Department of Integrative STEM Education

Technology & Engineering Education

Senior Design Abstracts

May 6, 2020

Student Name: Marissa Dolch

Project: An emergency communication device for airport employees

Time: 11:00 am – 11:25 am

Aviation employees often strain to communicate in their work environments because high decibel volumes are produced. Studies show, “...many people in the world are exposed to intermittent or continuous hazardous sound levels ( > 85 dB) at their work environments ... Flight crews, pilots, airline ramp employees, technician and maintenance workers at airports are all at potential risk of Noise-Induced Hearing Loss” (Azizi 2010). Working at an airport requires an abundance of communication skills. Communication at an airport is usually given through radios, a headset or hand gestures. These communication signals can alert individuals if an unsafe situation has occurred. Currently, there are no solutions to aid an individual who suffers from hearing loss in receiving emergency alerts. Having a communication device will allow individuals with hearing loss to be notified of communication alerts that are crucial to the individuals’ safety and also will allow hearing-impaired individuals who wish to pursue a job in the aviation field or any loud environment to do so. The communication device will be attached to an aviation headset and the vibration sensation will be placed behind the individual's ear. One vibration will be sent via an armband from another individual that needs to communicate the alert. To evaluate this strategy, the device will be tested by aviation employees who have hearing impairments at the Newark Liberty International Airport. The expected outcome is for individuals to be able to communicate with others clearly and effectively in a loud environment.

Student Name: Andrew Avallone

Project: The design of a pool chemistry scale

Time: 11:30 am – 11:55 am

Pool technicians nationwide encounter the time-consuming task of efficiently calculating and weighing powder chemicals to balance pool water chemistry. The most traditional methods for calculating chemical concentrations are to use a luggage scale, traditional body weight scale, or user estimation after making the timely calculation via a table or calculator. These are untimely in their nature and can be inaccurate when balancing water, often needing more chemicals to correct. This senior design project is an all-in-one, compact calculator and scale created to solve the issue of making tedious calculations and inaccurate weighing of chemicals in traditional water balancing methods. Using a digital interface, users input pool volume and current water parameters. The pool scale and calculator will then automatically calculate the required amount of chemicals required to get the pool water to proper levels. With a built-in scale, users will have no need for any supplemental tools (like those mentioned above) with its fitting design. The Pool Boy Pool Scale can be placed on top of any five-gallon bucket so that measured chemicals can be dumped into it with its convenient, latching bottom. The scale is simply lifted off the bucket, chemicals dumped into the pool, and placed back onto the bucket for the next chemical measurement. With long term use of this design, homeowners and pool technicians alike can expect to save hours of time with the precise and timely use of this product.

Name: Olivia Danzi

Project: An automated stop block for a standard miter saw

Time: 12:00 pm – 12:25 pm

Human error is the primary cause of inaccuracies and inconsistencies, “[costing] the average multinational corporation an estimated $62.4 million a year” (Qureshi 2016).  In a manufacturing sense, machine add-ons can help to lessen these errors by removing the responsibility from the operator and transferring it to a reliable product.  This can be seen with several woodworking machines already, such as planers. Human error often occurs in the shop when stop blocks are set on the miter saw.  The usage of stop blocks on miter saws can be incredibly inaccurate and inconsistent due to it being fully reliant on the operator to set the block. Currently, there is one product on the market that solves this problem, however the smallest version retails at $3,150.  This existing product does not solve the posed problem for this project's target population, due to its high price point.  There must be an automated stop block attachment for miter saws that can be manufactured for less than $200 in order to truly solve this problem for the target client of this product.

The goal is to design an automated stop block that can be used as an attachment to an existing miter saw in order to improve accuracy and precision when making cuts.  The target audience for this product is any miter saw owner who would benefit from the attachment; including general contractors, Technology Education teachers, and hobbyist woodworkers.  In order to perform the intended function of automating the act of setting and locking a stop block on miter saws, the design strategy is broken into three subsystems: the input interface, output movement mechanism, and universal fence.  In an effort to appropriately evaluate the design’s ability to improve accuracy and precision, various stop block distances will be inputted, pieces will be cut using the stop block, and the resolution will be measured to record quantitative data.

