research activities that address the challenges of the IoT Addressing are outlined. Our major area of research is on the addressing issues of the future IoT. Accordingly, drawbacks of IPv6 which is understood as a replacement to the IPv4 are discussed. Finally, we provide a solution by integrating the existing

\textsuperscript{1} M.S in Computer Science at University of Bridgeport, 1610 Fairfield Avenue, Apt#112, Bridgeport, CT 06605, hkasinat@my.bridgeport.edu
\textsuperscript{2} M.S in Computer Science at University of Bridgeport, 170 Lafayette Street, Room-112 North Hall, Bridgeport, CT 06604, kjha@my.bridgeport.edu
\textsuperscript{3} M.S in Computer Science at University of Bridgeport, 400 Atlantic Street, Apartment B2, Bridgeport CT 06604, mgaat@my.bridgeport.edu
\textsuperscript{4} M.S in Computer Science at University of Bridgeport, 1610 Fairfield Avenue, Apt#112, Bridgeport, CT 06605, mturlapa@my.bridgeport.edu
\textsuperscript{5} M.S in Computer Science at University of Bridgeport, 170 Lafayette Street, Room-112 North Hall, Bridgeport, CT 06604, agulla@my.bridgeport.edu
standards and protocols to the MQTT protocol and evaluate the solution in a real world scenario, latency and delivery semantics. Mosquitto is an open source message broker that provides a server implementation of the Message Queue Telemetry Transport (MQTT) protocol. A great advantage of the Mosquitto broker is its compliance to the MQTT protocol. The MQTT protocol proves to be suitable for Wireless Sensor Networks (WSNs) and various heterogeneous environments due to its small code footprint, low bandwidth usage and also standardized interfaces. This MQTT is implemented by Mosquitto broker which is an open source message broker adapted to mobile IoT environment. In future, we propose to make changes to the present systems by replacing state complexity with computational complexity, using data intelligence to permit user choices so as to provide appropriate reactions to the same, obtain correlations from data analytics to help get an optimal solution to inherently hard Network problems.

**Keywords:** Internet of things(IoT), network, smart devices, future protocol, challenges.
A Novel Mechanism for Cheiloscopy Authentication Using Bio-hashing Technique

Mohan Raju Anga, Kotaiah Tellagorla, Mohammad Farooqui and Abdelshakour Abuzneid

Department of Computer Science, University of Bridgeport, CT.

Authentication means verification of user with his user credentials. This is done by password, tokens and biometrics. However, the latter one was promising due to its salient features compared to the former ones. Even though the biometric authentication is better than passwords and tokens but it also faces some security breach. Therefore, we try to improve the existing system of biometric authentication by making it a multi factor process and taking into consideration the lip pattern (Cheiloscopy) of a person. It is medically proven that humans possess a unique lip pattern similar to the finger print and the iris. In the initial part, we apply different image processing algorithms to capture the lip print and then process if to obtain feature vector, which is hashed with a random number. In the later stage, a random code is sent to the registered mobile number. When both the credentials match then the user is authenticated. Therefore, we enhance the level of security by bio-hashing and multi-factor authenticating.
BIOPRINTING USING DUAL INJECTION MULTI-DIMENSIONAL EMBEDDING OF HYDROGELs

Steven Falzerano\textsuperscript{1}, Isaac Macwan\textsuperscript{2} and Prabir Patra\textsuperscript{3}

The goal of this paper is to demonstrate the use of robotics in multidimensional dual extrusion biological printing with the assistance of a polymer based hydrogel substrate. Current methods of 3D biological printing (bioprinting) are hindered by the necessity to create a scaffolding to support the intended acellular scaffold to in turn support embedded cells and cellular growth. Modern techniques using multiple extruders and angling are limited in their direction of application and thus their ability to maintain a precise scaffold structure over time. We have devised an affordable means of overcoming these concerns in constructing and maintaining 3D engineered tissue by means of a unique robotics based 3D printing method.

The printer features a 150μm extruding needle and multiple 1.25mm pitch lead screws each run by finely tuned stepper motors for precision construction. The main printer can be paused, allowing the rotating plate to be properly angled for the robotic arm to continue embedding, as well as to make repairs and provide the means for maintaining the scaffold from any angle. This new technique uses multiple computer aided sliced stereolithographic files to guide the device in overcoming the necessity of printing a single layer by layer structure at any one angle, allowing for greater control of construction, maintenance and repair.

Using a standard 3 axis 3D printer in conjunction with a rotating printing platform and a secondary 4 axis stepper motor robotic arm with an additional extruder, we have managed to develop a bioprinter capable of overcoming several limitations facing standard 3D printing techniques. In addition to this method, we have produced greater structural stability and support through the use of a biocompatible low viscosity hydrogel polymer substrate and biological ink (bio-ink). The substrate used for the embedding and suspension of the bio-ink consists of 2.3% PVA and borax, a hydrogel that we found to have the necessary shear elastic modulus and buoyancy to allow for the printer's needle to move through unhindered without affecting the previously printed layers and yet allowing the bio-ink, consisting of a PDMS and graphene oxide to freely remain suspended at the level of extrusion.

Multidimensional 3D printing, with near limitless degrees of freedom will be the first step in allowing continued robotic growth and preservation of all tissue engineering projects. Having the ability to mechanically apply all necessary structural changes and growth factors will allow for fully automated and thus uninterrupted production of any form of tissue.

\textbf{Keywords}: 3D printing, hydrogel, Bioprinter

\textsuperscript{1} Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, sfalzera@my.bridgeport.edu
\textsuperscript{2} Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
\textsuperscript{3} Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Influence of graphene on PCL scaffold for tissue engineering applications

Guruvel Raja Veluchamy Murugeshan\textsuperscript{1}, Sheila Berna\textsuperscript{2}, Isaac Macwan\textsuperscript{3} and Prabir Patra\textsuperscript{4}

Background:
An important approach in tissue engineering is to develop suitable scaffold with good properties which is meant for implantation. PCL is widely used FDA approved polymer in biomedical field. It is biocompatible, biodegradable and also has good mechanical properties.

Methodology:
We fabricated PCL scaffolds using electrospinning technique by optimizing various conditions to get bead free nanofibers. Nanofibers produced by electrospinning technique were characterized using Scanning electron microscope to confirm the size, surface morphology etc. Graphene is introduced into PCL scaffolds to increase the conductivity of the scaffolds and also to further improve the mechanical properties of the scaffold. These scaffolds provide a good platform for the cells to interact well and proliferate.

Results:
Impedance measurements were done for various concentrations of PCL and PCL with graphene. We found that if there is an increase in graphene concentration, there is decrease in impedance measured for the fibers.

Conclusion:
The future study would be to implant the prepared PCL-Graphene scaffolds into an animal model.

