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## **Abstracts from the 2013 Oklahoma Research Day**

**Held at the University of Central Oklahoma**

### **05. Mathematics and Science**

### **06. Computer Science**

#### **05.06.01 A Comparison of Artificial Neural Network Libraries**

**Patrick Harrington,**

*Northeastern State University*

Artificial neural networks were designed to model the unique architecture of the human brain, and are used to solve complex problems that are otherwise hard to solve using traditional algorithmic techniques. Neural networks are used in character recognition, speech recognition, and can be applied to NP-complete problems including the traveling salesman problem. There are several computer programming libraries, complete with code, available that allow for implementation of neural networks. Our research uses the concept of neural networks to compare three of these artificial neural network libraries: FANN, Snipe, and Encog. Our comparison is based upon the areas of the features, extensibility, documentation, and efficiency of the libraries. Our findings indicate that the Encog library is the most robust and the overall best choice.

#### **05.06.02 Android TextEncrypt**

**Rad Alrifai, Clinton Parker,**

*Northeastern State University*

With a drastic increase in high profile hacking attacks in the last few years, the general public has become increasingly aware of computer security issues. Cell phones, despite being mobile computers now, are generally not considered unsafe by the average person as long as they maintain possession of it. Unfortunately, the most common encryption standards used by cell phone transmissions currently, A5/1 and A5/3 (known as KASUMI) have been shown to be weak and vulnerable to attack with very modest computational resources. Additionally, due to the nature of the SMS service architecture, text messages that are sent are stored in multiple locations other than the sender and receiver. TextEncrypt attempts to mitigate these weaknesses by encrypting a text message with AES 128bit encryption before ever broadcasting the message, thereby adding an additional layer of significant protection behind the obfuscating layer of the current lacking standards. Should an attacker either decrypt the radio signal or gain access to an SMS server, they will still need to decrypt the individual messages. This is currently a nontrivial task.

### **05.06.03 Sharing and Social Networking through Mobile Devices Based on Cloud Computing**

**Zhibin Zhang, Jicheng Fu,**

*University of Central Oklahoma*

This research cooperates with Cloud Computing. It will investigate a new way to allow users to share information through mobile devices and to find other users within a certain physical range. The purpose of this research is to invent a tool that allows people to share data and to socialize with each other more easily and effectively. Right now there is a running prototype web application online at Google App Engine.

### **05.06.04 Towards an Intelligent System for Clinical Guidance on Wheelchair Tilt and Recline Usage**

**Jicheng Fu, Paul Wiechmann,**

*University of Central Oklahoma*

We propose to construct an intelligent system for clinical guidance on how to effectively use power wheelchair tilt and recline functions. The motivations fall into the following two aspects. (1) People with spinal cord injury (SCI) are vulnerable to pressure ulcers. (2) Clinically, wheelchair power seat function, i.e., tilt and recline, is recommended for relieving sitting-induced pressures. The goal is to increase skin blood flow for the ischemic soft tissues to avoid irreversible damage. Due to variations in the level and completeness of SCI, the effectiveness of using wheelchair tilt and recline to reduce pressure ulcer risks has considerable room for improvement. In this study, we propose to use the artificial neural network (ANN) to predict how wheelchair power seat functions affect blood flow response to seating pressure. This is regression learning because the predicted outputs are numerical values. Besides the challenging nature of regression learning, ANN may suffer from the overfitting problem which, when occurring, leads to poor predictive quality (i.e., cannot generalize). We propose using the particle swarm optimization (PSO) algorithm to train ANN to mitigate the impact of overfitting so that ANN can make correct predictions on both existing and new data. Experimental results show that the proposed approach is promising to improve ANN's predictive quality for new data.

### **05.06.05 Vigenere Cipher Tool**

**Rad Alrifai, Adam James,**

*Northeastern State University*

There are several ways of encrypting messages and the vigenere cipher is one of them. Whether users are trying to hide their data or expose the data of others, Vigenere Cipher Tool can help. This software is intended to enable users to encrypt and decrypt data using the vigenere cipher. It also allows the user to test the strength of their key and decypher encrypted text without the use of a key. The Vigenere Cipher Tool was created in order to write and break secure messages and to learn about the strengths and weaknesses of the vigenere cipher. In order to break the cipher, the Vigenere Cipher Tool utilizes common vigenere code breaking tactics. The first step in breaking the cipher is to find sequences in the encrypted text that repeat themselves and record the distances between occurrences. The factors of these occurrences will determine the key size used in the encryption process. Once the key size is determined, the text is analyzed using letter statistics to find the key itself. Vigenere Cipher Tool is run in a console and allows you to choose to either encrypt a message, decrypt a message, or break the cipher text to a message. The layout is very simplistic and it reads plaintext and cipher text from files. It also will write to files when needed. The Vigenere cipher was very significant when it was invented. This cipher impacted our world as a form of formidable encryption for nearly 300 years.