Name: Michael Richvalsky

Project: An automated drink dispenser for the bar tending industry

Time: 12:30 pm – 12:55 pm

An automated drink dispenser can facilitate the serving of alcohol in order to create a more efficient and consistent experience for the end user. During a busy time, this machine will be able to alleviate the pressure of a human bartender having to make the same drinks over and over again while they are busy. The specific target audience is bar owners that want to be able to differentiate themselves from their competition by being more efficient and getting a consistent drink every time for their customers. In addition, this drink dispenser will bring in people who are curious about seeing it work and make a drink for them. One problem with the current landscape of the automated drink machine market is the entry price point of them. Large companies such as Royal Carribean and Holland America have robotic drink mixers that cost over $110,000 dollars to implement in each ship that they have. This price point hinders most of the world from being able to experience the wonders of automation in mixology. The design strategy is to create an affordable, efficient drink mixer that is able to pour out popular drinks for the end user without the need of much human interaction.

Name: Christopher Coombs

Project: Gesturing & Creativity: a pilot study

Time: 1:00 pm – 1:25 pm

Creativity is a vital skill that facilitates problem-solving tasks in any field. Creativity is defined as novel idea generation. Thus, classroom instruction should be designed to promote and develop creativity to enable students to approach problems with persistence and open-mindedness. Gesturing has been shown to aid in creativity and communication (Kirk and Lewis 2017). This pilot study will examine how undergraduates use gesturing when attempting to generate novel ideas and determine if encouraging gesturing impacts creativity in college students. The researchers will measure creative fluency with the Alternative Uses Task. The task will ask students to generate novel uses for familiar items. The experiment will consist of three conditions in which students will be either unprompted (gestures will simply be observed), encouraged to make gestures, or restricted from gesturing while completing the Alternative Uses Task. Participation will be open to the TCNJ student-population at-large. The researchers will record the participants as they complete the task and analyze videos to determine how and in what ways gesturing impacts participant performance. Various types of gestures will be noted and recorded in the unprompted and encouraged conditions. Participant videos and performance on the Alternative Uses Task will be analyzed using the qualitative analysis software, MAXQDA. The results of this study will be used to enhance design-based courses at TCNJ, especially Creative Design (TST 161), by providing insight into ways instructors can improve their lessons to help students develop their creative thinking skills. If gesturing is found to improve creative fluency, instructors can structure classrooms to enable students to communicate with gestures when solving problems individually or in teams. Instructors can also be intentional with their movements and gestures towards students who are solving design challenges in order to inspire novel idea generation.

Keywords: creativity, gesturing, problem-solving, undergraduate students

Name: Kerry Riess

Project: The design of a soccer shooting trainer

Time: 1:30 pm – 1:55 pm

Learning proper shooting technique in soccer can often be very cumbersome and expensive. It is common for soccer players to lack confidence in their shooting ability due to their lack of proper training or time to practice such techniques. The objective of this project is to design a technology to assist soccer players in improving their shooting technique and self-efficacy in shooting on goal through a system of integrated electronic sensors and output devices. This shooting assistant is to be practical for the client to purchase, give users valuable feedback, and motivate them to improve. Currently, the most efficient way for players to develop and practice shooting skills is by hiring expensive one-on-one trainers or by training solitarily, which can be monotonous. Technologies that can be purchased specifically for the development of shooting proficiency may not include electronic media to help motivate users and are typically expensive. Some of these technologies can be paired with smart devices, but do not address how to properly aim on a goal frame. The efficiency of the design will be tested by making observations of a set of individual players training alone and those training in a team while using the device and comparing their data to that of a control group. I hope to observe an increase in shooting accuracy and self-efficacy in players after they utilize the technology that is to be designed during this project.

Name: Joseph Gerardi

Project: A linear pan and tilt camera slider for video production

Time: 2:00 pm – 2:25 pm

Seeing ones big idea on the big screen is the primary focus of a filmmaker. These artists are struck with a stressful problem when producing their creative idea; the budget. Film equipment can cost in the thousands, which limits the amount of equipment that is accessible to utilize in these productions. Without proper gear (sliders, tracks, etc.), the film may not communicate the way the director envisioned. A lack of equipment can often make it challenging to bring creative shot composition ideas to life. A camera slider adds a third dynamic element to a composition creating an entirely different immersive dimension to a shot. In an effort to combat this financial burden, providing budget videographers with an affordable alternative will supply them with the fundamental tools to produce their next breathtaking film with no economic limitations.

The tool in question is categorized as a camera slider, a piece of gear allowing the operator to accomplish a dynamic shot via moving the camera horizontally along the x-axis. The functional prototype will maintain smooth travel across the rails with pan and tilt features within the head. This system will be controlled with a wired remote design and powered internally for portability. This project has five different sub-systems. First being the controller, or “brain”, of the operation, second is the drivetrain for the horizontal linear movement across the rail, third is the tilt features of the head, fourth is the pan features of the head, and last is the base plate for the camera head to rest on.