Keywords: PCL, Graphene, Scaffold, Electrospinning

\textsuperscript{1}Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, gvelucha@my.bridgeport.edu
\textsuperscript{2}Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, sberna@my.bridgeport.edu
\textsuperscript{3}Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
\textsuperscript{4}Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Biochip with Graphene-based Nanosensor for Non-invasive Glucose Sensing

Peiqiao Wu¹, Ce Zheng², and Xingguo Xiong³

Abstract - Blood glucose test is important for diabetes diagnosis and self-monitoring nowadays. Traditional blood glucose test uses a lancet device to prick the patient’s finger to get a drop of blood sample for testing. Since this invasive test causes pain to patient and increases the risk of cross-infection of blood-transmitted diseases, non-invasive glucose monitoring has become very attractive alternative to blood glucose test. Meanwhile, research has also found that saliva glucose is promising to be used as biological sample for diabetes diagnosis. However, the major challenging in the testing is that the glucose concentration in saliva is generally very low and many other ingredient in saliva may interfere with the measurement. In recent years, graphene has offered the opportunity for non-invasive painless glucose sensing due to their extremely large surface areas and improved catalytic activities even in the molecular level. In this poster, we designed a Lab-on-a-Chip (LoC) which combines graphene-based glucose nanosensor with microfluidic biochip for non-invasive glucose sensing. The proposed device consists of two electrolyte solution reservoirs for storing electrolyte solutions and saliva sample; two micropumps for pumping the electrolyte solution and saliva samples into the following micromixer; the microvalves for regulating the direction of the microfluidic flow; the micromixer for improving the mixing of biological sample and testing chemicals. Once electrolyte solution and saliva samples are thoroughly mixed, they are injected into the electrochemical reaction chamber. There are three electrodes pre-embedded in the chamber: Counter Electrode, Reference Electrode and Working Electrode with graphene and Cu nanoparticles pre-deposited on its surface. The glucose concentration in the saliva sample can be derived by measuring the electrochemical current between the electrodes when glucose molecules in saliva interact with Cu nanoparticles in graphene sheets and changes the electrocatalytic activities. After the glucose level is identified, the mixed solution is pumped into waste collection reservoir for disposal. The functional working stages of the device is simulated by COMSOL. The simulation result is used to verify and optimize the performance of the biochip for glucose sensing.

Keywords: Lab-on-a-Chip (LoC), Glucose Sensing, Graphene, Nanosensor, COMSOL simulation.

¹ Department of Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: peiqiaow@my.bridgeport.edu
² Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: cezheng@my.bridgeport.edu
³ Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@my.bridgeport.edu
CHIRALITY BASED SEPARATION OF CARBON NANOTUBES BY ANALYZING THE SPECIFIC INTERACTION WITH THE AMB-1 FLAGELLIN DERIVED TRI-PEPTIDE

Shrishti Singh¹, Isaac Macwan², Prabir Patra³

BACKGROUND: Chirality based separation of a mixture of carbon nanotubes (CNT’s) into individual m-CNT and s-CNT is carried out through expensive and tedious lithography on an industrial scale for semiconductor based applications. Hence, studies were conducted to determine a cheaper and safer method. It involves the interaction between the flagellum of Magentospirillum magneticum (AMB-1) and a CNT mixture. It was observed that the glycine residues in D3 domain of flagellin protein specifically interacted with m-CNT. In this work, the interaction between glycine with two flanking amino acid residues is substantiated to determine the role of glycine and its specific interaction with m-CNT.

METHOD: Molecular Dynamics based simulations were carried out using VMD and NAMD. R-type flagellin pdb (1UCU) file was obtained from the Protein Data Bank. Glycine residues with two flanking amino acid residues (forming a tri-peptide) were extracted from the D3 domain of R-type flagellin pdb file. Simulations were carried out between m-CNT and various combinations of tri-peptide with glycine in the middle of the two flanking residues for a period of 50 ns. All simulations used the CHARMM force field, TIP3 water model and a 0.05 mol/l neutralizing NaCl concentration. Temperature was maintained at 300 K at a pressure of 1 atm.

RESULTS: The flanking residues of glycine played an important role in the specific interaction of glycine with m-CNT. The presence of a more hydrophobic residue on either side of glycine contributed a more hydrophobic nature to glycine thus establishing a stronger interaction between glycine and m-CNT, whereas hydrophilic flanking residues resulted in weaker interaction between glycine and m-CNT.

CONCLUSION: The study of specific interaction between glycine and m-CNT can provide an in-depth analysis on the overall specific interaction of D3 domain of AMB-1 flagellin protein. Once established that glycine in D3 domain specifically interacts with m-CNT, the use of AMB-1 flagellin for chirality based separation of CNT mixtures can further be explored.

KEYWORDS: AMB-1, flagellin, CNT, glycine, chirality

¹Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, shrsingh@my.bridgeport.edu
²Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
³Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Gait balance detection and analysis with smartphone application

Prithi Donthula¹, Lavanya Vuligonda²

Gait detection is a major concern problem in the field of biomedical engineering. Many experiments have been conducted to prevent the fall. This work consists of the devices and their function to detect and calculate the Gait. Gait can be detected through various methods. This work deals with gait detection using following devices-: 3-axial accelerometer sensor, Arduino Uno kit, GPS-GSM module, buzzer(alarm) and Bluetooth. For the analysis of different patterns, we use MATLAB. Arduino Uno kit is an open source electronics prototyping platform based on flexible and easy-to-use hardware and software. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer.

Accelerometer helps in tracking human motion and it plays a vital role in gait detection. An accelerometer is a device that converts acceleration into an electrical signal. Both dynamic and static acceleration can be measured using an accelerometer where dynamic acceleration is the acceleration due to any force except for the gravitational force applied on a rigid body and the static acceleration (or gravitational acceleration) is due to the gravitational force. The output of an accelerometer can be analog or digital. Here we use 3-axial accelerometer. In tri-axial accelerometers, X, Y, and Z axes can sense tilt. The Z axis can be combined with both of the tilting axes to improve angle/tilt sense precision and accuracy. In order to define the angles of the accelerometer in three dimensions, the pitch, roll and theta are sensed using all three outputs of the acceleration. Pitch (ψ) is defined as the angle of X-axis relative to ground. Roll (φ) is defined as the angle of the Y-axis relative to ground, and theta (Ѳ) is the angle of the Z-axis relative to gravity. As gait detection is all about calculating the tilts of the human 3-axial accelerometer can provide better accuracy. On the smartphone side, the application is made of four major components: Background Service, Classification Engine, Notification System and Graphical User Interface. Smartphones are very common devices in daily life and can be used to access gait patterns and also to detect the location of patient during the fall with the help of GPS-GSM module which would send the location of the person in the form of a message to the doctor or the prescribed person according to the data given to the module. It is possible to locate people or other objects in an environment without using expensive global positioning system (GPS) devices. We will be also using a buzzer(ALARM) in the kit which produces sound during the fall of the person so as to give an indication to patient/user before the fall or to alert the people around to help. The signals can be real time monitored on smartphone by using Bluetooth where gait analysis application is developed. We are also trying to analyze and process the gait signals from Physionet website databases, (Gait in Neurodegenerative disorder database) with various kinds of diseases such as Parkinson’s disease, Huntington’s disease, Amyotrophic lateral sclerosis and Healthy control. With the signals obtained, in this study, we try to develop a new automated approach for classifying (diagnosing) locomotive patients using features that may be extracted from their gait signal. We selected four groups: patients with Huntington’s disease, Parkinson’s disease and Amyotrophic Lateral Sclerosis and a group of

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healthy subjects. We examine various classification methods such as support vector machine with different kernels, K-nearest neighbors, Artificial neural networks etc., with different features such as mean and standard deviation of power spectral density and introduce novel feature with acceptably lower error rate.