### **05.06.06 Prime Propagator**

**Rad Alrifai, Colin Clinton,**

*Northeastern State University*

Prime Propagator is an application used to generate prime numbers. Normally, prime generators use a formula to come up with a possible prime, test it, store it in an array if prime, and then increment a counter. On the other hand, Prime Propagator uses a unique approach. It stores its outputs (the primes) into a linked list to be used as inputs to the upcoming sequences of calculations to generate more prime numbers. The software for Prime Propagator is written in C++. The Prime Propagator application consists of the following four main components: A linked List for storing the prime numbers, a mathematical calculation module to identify probable prime numbers, an input algorithm to evaluate numbers stored in the linked list as candidate for additional processing, a factoring function to verify whether a given result is a prime number or a composite number.

### **05.06.07 Njord: A web application Controller**

**Rad Alrifai, Justin Smith,**

*Northeastern State University*

As the Internet is growing and new tools are emerging such as AJAX, HTML5 and WebGL, the need to rapidly and efficiently develop web applications is becoming increasingly critical to almost every business. Njord is a web application controller developed to increase the reuse of the interface between backend application software and web applications. By reducing the amount of time spent on coding, programmers can concentrate more on the software functionality rather than implementation. This web application Controller was developed using several technologies including: Bottle.py to handle routing and access to HTTP environment, PyMysql to extend the functionality of MySQL database, MySQL to manage relational data, Mongo to manage NoSQL database, and Git to control the various revisions of source code.

## **05.06.08 Early Rise Alarm**

**Rad Alrifai, Christopher Allen,**

*Northeastern State University*

Waking up on time is a problem many people struggle with on a day to day basis. Whether it be oversleeping or hitting snooze one too many times, many people could benefit from a more effective way to wake up each morning. The best place to implement a feature that would accomplish this would be the first thing most people interact with every morning, an alarm clock. With more and more people using alarm apps on smartphones, a good place to improve current alarm designs would be through mobile apps. When most alarms go off, usually no action is required other than choosing off or snoozes; this functionality can be improved. The Early Rise Alarm contains a math function feature contains a simple equation to be solved in order turn off the alarm. This web application was developed using objective C and Apple's IOS platform.

## **05.06.09 Construction project management software(#CPM)**

**Rad Alrifai, Daniel Gibson,**

*Northeastern State University*

Construction project management software (#CPM) is interactive applications that can help users learn the basics of construction management and its business practices by playing games. The game covers various topics involving bidding, scheduling, cost, project management decision making and final project completion. The goal is to let the enthusiasts control a project to ultimately succeed by beating the cost and delivering the project on time. To complete a game, the user needs to make various decisions and perform several tasks. Each completed decision and task has its own perks and its repercussions. There are fun interactions as well as sudden mishaps that can arise in construction that must be handled to ensure successful project completion. The ultimate goal is to help the user understand construction management and its practices in a fun interactive way. The audience of #CPM would include construction companies, Universities, Colleges, Tech/Trade Schools, and others who are generally interested in construction management.

## **05.06.10 Volunteer Portal**

**Rad Alrifai, Daniela Odell,**

*Northeastern State University*

Technology provides the fastest, easiest form of communication in today's world. My goal is to broaden the hopes of volunteers to help in their community and give the volunteer organizations the opportunity to seek out volunteers, by creating software to make communication and connections easy and fast between volunteers and organizations. Volunteer Portal should allow volunteers to give back to their community by giving them a convenient and easy opportunity to connect to volunteers in the Tulsa, and surrounding areas. Volunteer Portal is a website which includes many features and contains a web application. By using this website, volunteers can log in, browse organizations, and add their own information for organization viewing. Organizations should be able to log in, browse volunteers, and find the best match for the volunteer openings that they are searching for. This web application was developed in C#.