**Keywords:** Gait, Accelerometer, Smartphone, Physionet, Support Vector Machines.

1. M.S in Biomedical Engineering at University of Bridgeport, 1610 Fairfield Avenue, Apt#112, Bridgeport, CT, 06605, pdonthul@my.bridgeport.edu

2. M.S in Biomedical Engineering at University of Bridgeport, 1610 Fairfield Avenue, Apt#112, Bridgeport, CT, 06605, lvuligon@my.bridgeport.edu
FPGA based magnetic field control for guiding Magnetotactic baceteria

Marvin Xavierselvan¹, Isaac Macwan² and Prabir Patra³

Introduction: Magnetotactic bacteria (or MTB) are a group of bacteria that orient along the magnetic field lines of Earth's magnetic field. These bacteria have organelles called magnetosomes that contain magnetic crystals, which aid in aligning with the magnetic field. MTB’s can be used in various applications like MEMS, Micro Total Analysis Systems and lab-on-chip. These bacteria can be guided along a predefined path by controlling the magnetic field. Magnetic field can be created using solenoid coils and the field strength is varied by changing the current through the coil, these bacteria can sense the magnetic field and can align itself towards the field to move towards the North Pole. By changing the magnetic field along a predetermined path, these bacteria can be guided. We propose an idea to control the path of Magnetospirillum magneticum (AMB-1) that can be used in drug delivery systems.

Materials and Methods: We used a small coil of thickness 50 micrometer to make a tiny mesh that creates a path for the bacteria by creating the magnetic field. Altera DE2 board is used to provide the current supply for the coil and also to change the direction and the strength of magnetic field. We used the AMB-1 Magnetobacteria for the experiment.

Results and discussion: We have made a very small mesh to create a path for the bacteria to move. We used FPGA board Altera DE2 to pass the necessary current through the tiny coil and also able to change the current direction in the coil and presence of current in particular portion of mesh alone. We can also sense the magnetic field generated by the coil.

Conclusion: We focus on making an FPGA mesh for guiding the MTB by controlling the magnetic field generated by the mesh. We also focus on implementing this idea for making a programmable drug delivery system using bacteria.

Keyword: Magnetotactic Bacteria, Magnetospirillum magneticum (AMB-1), FPGA

¹Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, mxaviers@my.bridgeport.edu
²Department of Biomedical and Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, imacwan@bridgeport.edu
³Department of Biomedical and Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604, ppatra@bridgeport.edu
Design and Implementation of Dynamically Configured Multi-port Cache Memory employing new DMP Technique

Akshit Jain\textsuperscript{1}, Abhishek Krishna\textsuperscript{2}, Isaac Macwan\textsuperscript{3}

Abstract: This poster reports a functional 64*32 Multi-port Static Random Access Memory (SRAM) operation and compares it to an area and energy efficient multi-port SRAM architecture which uses a dynamic memory partitioning algorithm. To achieve such memory system, we used Mentor graphics software for construction of the memory architecture (0.5 um technology).

The algorithm used in this project takes the conventional SRAM and divides it into sections by creating isolation nodes and control lines to dynamically partition the bit lines of a memory block. The partitions made are virtually isolated sections which can be accessed simultaneously and independently.

The proposed system consists of 3 main sub-modules – Isolation Control Line (ICL) generator, a controller and the SRAM isolated module.

- The Isolation Control Line (ICL) generator takes the value from the system which contains the information regarding the storage location of the data. Multiple addresses can be given simultaneously with read or write to be performed. The 32*64 SRAM block is divided into two blocks depending on the address location. These locations can be accessed from the top or bottom. Operate the read or write operation depending upon the instructions.
- The Controller is a synchronous circuit which takes in the signals from the input and decides the operation. The possible operations are based on the combination of read or write in block1 and block2. A state machine and flow diagram is constructed to justify the logic. The controller takes the input from the ICL Generator and uses it to decide the function to be performed. The critical cases like write operation in both the blocks are given sufficient delay to complete the operation and avoid overwriting the data.
- The SRAM module is the circuit which can store data. It consists of a decoder (6*64), SRAM array (32*64), read and write driver circuit, precharge circuit and pass transistors (for isolation of blocks). The decoders take the address input and give output (word line). It switches on the specific row of SRAM in which the address location exists. Now the precharge circuit is switched ON to precharge the Bit Lines depending on the read/write operation. It is followed by the operation of read/write driver circuit. It is used to overwrite the previous data in SRAM cell in write operation and reports previously written value inside the cell in case of read. Pass-transistors are used to isolate the cells so that the signal switches on only the part of the SRAM block which is in the operation and switches off (by bypassing the cell) which are not required.
The proposed design saves silicon area, leakage power and reduces bit line latency in comparison to conventional SRAM architecture.

**Keywords:** SRAM, Multi-port memory, Dynamic Memory Partitioning, Mentor Graphics.

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1 Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: akjain@my.bridgeport.edu

2 Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: abkrshi@my.bridgeport.edu
Detecting and Defending Against DoS Attacks in Various Networks

Krishna Sagar Biradawada, Phaneendra Atmakuru, Bala Rohit Reddy Gurivireddy, Sandeep Kumar Darla, Bhargav Ram Mutukula

Abstract: Denial of Service (DoS) attack is one of the significant problems on the internet. In this paper, we discuss the DoS attacks in both LAN and wireless LAN networks. The problem needs to be tackled on many fronts simultaneously. This paper throws light on various detection and defending techniques against DoS attacks. There are many detecting techniques like Network-based intrusion detection system, Network novel authentication scheme and change point monitoring (CPM) were discussed. We discuss how to defend against DoS attacks using various techniques like using router, Protocol architecture, IP algorithms, and Active queue management and we explore the tools that will help in defending against DoS attacks. The goal is to enlighten everyone by the current day trends in detecting and defending against DoS attacks.