### **05.06.11 Lawn Gnomie: An Android Application**

**Rad Alrifai, Bridgette Cowden,**

*Northeastern State University*

Most Android games are too hard for children to play which quickly makes them lose interest in the game. Lawn Gnomie is a game that is simple, child friendly and gives the child a character that would pique their interest in the game right away. Lawn Gnomie is an easy to play game that is based on the classic 1970s game 'Snake'. The game gives a colorful child-friendly atmosphere and simple game mechanics. The gameplay mechanics are two buttons, a left turn and a right turn, making it very easy for a child to pick up and understand how to play. The gameplay logic is simple in itself. Because children love cartoons, the game was built in a cartoony style including the background, font, character, items and even sound. The theme was created to pull the child into not only the gameplay but the images surrounding it. The impact of its use is to give children an entertaining Android game that they can understand.

### **05.06.12 Computer Science Jobs Application**

**Rad Alrifai, David Boling,**

*Northeastern State University*

One of the project's goals is to provide Computer Science faculty with a single place to post any internship or employment opportunities they may receive. The second goal of the project is to provide Computer Science students with a single place to search for employment or internship opportunities without the need to visit with each professor individually. The system administrator, however, has to be able to not only search the database, but also add jobs, employers, other administrators, job seekers, and contacts to the database. The administrator also must have the ability to remove jobs, employers, other administrators, job seekers, and contacts from the database. The software was developed using C# and Microsoft SQL Server Database.

### **05.06.13 Point Of Sale System**

**Rad Alrifai, Charity Henson,**

*Northeastern State University*

This software is a point of sale (POS) system that manages sale transactions and to simplify book keeping. This software will allow the user to calculate the bill of a customer, edit specials and menu items, edit transactions, and keep track of sales using a specified time period chosen by the user. The menu items and checkout information will be stored in a database. This software application was developed in C#, MySQL, .NET Connector, and MySQL Workbench.

## **05.06.14 An Android Shopping Platform**

**Rad Alrifai, Brent Spencer,**

*Northeastern State University*

Customers often have trouble finding prices and other information about items when shopping at retail stores. This application helps customers to find information about items in the store by using their mobile phone. The software can scan the bar code of an item to retrieve information about it from the store database. The application sends a message to the database to request the needed information about the item before allowing the user to add that item to the shopping cart. The application uses the camera to scan a barcode then sends it to the database to match against data stored in the catalog class. The code can then displays the retrieved information about an item before adding it to the shopping cart.

## **05.06.15 Fast Strong Planning for FOND Problems with Multi-Root DAGs**

**Andres Calderon Jaramillo, Jicheng Fu,**

*University of Central Oklahoma*

We present a planner for addressing a difficult, yet under-investigated class of planning problems: Fully Observable Non-Deterministic (FOND) planning problems with strong solutions. Our strong planner implements two novel ideas. First, we employ a new data structure, MRDAG (multi-root directed acyclic graph), to define how the solution space should be expanded. We further equip a MRDAG with two heuristics to ensure planning towards the relevant search direction. Results show that our strong algorithm achieves impressive performance on a variety of benchmark problems: it runs more than three orders of magnitude faster than MBP and Gamer and demonstrates significantly better scalability.

## **05.06.16 Solving Karnaugh Maps on Mobile Devices**

**Hong Sung, Toan Nguyen,**

*University of Central Oklahoma*

Karnaugh map (K-map) is an engineering tool to optimize combinational circuits. This project was to implement an application program to solve K-map on Android mobile devices with simple user interface. The user interface is similar to that of a calculator. It is made of a two-dimensional array of buttons. Touching each button will cycle its value from 0 to 1 to X (don't care) and back to 0. Upon entering input values, the user can press the solve button to show all possible solutions. The prime implicants (PI's) are highlighted on the K-map grid. Essential PI's (EPI's) are highlighted red while non-EPIs are highlighted green. If both EPI's and PI's are overlapping, such cells are highlighted orange. In addition to color-coding, the program displays PI's one by one by selecting Next or Prev button. This project utilized Quine-McCluskey algorithm to find all PI's. Using the results of this algorithm, Petrick's method was utilized to identify all optimized solutions. The program was tested and demonstrated on an Android smartphone with 600MHz CPU. The performance was satisfactory. User touch input is instantaneous. The computing time does not exceed two seconds for four-variable K-maps. The optimized solutions are verified by hand and from class homework solutions. All of the main expectations match with the objective of the project.