Keywords: Denial-of-Service, DoS Attacks, SCTP, DoS Attacks in WLAN.
Structural Analysis and Design of the Frame of a Desktop 3D Printer

Yi Tan¹, Yazhou Liu², Junling (Joyce) Hu³

3D printing has gained popularity in recent years as more affordable desktop 3D printers are available in the market for a wide range of applications. A desktop 3D printer is a precision machine designed to provide accurate dimensions during the printing process. A 3D printer with a weak frame causes misalignment in layers and reduction in dimensional accuracy in printed parts. The typical layer thickness is usually 0.2mm, thus the tolerance should not exceed 0.02mm to avoid misalignment during printing. This project conducted an analysis of the whole frame structure of a desktop 3D printer, with an emphasis on the main beam and two supportive frames. The vertical deformation is found to exceed the tolerance requirement with the original aluminum structure frame. The main frame is redesigned with a beam cross-section optimized using ANSYS to increase stiffness without significantly increasing the cross-sectional area.

Keywords: 3D Printer, frame design and testing

¹ University of Bridgeport, "Yi Tan" <yitan@my.bridgeport.edu>
² University of Bridgeport
³ University of Bridgeport
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Analyzing the fluxes in brain lobes at different Stages of Alzheimer’s disease

1Dr. Buket Barkana, 2Sri Lakshmi Priya Pedapati, 3Shobhitha Sarab, 4Shruthi Sabbidi

One out of nine, over the age of 65 is affected with AD disease. AD disease has no cure but there are treatments depending on symptoms and still the research continues for the delay, prevent and cure. In this paper the changes in lobes of the brain at different stages of Alzheimer’s disease were analyzed. Just as the other organs the brain changes along with the age and at a certain age our brain cells die. This Disease has a great effect on the quality of life for affected individuals and caregivers and also affects the surrounding individuals. It makes the person depend on other person completely which is very challenging to survive in present day. They have tough time to adjust and cope up with the changes occurring in the patient. There are many diseases which are much more dangerous, but the reason behind this research is as every person might go through this disease at a certain age mostly after their 60’s and a statistical data is proposed which could be useful for further treatments depending upon the stages of AD. In this research MRI images were taken from the database OASIS (Open Access series of Imaging studies). Images from that database were of different age groups used to analyze the results between the healthy brain and diseased brain. The images are of axial length 208*176 pixels we processed the images with the aid of using Matlab and changed the gray scale image to binary image. The images are of axial length 208*176 pixels and are processed by using Matlab, converted the Gray scale image to binary image. The binary images derived are often called as masks. Bitwise operation is performed on basic masks to get the morphological structures. According to the final image which is masked intensity level of the white and gray in an image through histogram. But the optimal thresholds for white and gray intensities are found out which calculates histogram of an image. It provides ultimate threshold for segmenting the pixels of an image into two or more sections based on their intensities. Based on this a unique threshold values are set to calculate the count of white matter, gray matter and transition matter (the gap between white and gray in a histogram). Statistics were drawn depending upon the mean value of grey matter and white matter during different stages and loss of gray matter and white matter were analyzed and further these results could be used for further medical diagnostics and treatment.

1 Department of Electrical Engineering, University of Bridgeport, bbarkana@bridgeport.edu.
2 Department of Biomedical Engineering, University of Bridgeport, spedapat@my.bridgeport.edu.
3 Department of Electrical Engineering, University of Bridgeport, ssarab@my.bridgeport.edu.
4 Department of Electrical Engineering, University of Bridgeport, ssabbidi@my.bridgeport.edu.
Design of a Piezoelectric Micromotor for Microrobot Application

Xuan Zhang¹, and Xingguo Xiong²

Abstract - With the rapid development of robotics technology, nowadays the robots have the trend to become smaller and smaller in size. Smaller size microrobots can be used for microelectronics assembly lines, micro surgery and many other applications. In order to make such small robots, the important driving parts – motors should also shrink their size. MEMS (Microelectromechanical Systems) technology is a good choice for the fabrication of such micromotors. It allows the feature size of micromotors to be shrunk to the size range of microns. Micromotors based on various actuation techniques have been reported. Among them, piezoelectric micromotor is very attractive due to its easy operation and good controllability. However, MEMS micromotors generally have the limitations of small displacement and weak output force/torque. In this poster, a piezoelectric micromotor with relatively large displacement and strong output force is proposed. Its special design allows it to convert the high-frequency vibration into large continuous linear movement and strong output force. The working principle of the micromotor is analyzed and a theoretical model is developed to predict its performance. COMSOL simulation is used to verify the working mode of the micromotor. The simulation results are further used as feedback to improve the micromotor design. It is well suitable to be used in microrobot for high-accuracy microelectronics assembly lines.

Keywords: Microelectromechanical Systems (MEMS), Micromotor, Servo Motor, Piezoelectric Actuation.

¹ Xuan Zhang: Master student in Department of Department of Electrical and Department of Computer Science, University of Bridgeport, Bridgeport, CT 06604; Address: 343 Park Avenue, Bridgeport, CT 06604; Email: xuazhang@my.bridgeport.edu; Tel: 401-574-601
² Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu

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Analysis of the structural evolution of Graphene-CNT-Polypyrrole nanocomposite.

Maitri Jariwala\textsuperscript{a}, Ankarao Kalluri\textsuperscript{a}, Shrishti Singh\textsuperscript{a}, Ashish Aphale\textsuperscript{a}, Isaac Macwan\textsuperscript{a,b}, Prabir Patra\textsuperscript{a,c}

BACKGROUND: Structural evolution of various polymers is significantly related to the synthesis and performance of nanocomposite substrates. Polypyrrole is a conductive polymer whose structure is well studied and its role in synthesizing free standing graphene films is being studied. In this work, we report the evolution of the formation of polypyrrole chains and its intercalation with graphene/carbon nanotubes (G/CNT) nanocomposites. Experiments were carried out to demonstrate the growth of the polypyrrole layers and their interaction with G/CNT. The above mentioned nanocomposite has been recently utilized to create a hybrid electrode for a supercapacitor device.

METHODS: 0.89 ml of pyrrole monomer was dispersed in 25 ml of deionized water containing 0.355 g of sodium sulphate. 0.0125 g of CNT and 0.0125 g of graphene was added to the solution. The solution was then sonicated for 15 minutes at constant temperature. Cyclic Voltammetry (CV) was used for the synthesis of nanocomposite on graphite rods at a scan rate of 10mV/s in the voltage range between 800 mV-900 mV. The procedure was repeated for 5, 10, 25, 50 and 100 cycles of CV. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) were utilized to image the evolving morphology of the G/CNT/Ppy nanocomposite. X-ray diffraction (XRD) was utilized to determine the crystal structure of the nanocomposite film.

RESULTS: With the increase in the number of cycles, the visible deposition of the nanocomposite on the graphite rod increases. SEM and TEM images of the nanocomposite film reveal distinct structural differences with the images of polypyrrole layers appearing as a cauliflower-like structure with 5 cycles, as a thin-layered morphology whereas for 100 cycles, the nanocomposite images demonstrate a high level of multi-layered morphology. The XRD data reveal a distinct crystallized structure of the nanocomposite films for larger cycles and step-by-step evolution of the polypyrrole layer as it crystalizes on the G/CNT substrate.

CONCLUSION: The structural evolution of Graphene-CNT-Polypyrrole nanocomposite has not been reported till now. Its structural elucidation can bring a new nanocomposite to the forefront whose complete study can improve the performance of the devices such as a supercapacitor by modulating its charging and discharging characteristics as well as its apparent use in biosensing of the biological macromolecules.

\textsuperscript{a}Department of Biomedical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604. 
\textsuperscript{b}Department of Computer Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604. 
\textsuperscript{c}Department of Mechanical Engineering, University of Bridgeport, 126 Park Avenue, Bridgeport CT 06604.
Design of a 4X4 Pipelined QCA Multiplier

Mingwei Jing¹, and Xingguo Xiong²

Abstract:

In this poster, a 4X4 QCA (Quantum-dot Cellular Automata) multiplier based on pipelined architecture is designed and simulated in QCADesigner software. Quantum-dot Cellular Automata is a promising technology for future next-generation nanoelectronic circuits. It has the advantages of ultra-low energy consumption, extremely fast speed, very small circuit area and high device density. QCA circuit also suffers from noise coupling problem. That is, when two quantum-dot arrays are too close to each other, their fields will affect each other leading to cross-coupling between wires and causing errors of the circuit. Thus, we designed pipelined parallel array QCA circuit to help overcome the noise coupling problem. Pipelined architecture also leads to improved throughput with minimum area overhead. The 4X4 QCA multiplier is designed and simulated in QCADesigner software. The pipelined architecture can be easily extended to other QCA logic circuits as well.

Keywords: Quantum-dot Cellular Automata (QCA), Multiplier, Pipeline Architecture, QCADesigner.

¹ Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: mjing@my.bridgeport.edu
² Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu
Integration of SDN and NFV with Next Generation Networks

Hemanth Swamy¹, Ashwitha Thokala Shashikumar², and Amir Esmailpour³

The Next Generation Network (NGN) will provide higher capacity and low latency. The development of different technologies such as Network function Virtualization (NFV), Software Defined Networking (SDN) and cloud computing are among the deriving forces that will bring about possible solutions to the addressed features promised by NGN. NFV and cloud can be used to offer quicker and more reliable network access for growing traffic, while SDN can be used to separate data layer from control layer. So this poster presentation provides analysis of technologies such as SDN and NFV that offer different architectural options to address the needs of future networks.

Keywords: NGN, SDN, Cloud computing

¹ University of New Haven, 300 Boston Post Road, CT 06516, hswam1@unh.newhaven.edu
² University of New Haven, 300 Boston Post Road, CT 06516, athok1@unh.newhaven.edu
³ University of New Haven, 300 Boston Post Road, CT 06516, aesmailpour@newhaven.edu
Preliminary Design of a Wall Climbing Robot

Majed Hotami¹, and Yong Zhu²,

Design and fabrication of a wall climbing robot is a challenging task. Locomotion and adhesion method in the case of wall climbing robots are very challenging. There are three types of locomotion mechanisms: the crawler, the wheeled and the legged types. There are also three types of adhesion methods: vacuum or suction cups, magnetic, and transfixing to the surface. During the last decade, various types of wall climbing robots were designed to move over a smooth and curved surface. To keep the robot attached to a wall firmly, suction cups or magnets were used. Climbing robots are very helpful and intelligent machines that can be used in a variety of applications like maintenance, building, examination, and safety in the process and construction industries. Climbing robots are mostly used in situations where humans cannot access directly or human access is expensive. Recently, wall climbing robots are extensively used for cleaning purposes. Some personalized window cleaning robots have already been used in building maintenance, but their operating cost is very high. Therefore, the need for small, lightweight and portable robots are increasing.

In this project, a wall climbing robot was designed in such a way that it can climb a wall with a minimum numbers of vacuum cups. The designed robot is modeled in Autodesk Fusion Ultimate 360. Two types of design will be presented. The initial design consists of two legs, one shaft, two vacuum cups, and four servo motors. The servo motors are used to control the rotation of the robot legs and shaft. Two servo motors are connected to the legs with a short pin, while the other two are connected with the shaft with the help of a long pin. Two motors are used to rotate the two legs of the robot and other two are used to rotate the robot shaft. After designing and modeling both legs and the shaft of the robot, they were fabricated using 3D printing technology. However, after initial testing, we concluded that the robot will not move with two vacuum cups because an issue was encountered while trying to install the servo motors onto the legs. Therefore, the design was modified from using two vacuum cups to using eight vacuum cups instead. The modification was successful, which made the continuous climbing possible. At present, the robot is designed in such a way that it will only conduct linear movement. To make this robot more advanced in future, maneuverability and other functions need to be incorporated. This robot can be used for oil tank inspection. Moreover, it can be used in military, police, and personal security applications. It can also be used in various environments and situations. For example, at one place it can be used for surveillance purposes, such as it can take snapshots with the help of a mounting camera, while in another case it can be used to provide information in hostage situations.

Keywords: Robot, Wall Climbing, Design, Servo Motors, Vacuum Cups

¹,² Department of Mechanical Engineering, Wilkes University, 84 W South St, Wilkes-Barre, PA 18701, majed.hotami@wilkes.edu
Design and Simulation of a 4-bit Multiplier Using Quantum-dot Cellular Automata

Mehak Jaswal¹, Advisor: Xingguo Xiong²

Abstract – Quantum-dot cellular automata (QCA) is one of the most promising technology for the next generation nanoelectronics. Traditional VLSI technology utilizes voltage levels to represent information (digital “0” and “1”). The change of states results in current flow, hence leading to power consumption. However, QCA circuits utilizes charge polarity inside a quantum-dot (with size in the range of nanometers) to represent digital information (“0” or “1”). Hence it has the advantages of low energy consumption, high integration density and fast speed. In this poster, the design and simulation of a four-bit multiplier using quantum-dot cellular automata is reported. Multiplier is one of the most important mathematical units in ALU (Arithmetic-Logic Unit) and microprocessor design. The multiplier is design and simulated with QCADesigner software. The correctness of the design is verified with simulation results in response to some test pattern sequences. Modularized architecture is utilized in the design so that the multiplier can be easily extended to 8-bits or more. The propagation delay and area of the designed multiplier are also analyzed. The robustness of the signals in the multiplier is also discussed.

Keywords: Nanotechnology, Quantum-dot Cellular Automata (QCA), Multiplier, Quantum Computing.