## **05.06.17 Simplified Angry Birds**

**Hong Sung, Vinh Luong,**

*University of Central Oklahoma*

Mobile gaming on highly portable and interactive touch-based devices, such as smartphones and tablets, has become a hot trend in recent years. Some would agree that it is potentially becoming the next-generation of gaming platform. This project attempted to create a physic-driven game similar to one of the most popular games in the mobile market, Angry Birds. This game was developed on Android operating system. To keep things simple yet effective, the game was designed and programmed using object-oriented principles and standard Java programming language on the Eclipse Integrated Development Environment. Furthermore, in physic-simulation, which is the core of the game engine, rectangle shapes were utilized to simplify collision detection among objects. The end result was an interactive game that plays like the original Angry Birds, but without using sophisticated and dedicated graphics library such as OpenGL. Overall, this project has shown the practicality in creating simple animation-based games using standard Java language for the mobile computing platforms.

## **05.06.18 Increasing the Experimental Speed by Automating Data Generation**

**Paul Wiechmann, Jicheng Fu,**

*University of Central Oklahoma*

In this work, we attempt to automate the generation of experiment data, which can help find the most relevant set of attributes, from a set of twelve available attributes, for determining optimal power wheelchair tilt and recline settings for the prevention of pressure ulcers in patients with spinal cord injury. Attributes are added one at a time to a set of core attributes and are evaluated using four well-known classification algorithms, namely, artificial neural network, support vector machine, J48 decision tree, and random forest. The process is performed iteratively, using the attribute set with the highest percentage of correct predictions as the new core set, until the accuracy stops improving. The program was implemented in Java, using the machine learning software WEKA for the classification algorithms. File generation was implemented in C++.

## **05.06.19 Fairness Bandwidth Allocation in Multimedia's Multicast**

**Lie Qian, Sky Pettett,**

*Southeastern Oklahoma State University*

Multicast is an efficient mechanism for delivering data to multiple receivers. Layered multicast schemes enable efficient distribution of real-time multimedia traffic over heterogeneous networks like the Internet. To achieve fair bandwidth allocation in layered multicast, different max-min fair allocation solutions were proposed. Our scalable distributed max-min fair bandwidth allocation algorithm does not maintain per-session information in core routers; therefore has  $O(1)$  storage complexity in core routers.



## **05.06.20 From linear equation to Secure communication using operational amplifier circuit**

**Quinten Walker,**

*Langston University*

Many attentions have been paid to the fundamental research of chaotic systems. Recent increase in its popularity is due to its proposed capability to benefit the field of communication, such as security and encryption and cryptography, multipath, and spectrum spreading. The main security goals are privacy and authenticity of the communicated data. The symmetric encryption setting considers two parties who share a key and will use this key to imbue communicated data with various security attributes. Chaotic systems have been proposed as an efficient encryption machine if synchronized. Through the synchronization of coupled chaotic circuits, information can be scrambled and descrambled effectively. However, most circuits presented are complex and difficult to implement experimentally. Recently, numerous researches have been devoted to design simpler chaotic circuit. This work focuses on jerk equations and their electronic circuit implementation. It presents a step-by-step approach of solving differential equations using inexpensive electronic components. The numerical solutions obtained using Scilab and simulations using Multisim 11 are compared to experimental results. Then it uses to build jerk circuit that exhibit chaotic behavior under certain conditions. It extends to synchronization of two independent jerk chaotic circuits. Chaotic signals are unpredictable, yet they can be synchronized in a way that can be beneficial to the encryption and secure communication field of study.

## **05.06.21 Wheelchair Maneuvering Skills – Teaching Young Children to “Drive” Wheelchairs**

**Susan Hanks, Jicheng Fu,**

*University of Central Oklahoma*

Learning how to drive a wheelchair can be a difficult and time-consuming process, especially for children. As they are learning, they are more exposed to harming themselves and others. This research project offers a safe solution. By using computer simulations, users can practice their driving without fear of injury, allowing them to take risks without consequences. This will help them gain confidence in using their wheelchairs as well as enhance their reflexes and hand-eye coordination. There have been many challenges in working with this simulation. The collision detection is probably the most significant challenge. Precision and accuracy is needed. There are three possible methods. The first method is to have bounding rectangle around the objects. When two rectangles intersect, collision is indicated. Unfortunately, this is not very precise. The second method compares all of the pixels in the wheelchair to the pixels in the object that it may be hitting. Any intersecting pixels will be checked for transparency. Transparency indicates collision has not happened. Although it is more precise, it is also time-consuming. The third method is to combine the previous two ideas. Checking for rectangle intersection first increases the speed and the pixel comparison will increase precision. This project's aim is to allow users to become more proficient in the use of wheelchairs and gain confidence in their ability without injury.

## **05.06.22 Using Software Design Principles to Model a Bioinformatics Software Project**

**Wenxi Zeng, Jicheng Fu,**

*University of Central Oklahoma*

Object-Oriented Programming (OOP) has become the most popular way when we design and implement software. Novice software developers tend to mix up everything in big classes. However, OOP is not only about programming, but also includes Analysis (OOA) and Design (OOD). In the prototype of our Wheelchair Simulation System, we created two big classes SimEnvironment and WheelChair to represent map and wheelchair, respectively. Then we have two classes OpenEnvironment and Track to inherit from SimEnvironment. However, this was conceptually inaccurate. In the real-world world, we not only have maps and wheel chairs, but also many other things, such as Pedestrians. We tackle the difficulty of modeling by using abstractions, i.e., creating interfaces, such as the visible, moveable, collideable, and rotatable interfaces. Then, we let a specific class implement an interface when necessary. For instance, the wheelchair class implements the visible, moveable, collideable, and rotatable interfaces. In contrast, the track class only inherits the visible and collideable interfaces.

## **05.06.23 Global Grids and Volunteering Computing**

**Warren Moseley, Mary Phillips,**

*Southwestern Oklahoma State University*

There are hundreds of thousands of personal computing devices that sit idle each day. This translates in to many machine cycles that go to driving screen savers. The BOINC Project at Berkley was a groundbreaking experiment in the area of volunteer computing setting the groundwork for allowing people to volunteer machine cycles to a joint computer effort. The BOINC project of Berkeley University is one that can revolutionize the way that we solve problems. According to the BOINC website, you can "Use the idle time on your computer (Windows, Mac, or Linux) to cure diseases, study global warming, discover pulsars, and do many other types of scientific research. It's safe, secure, and easy. The Berkeley Open Infrastructure for Network Computing is an open source middleware system for volunteer and grid computing. An open source middleware system is software that the developing company makes easily available to the public; the software is the bridge between multiple applications, often on different operating systems, such as with messaging and queuing software. According to Wikipedia, The BOINC project started in February 2002 and the first version was released on 10 April 2002. Using the power of personal computers from all around the world, solving large problems such as climate control or even searching for extra-terrestrial life are in our reach.

## **05.06.24 Cache Memory Simulation**

**Thomas Turner, Eric McDonald,**

*University of Central Oklahoma*

A cache is a small store of very fast and costly memory that enables computers to execute programs much faster than would be possible without this device. Although programs are large and need, on occasion, quantities of information, neither the instructions nor data are referenced randomly. The pattern of memory references occasioned by executing a computer program is called locality of reference. At any one time, a program executes a fraction of the instructions that comprise the total program and accesses only a small portion of the data managed by the program: it is this feature of a program that makes a cache possible. If we can put the instructions and data that are used by a program in the moment that they are needed, we can benefit from the very fast memory of the cache to execute the computer program. At the same time we also benefit from having slower, cheaper memory to store the part of the program we are not executing. In this way, we benefit from having relatively fast execution at a relatively economical cost. This poster, titled Cache Memory Simulation, documents a simulation illustrating three cache designs. The purpose of the simulation is to aid students in their understanding of this aspect of computer architecture.

## **05.06.25 How Kalman filter can help us?**

**Yuqing Yan, Jicheng Fu,**

*University of Central Oklahoma*

Kalman filter is an algorithm designed to reduce the noise of data collected in some process over time. It is a set of mathematical equations which can be easily implemented to provide an efficient computational means to estimate the state of a process. It works in a two-step manner. In the prediction step, the Kalman filter produces estimates of the current state variables, along with their uncertainties. Once the outcome of the next measurement is observed, these estimates are updated using a weighted average, with more weight being given to the estimates with higher certainty. Because of the algorithm's recursive nature, it can run in real time using only the current input measurements and the previously calculated state; no additional past information is required. We applied Kalman filter in our research to filter out the noise associated with acceleration data collected by accelerometer sensors. Our experimental results show that Kalman filter did smooth out the noise and yield smoother curves for subsequent analysis.