¹ Department of Electrical Engineering, University of Bridgeport, Bridgeport, CT 06604, USA, Email: mjaswal@my.bridgeport.edu
² Department of Electrical Engineering, University of Bridgeport, Bridgeport, CT 06604, USA, Email: xxiong@bridgeport.edu
Flu Trend Prediction Using Social Media Network Data

Ali Al Essa¹, Miad Faezipour², Jeongkyu Lee³, Gopala Duggina⁴

Influenza can be a serious problem, and can lead to death, as hundred thousands of people die every year due to seasonal flu. An early warning may help to prevent the spread of flu in a population. Therefore, health care providers need to get an early warning of the flu season. Early detection will help them to take appropriate actions in order to prevent the spread of flu in a given population. Usually the required warning is obtained from Center of Disease Control and Prevention (CDC). It takes about 1 to 2 weeks to be published. For that reason, it is important to come up with faster prediction models. With the benefit of big data tools and techniques together, with the use of social media networks, an early warning can be achieved.

Presently, people use social media networks on a daily basis to share their news, events, and their daily health status. People can be used as sensors and a big data analysis system can be used to predict flu trend.

Since social media networks have enormous data, Hadoop systems and Hadoop Eco systems could be used for different analysis scenarios. An early warning obtained by these tools and techniques using data of social media networks can help health care industry to take actions at the right time to prevent the spread of flu.

The dataset for this study was collected using a developed crawler which works together with the Twitter API to stream and filter the tweets based on flu-related keywords. The crawler is also designed to pre-process and clean the unintended attributes of the retrieved tweets.

In this study, different analysis scenarios were implemented using Hadoop Systems and Hadoop Eco Systems to predict flu trend in different locations using Twitter data posted over the month of November 2015. The results show that an early warning can be achieved faster than the typical ways.

Keywords: flu; social media; trend; prediction; Hadoop; MapReduce; Hive

¹ University of Bridgeport, Computer Science and Engineering, 126 Park Ave. Bridgeport, CT 06604, alessa@my.bridgeport.edu
² University of Bridgeport, Computer Science and Engineering, 126 Park Ave. Bridgeport, CT 06604, mfaezipo@bridgeport.edu
³ University of Bridgeport, Computer Science and Engineering, 126 Park Ave. Bridgeport, CT 06604, jelee@bridgeport.edu
⁴ University of Bridgeport, Computer Science and Engineering, 126 Park Ave. Bridgeport, CT 06604, gduggina@my.bridgeport.edu
Design and simulation of multiple filament extrusion system

Ibrahim Shehadeh¹, and Prof Junling Hu²

The improvement and development of 3D printing processes requires the ability to implement an unlimited number of filaments. This practice saves operation cost, printing time, and increases the printer durability. This poster proposes an alternative design for a chamber test that can be added to the printer. The chamber must guarantee that the overall optimized printing parameters provide the best performance and the main printing extrusion parameters match the chamber. Furthermore, we model the thermo process to study the effect of process's parameters on the printed parts quality.

¹ Ibrahim Shehadeh, Graduate student, University of Bridgeport, Ishehade@my.bridgeport.edu
² Junling Hu, Associate Professor, Chair, Mechanical Engineering, School of Engineering, University of Bridgeport, jjhu@bridgeport.edu
The Effects of Intermittent Solar Radiation in Off-grid Solar Power System  
A Case Study of Two Cities; Irbid and Abu Dhabi 
'Worst Month' Method  

Taleb Hussein Al-theanat¹, Mhd Aymen Lpizra ²

Abstract—Many Photo-Voltaic (PV) Engineers design the PV system based on the annual average solar irradiation values of the installation area. This design is adequate if the weather of the installation area provides a small variation between the maximum and minimum solar irradiation values. This study illustrates the impact of the solar radiation by comparing the design of two off grid PV systems installed in two different locations have same annual average solar irradiation values. The case study selected the city of Irbid in Jordan and Abu Dhabi in UAE. The monthly average Irradiation values in Irbid are very diverse where the minimum, average and maximum values are spaced compared with the values in Abu Dhabi which has no significant variation of solar irradiation from month to month. Comparing the Design of the two different systems will reflect the impact of the sporadic solar irradiation on the rating values for the components of each system, which is affecting PV system cost. The design assumes the same load based and the worst case scenario of the solar irradiation.

Each system will consist of PV modules, charge controller, power inverter and batteries.

Keywords: Photovoltaic System, Off-grid, solar irradiation, PV module.

¹ University of Bridgeport, Bridgeport, USA, talthean@my.bridgeport.edu  
² University of Bridgeport, Bridgeport, USA, mlpiza@bridgeport.edu.
Numerical Study on the Thermal Performance of Embedded Heat Pipes for CPU Cooling

Alan Eskandar\textsuperscript{1} and Professor Junling Hu\textsuperscript{2}

Thermal management of central processing units (CPU) becomes more challenging in the development and production of high performance computers with faster and smaller size CPUs. More heat is and higher heat flux produced by these faster and smaller CPUs may cause components to overheat and fail unexpectedly. The conventional CPU cooling uses an aluminum or copper heat sink attached to the CPU chip and a fan is used to increase air flow through the heat sink to maximize heat transfer. The convection heat transfer through the heat sink depends on the air flow rate generated by the fan. The size and speed of fan need to increase in order to generate high flow rate to cool high performance CPUs. The typical active fan heat sink cannot provide effective cooling to the current high performance CPUs under the low-noise conditions and the limited space inside computers. Heat pipe has emerged as a promising heat transfer device for CPU cooling. Heat pipes are two-phase cooling devices with an effective thermal conductivity over 200 times higher than that of a copper heat sink. Heat pipes have light weight, low cost and the flexibility of many different sizes and shape options. They can be embedded into the metallic heat sink to provide more efficient thermal management.

This paper studied the thermal performance of a heat pipe embedded in the Noctua NH-D15 CPU cooler, which is a CPU cooling system comprised of a finned heatsink, a heat pipe, and two NF-A15 PWM fans. Computational fluid dynamics (CFD) analysis is conducted in SolidWorks Flow Simulation to study the conjugate heat transfer of the CPU cooling system. The heat transfer in the heat sink and heat pipe and the temperature and flow fields in the flow around the heat sink and heat pipe are examined to gain understanding of the heat transfer and flow pattern and insights for CPU cooler design improvements. The effects of heat pipe on the heat transfer and the maximum CPU temperature are studied by comparing the simulation results obtained with replacing the stock fan with a golf fan. The computed maximum CPU temperature will be compared with the CPU temperature recorded via a computer software tool at various CPU power levels and fan speeds.