## **05.06.26 Model-Driven Development: Where Does the Code Come From?**

**Jicheng Fu, Jianbin Wu,**

*University of Central Oklahoma*

Model-driven development (MDD) drastically changes the traditional view of software modeling, which no longer serves merely as documentation that will be put aside at a certain point during the development. Instead, MDD has made models a part of the development process. As a result, software designers and developers can focus on high-level problem solving instead of low-level implementation details. However, the current research focus is on model transformations and overlooks the importance of code generation, which includes the generation of infrastructural code and business code. In this study, we analyzed the root cause about why existing MDD approaches are only good at generating the infrastructural code, which is the static aspects of the system. Then, we proposed a comprehensive approach that considers functional, dynamic, and object modeling. Our approach is able to generate both infrastructural and business code. Finally, we conducted a case study to evaluate the proposed approach. Through this case study, we identified some insights on automated code generation in MDD. Our results demonstrate that it is not only likely, but also possible to fully automate the code generation process in MDD.

## **05.06.27 A Comparison Study between Compressed and Uncompressed Inverted Indexes for Memory Constrained Devices**

**Gang Qian, Grzegorz Bugaj,**

*University of Central Oklahoma*

As the number of applications grows on smart devices, there is a need to efficiently index and query their documents within given memory constraints. This study was done to determine the feasibility of using compressed in-memory inverted indexes for embedded devices. We focused on comparing compressed indexes with their uncompressed counterparts in terms of their memory consumption, retrieval speed and storage usage. Data sets used for the test was Reuters – 21578, and target platform is Android. The results of the comparison study is reported in this poster.

## **05.06.28 Characteristics and Applicability of Commonly used Classification Algorithms in Data Mining**

**Gang Qian, Rui Zhang,**

*University of Central Oklahoma*

Data Mining is an inter-disciplinary field that offers a spectrum of tools and algorithms to discover useful information and patterns from a huge universe of data. Because of the number of available algorithms, it is often difficult to choose a suitable algorithm for a given application. In this poster, we study seven commonly used classification algorithms, including decision tree, rule-based classifier, lazy learner, naive Bayesian, Bayesian network, artificial neural network, and support vector machine. Features and characteristics of the seven algorithms are compared and presented based on such criteria as construction cost, classification speed, expressiveness, stability, applicable data types, and easiness of handling of irrelevant, correlated or missing data. The goal of the project is to provide data mining practitioners with a guide to choosing the right classifier for their corresponding application domains.

## **05.06.29 An Approach for Raising Female Information Assurance and Security Workforce**

**Myung Ah Park, Michelle Hepner,**

*University of Central Oklahoma*

The gender inequity in the IT field has been addressed with different approaches such as outreach programs for middle/high school female students and gender-inclusive instructional methods to retain female students in the IT-related disciplines. However, efforts to promote future female IAS workforce have rarely been conducted although the gender inequity in the IAS field is even starker than it is in the general IT area. In this work, we will discuss problems with existing approaches for IAS education and propose a holistic IAS educational strategy which not only addresses those problems but also may be effective in bringing up a female workforce for the IAS field. Finally, we will discuss the experiences in our first attempt to implement the proposal.

## **05.06.30 A Mobile Cloud Computing Platform for Capturing Power Wheelchair Maneuvering Patterns**

**Travis White, Eddy Rajiah, Jicheng Fu, John Sluder,**

*University of Central Oklahoma*

Power wheelchairs are widely used to enable disabled persons to acquire independent mobility, which is important for health status, quality of life, social participation, etc. However, wheelchair driving could be challenging due to the users' pathologies, poor maneuvering skills, and adverse environments. As a result, wheelchair accidents constantly occur. It is therefore critical to capture wheelchair driving patterns based on which intelligent, safe control modules can be developed. Compared to traditional sensors of high cost and low availability, smart phones and cloud computing provide an ideal solution to collect and analyze wheelchair driving data in real-time. In this project, we used gyroscope and accelerometer sensors in the smart phone to collect driving data. Machine learning methods, e.g., KNN, were then used to analyze the data. However, smart phones are not practical places for intensive computations and data storage. Cloud computing complements mobile computing via outstanding computing and storage capabilities. In our platform, data collected by the smart phone are sent to the cloud for storage and analysis. The results are then made available to users of various devices. Our experiments with the smart phone and cloud computing demonstrated that we could leverage the advantages of both techniques yielding the mobile cloud computing platform. This platform is useful to quantify driving patterns, recover trajectories and gauge activity and participation.

### **05.06.31 Analyzing Wheelchair Motion Data**

**Ying Zhang, Jicheng Fu,**

*University of Central Oklahoma*

This study is a part of an intelligent wheelchair project. The aim is to analyze wheelchair driving data to capture patterns. All the data were collected using accelerometers. Specifically, there are six basic wheelchair motions: moving straight forward and backward, turning left and right, and stopping and starting. We also found that transitioning data existed between any two motions. However, values of the transition data are different. To reduce the variations as much as possible, our protocol used wheelchair's staying put as landmarks. Before taking any motions, the wheelchair remains stationary for 2 minutes. Hence, we could easily identify these landmarks from the acceleration data. Based on sample data, we could classify new data using KNN (K-Nearest Neighbors) in Matlab. A new data item is classified based on the similarity to the majority of its K closest neighbors. We tried different K values and found that the best K is 4 just in our test model.

### **05.06.32 Wheelchair Simulation Prototype**

**Devin Allen, Jicheng Fu,**

*University of Central Oklahoma*

The purpose of this research has two parts: 1) to create wheelchair simulation software that will help developers test and refine some artificial intelligence techniques that will be used in real wheelchairs later, and 2) to explore the depths of video game & simulation software development while creating a simulation software that can be used to train new users before they use an AI enhanced wheelchair. We used Microsoft XNA gaming platform to develop the software prototype (2-D). Later, we will migrate our 2-D simulation system to 3-D, which will be more intuitive and will enable the wheelchair users to learn driving faster. In our simulation the movements of the wheelchair can be controlled by any joystick that supports Microsoft Direct X. Furthermore, our current prototype implements a track that the user can drive on by using a joystick to control a 2-D avatar in a wheelchair. A collision detection method suitable for the curved path of the track has been implemented, but it still has a large room for improvements.

### **05.06.33 Building a Secure Web site over ASP.NET**

**Alyssa Baay, Myung-Ah Park,**

*University of Central Oklahoma*

Nowadays, everything is done over the Internet. With just a single click, one can go through million websites that provide information one is looking for. However, because of this innovation, one's identity may be at risk. In this work, we will present a web server running over ASP.NET that employs the security measures to prevent two most serious web attacks, namely SQL injection and Cross Site Scripting (XSS). We will show how these measures keep the site secure by applying the said measures and then trying to exploit the site.

#### **05.06.34 Knowledge Management for Small to Medium sized Businesses in Rural Western Oklahoma.**

**Warren Moseley, David Britton, Michael Brinkley, Patrick Spears,**

*Southwestern Oklahoma State University*

This project is about applying the Dynamics of Research in Knowledge Management from Corporation on a Large Scale to Small to Medium size businesses in Rural Oklahoma. In addition to the Knowledge Sharing and Research Sharing the goal was to apply the foundations and principles of the Malcolm Baldrige National Quality Award to small businesses. This project provides, training, consulting, and a framework for tools to support the ability to innovate by allowing Knowledge to become an asset and treating as such. What makes this project unique is the focus on quality as a result of using the Malcolm Baldrige Criteria for Excellence as provided by the National Institute of Standards.

#### **05.06.35 Grid Computing for 3d images and animation.**

**Warren Moseley, Aaron Wilson, Hayden Harrington,**

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This project consisted of studying different hardware and software configurations for utilizing parallel and network configurations to produce high quality photorealistic pictures and animated sequences. This project produced a series of short animated clips and put the results into a consistent story. The current approach to animation and digital image sequencing parallels the activities found in the Software Life Cycle and the Software Processes of the late eighties and early nineties. It became evident in this time period that there was a need to apply proven Object Oriented Analysis and Design Techniques to support the generation of robust and repeatable Software Systems. This project demonstrated that the same cognitive functions found in the Object Oriented Software Development Process can be readily applied to the creation of digital storytelling and digital animation. Computer Animation and Digital Storytelling require time-intensive and space consuming algorithms to accomplish the task. Rendering is the process of generating an image through computer programs from a mathematical or graphical model that describes 3-D objects. Rendering is a computationally intensive process, and parallel processing is required to complete rendering jobs in reasonable time. We have installed, configured and evaluated some of the proprietary software and some of the available open source software for rendering.