**Keywords**: Thermal management of CPUs, CPU heat flux and cooling, thermal performance

\textsuperscript{1} University of Bridgeport, alan.eskandar@gmail

\textsuperscript{2} University of Bridgeport, jjhu@bridgeport.edu
Resource allocation in device to device communication using cellular networks

swetha krishnamurthy rao¹, mounika vasireddy², naga pallavi kowtha³, anusha ponnam⁴, naga srinivas boyapati⁵

Device to device communication is a developing technology. The tremendous growth in devices to the already overloaded network has resulted in high traffic leading to the demand for wireless services. User demand now is faster transmission of data to devices located anywhere in this world. The issues that are to be addressed in device to device communication are resource sharing and QoS (Quality of Service). In cellular networks, the base station is usually responsible for allocating resources to the devices that request service from the network. The base station based on the request transmits data to the corresponding destination device. When the destination device is quite close to the source device, such data transfer results in high transmission rates which reduces the throughput or performance of the network. Therefore, the time to service a request and also the load on the system are high.

The base station instead of overloading the network can identify the location of the devices and if the location is close to each other can allow those devices to directly communicate with each other. This is the basic system model considered in device to device communication. The discovery of the devices close to the source is done by proximity discovery. There are two ways to discover a device, one is by network discovery where the device is able to discover other devices in radio proximity. The other discovery is by user assisted discovery where users of the same service are discovered with the help of the network used. Also, device to device communication helps in local services like video streaming, file transfer, gaming etc. This type of communication also helps the user with the freedom of either sharing or reuse of the existing resources which is termed as underlay or using the standard dedicated resource for each service which is termed as overlay. Due to high spectral efficiency, underlay is more often used than overlay. Reuse of the resources is called resource optimization where radio resources are used so that the same spectral resource can be used among the devices. The network lets two or more devices which are communicating to share the same resources.

Resource sharing involves problem of its own such as D2D to cellular interference, cellular to D2D interference and interference between D2D users. Interferences as mentioned above might reduce the performance of the system. Out of all these, interferences between the D2D

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¹ University of Bridgeport, "swetha krishnamurthy rao" <swkrishn@my.bridgeport.edu>
² University of Bridgeport, "mounika vasireddy" <mvasired@my.bridgeport.edu>
³ University of Bridgeport, "naga pallavi kowtha" <nkowtha@my.bridgeport.edu>
⁴ University of Bridgeport, "anusha ponnam" <aponnam@my.bridgeport.edu>
⁵ University of Bridgeport, "naga srinivas boyapati" <nboyapat@my.bridgeport.edu>
and cellular is the most important issue. D2D users monitor the transmission of data and calculate the path loss that occurs between the source device and the destination device. A limit is set to the interference which is called the threshold of the interference. When the transmission rate is above the minimum threshold then such transmission is stopped as it becomes clear about the occurrence of interference in the network. Therefore, it is essential to provide efficient management of interferences. Security is another concern of D2D communication. When two devices are communicating with each other, no one should be able to see the data transferred between them. In D2D, security is provided at different extents like in interactions between user and network, exchange of data between two or more users, access to the cellular network or the base station, security between the user’s device application and the base station in the networks and the configuration of different service. Various resource allocation schemes with due consideration on energy, location, interferences etc. are discussed in this paper.

Keywords: Quality of service, Mode selection, Data rate, Interference, Resource sharing.
GPS based attitude determination and verification using a serial robotic arm

Almat Raskaliyev¹, and Kishore Thota²

Robotics, Intelligent Sensing, and Control (RISC Lab)

School of Engineering, University of Bridgeport.

In this article, we emphasize the real-time requirement of attitude determination of the moving object and propose a reliable single frequency, epoch by epoch attitude determination method constrained by baseline lengths and an auxiliary dynamic model of the platform. This method takes advantage of preliminary information of baseline lengths and the predictive model of the rotating platform based on its potential trajectory and angular rates of rotation.

In this work we propose an algorithm for determining the attitude of a rigid body in 3 dimensional space. To do this, we use 3 L1 GPS receivers that use GNSS satellites. To test and verify our model we use a serial robotic manipulator, by changing the orientation of the manipulator's end effector at predetermined rates with the rigid body attached along with the GPS sensors we can verify our mathematical model. The data obtained shows that our model works very well. In this paper we discuss both the mathematical model as well as the experimental setup for model testing and verification, and present our results.

Our goal was to develop GPS-based attitude determination algorithm based on the predefined dynamic model. The performance of this technique was tested in a series of experiments by using a serial robotic arm. Finally, accuracy of this algorithm can be improved by incorporating appropriate cycle slip repair method for post processing of the occurred data gaps.

Keywords: GPS, robotic arm, attitude determination, GNSS.

¹ University of Bridgeport,126 Park Avenue,Bridgeport,CT,06604, raskaliyev@mail.ru
² University of Bridgeport,126 Park Avenue,Bridgeport,CT,06604, kthota@my.bridgeport.edu
A Review of Self-Assembly Materials

Weibin Ye

Self-assembly material is a kind of material which can process in a disordered system of pre-existing components forms an organized structure or pattern as a consequence of specific interactions among the components themselves, without external direction. As complex structure of materials systems are becoming popular though, there is a pressing need to further explore these kind of materials. This poster will review four aspects: principle, property, fabrication and application. It will specifically discuss the order of components, interactions and the building blocks of nano-level structures. For applications of this type of material, 3-D printing is a viable method to use based on the SA methods.

1 Department of Biomedical Engineering, University of Bridgeport, weibinye@my.bridgeport.edu
Analysis of Hypervisors in Virtualized Servers

Ananthi Selvamani\textsuperscript{1}, Vamshi Krishna Perumalla\textsuperscript{2}, Jagadeesh Battul\textsuperscript{3}, Sai Madhav Perumalla\textsuperscript{4}, Narender Rayala\textsuperscript{5}, Professor Omar Abuzaghleh\textsuperscript{6}

Abstract:

As the number of new computer applications grow to meet the requirements of end users, companies invest a significant amount of capital on purchasing new servers and hosting these applications. With an increased number of servers installed to host individual applications, the number of servers in data centers increases exponentially. In turn, this results in unnecessary additional costs such as dc space, power consumption, cooling equipment, network usage, and labor cost to maintain the servers. To address these additional costs, companies have incorporated a technique called server virtualization. Server utilization reduces these additional costs and improves the utilization of the server to its maximum efficiency. Hypervisor is a tool that enables the server virtualization technique to be achieved. Our project provides an overview of the concept of server virtualization, hypervisors and research on real time implementation measuring the comparison of various hypervisors. Furthermore, our poster will show an analysis of parameters needed to evaluate hypervisor efficiency with performance metrics.

Keywords: Server virtualization, hypervisors, server costs

\textsuperscript{1} University of Bridgeport, Department of Computer Science, aselvama@my.bridgeport.edu
\textsuperscript{2} University of Bridgeport, Department of Computer Science, vperumal@my.bridgeport.edu
\textsuperscript{3} University of Bridgeport, Department of Computer Science, jbattula@my.bridgeport.edu
\textsuperscript{4} University of Bridgeport, Department of Computer Science, sperumal@my.bridgeport.edu
\textsuperscript{5} University of Bridgeport, Department of Computer Science, nrayala@my.bridgeport.edu
\textsuperscript{6} University of Bridgeport, Department of Computer Science, oabuzagh@bridgeport.edu
A PEG-Based Hydrogel Bioink for Layer-by-Layer 3D Tissue Engineering Technique

Moudley Louis-Jean

The main goal of tissue engineering is to design an organ through the help of a computer-aided design then expect it to be implanted into an individual. It is agreed that it is the perfect solution to counteract the increase in the number of people that died each year because they were unable to receive an organ or because they body reject the organ implanted in them. Tissue engineering assist in the design and engineering constructs that are as compatible as our body’s own system. It is certain that building a 3D designed scaffold then applied seeding of different types of cells followed by cell culture through the use of pure scaffold printing is a way to go. But keep in mind that this state of the art and promising design no matter how amazing it sounds has a lot of flaws that effects cell viability, growth and proliferation that could be encountered by a more efficient approach. While engineering a tissue using the scaffolding method by applying processes like porogen melting, salt-leaching, and gas foaming through the process it leads to an insufficient control of geometry. Another issue is that 3D designed scaffolds impact cell behavior. Furthermore, 3D scaffolds face some more and very hard to solve problems such as vascularization inside the scaffolds and inability to print and well placed different types of cells where they are supposed to be in the scaffolds. A new method with a whole new different aspect incorporating into the synthesis of a new hydrogel based system come into play which will take into account most of the problems facing the traditional process of bioprinting and solves them by using 3D tissue printing. This new process uses a layer-by-layer of PEG gel bioink technique. The growth of the field of bioprinting has intensely been slowed due to many factors like our ability to synthesize compatible bioinks. In changing the properties of the materials we can definitely design better bioinks that can tackle useful issues that scientists faced like stiffness and degradation con definitely enable better cell migration and tissue formation. To add, the synthesis of this new bioink method will allow us to create a better more reliable products will facilitate the manipulation of biological, chemical, mechanical and physical properties of the materials and generating a superior construct. Polymer solutions have the inability to self-support during layer-by-layer printing so the solution must be made very viscous or gelled rapidly right after printing. To prevent gel deformation during layer by layer printing we could use high polymer fraction gel but this process will not be ideal because it prevent matrices formation and vascularization in vivo and also inhibit migration, cell proliferation, and scattering. Here we will focused on a novel 3D tissue printing method using layer-by-layer gel deposition PEG-based bioink.

**Keywords**: tissue engineering, 3D tissue printing, scaffolding, bioink, PEG.

1 University of Bridgeport/Department of Biomedical engineering, Master’s student, 126 Park Ave Bridgeport CT, 06604, mlouisje@my.bridgeport.edu
Device to Device Communication Using Cellular Networks

Chandra Sekhar Koneru¹, Mustafa Ali Baig Mirza², Manoj Balla³, Srinivas Nalluri⁴, Nihal Bayya⁵, Omar Abuzaghle⁶

Abstract:

Device to Device (D2D) Communication Using Cellular networks is an active research area these days. This is the very base of the 5th generation (5G) mobile networks. Though the D2D communication using Cellular Networks has a many advantages, it is still in the developing phase. In this poster, we investigate the techniques for implementing the D2D communication by using the existing radio spectrum and by achieving high data rates. The problems related to the implementation of the D2D communication using cellular networks is evaluated and had deliberate the proposed methods for solving these specific problems. The protocols used for establishing connection between two devices with single frequency by using the resource allocation protocol is investigated. Full duplex D2D connection is phased including communication setup, resource allocation and its performance is analyzed. The major problems which are to be solved like Interference, Spectrum Overloading and Power Control. Session Setup Mechanism based on Selective scanning which is used to reduce the interference and also to effectively connect two devices is evaluated. Resource allocation which is mainly done to reduce the interference and also to increase the spectrum utilization, is analyzed extensively. By removing the problems concerned with the D2D communication, its architecture in the 5G networks are evaluated.

Keywords: Cellular network, Device to Device, Resource allocation, 5G network.

¹ University of Bridgeport, Department of Computer Science, ckonera@my.bridgeport.edu
² University of Bridgeport, Department of Computer Science, mmirza@my.bridgeport.edu
³ University of Bridgeport, Department of Computer Science, mballa@my.bridgeport.edu
⁴ University of Bridgeport, Department of Computer Science, snallur@my.bridgeport.edu
⁵ University of Bridgeport, Department of Computer Science, nbayya@my.bridgeport.edu
⁶ University of Bridgeport, Department of Computer Science, oabuzagh@bridgeport.edu.
Design of an Ionization-based Portable PM2.5 Air Quality Sensor

Zhong Deng¹, advisor: Xingguo Xiong²

Abstract – PM (Particulate Matter) 2.5 refers to microscopic solid or liquid particles with diameter of 2.5µm or less which suspend in the air. Nowadays PM2.5 pollution has become a serious problem in developing countries due to their intensive manufacturing and construction activities. Those particles are threatening people’s health because PM2.5 can easily invade human lungs and penetrate into deep inner tissues inside human body. PM2.5 pollution is linked to increased lung cancer, heart attack and many other diseases. Monitoring the PM2.5 concentration in the air has become pressing need for people living in the area with serious air pollution. Conventional air quality sensors use beta ray attenuation to sense PM2.5 concentration in government apartment. Optical sensing is frequently used in portable PM2.5 sensors. However, for beta ray attenuation method, if the membrane is not the same as the particles in the air, it will cause inaccuracy to the measurement result. The optical method is also affected by the humidity in the air because water steam also reflects the light. The sensor may incorrectly recognize the water steam in the air as PM 2.5 particles. Ionization based PM2.5 sensing can avoid the above disadvantages of both methods. In this poster, the design of an ionization-based portable PM2.5 air quality sensor is proposed. The input air first passes through a filter to ensure only particulate matter with diameter of 2.5µm or less can enter the sensor. The particulate matter in the air sample is then ionized to become charged particles. Such ionized particulate matter will then be accelerated by an electrical field and finally hit the collection electrode. The resulted charge accumulation will be measured by a sensing circuitry and the concentration of PM2.5 particles in the air sample can be derived. The ionization-based PM2.5 air quality sensor is designed and its function is verified by COMSOL simulation.

Keywords: Particulate Matter (PM), PM2.5 sensor, Air Quality Monitoring, Ionization.

¹ Department of Electrical Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: zhden@my.bridgeport.edu
² Department of Electrical and Computer Engineering, University of Bridgeport, 221 University Avenue, Bridgeport, CT 06604. Email: xxiong@bridgeport.edu

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