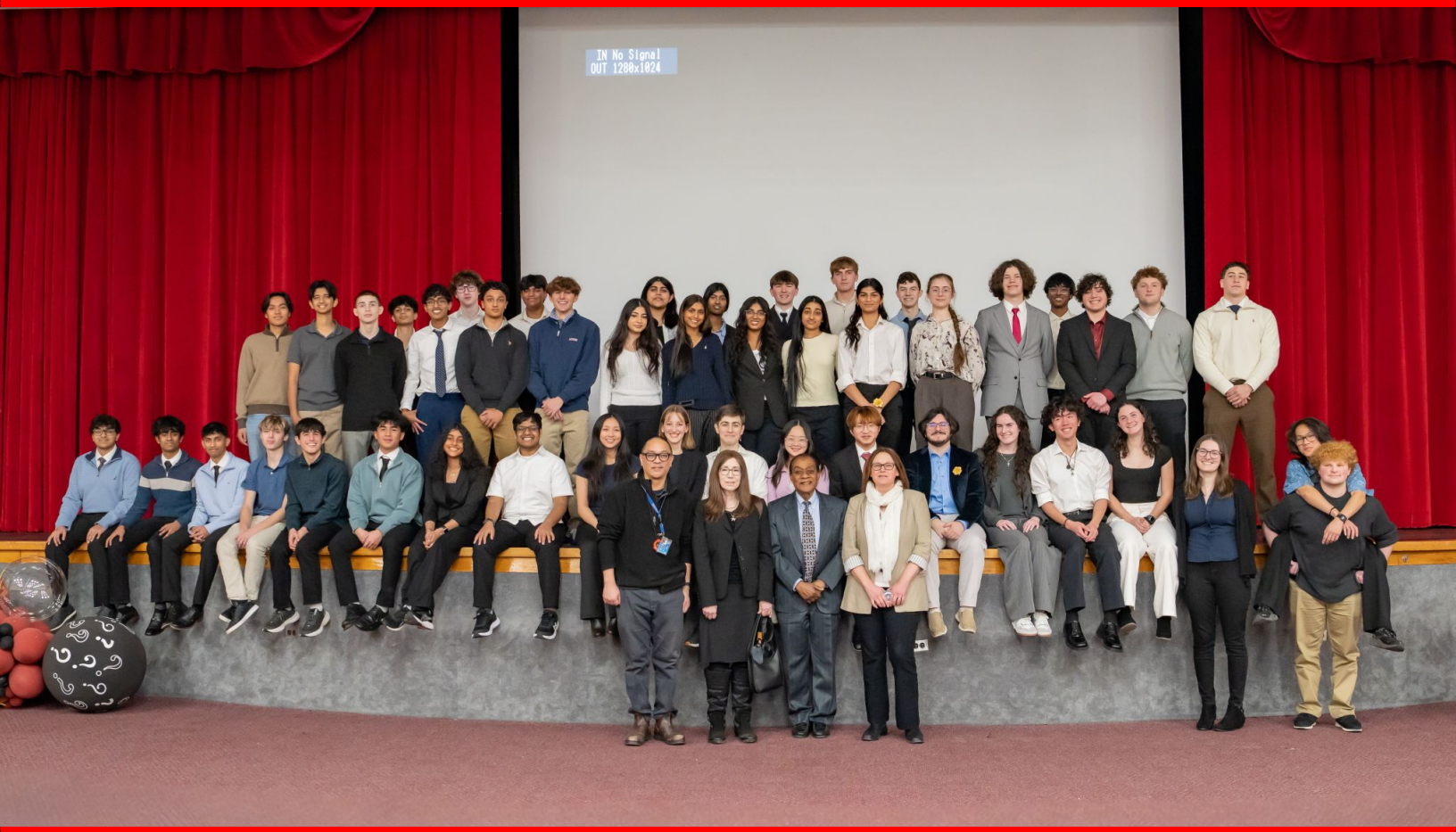
Journal of Science & Engineering

Volume 2, Number 8, June 16, 2026

ISSN 3066-7623 (online) 3066-7607 (print)

Special issue:
Science & Engineering
Senior Projects and Internships,
Semester II Abstracts



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Our editorial office is located at:

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https://sites.google.com/frhsd.com/seopenhouse/home

Journal of
Science & Engineering

Volume 2, Number 8, June 16, 2026

From the cover: Science & Engineering class of 2026. *Cover image: Mr. Wai Him Leung P'26.*

Special issue: Science & Engineering Senior Projects and Internships, Semester II, June 16, 2026.

Science & Engineering Learning Center
Senior Projects and Internships
Semester II
June 16, 2026

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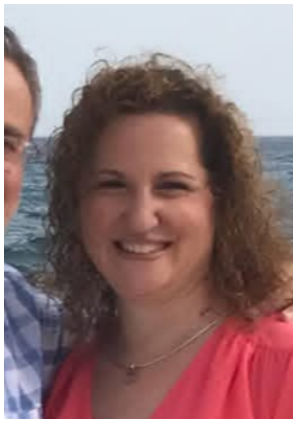
Mr. Erik Levin will be retiring after more than three decades of service to education.

I was fortunate to have Mr. Levin my senior year in S&E, long ago. We were in amazement of the wise, brilliant engineer who would come in during afternoons and be able to open new frontiers in robotics, electronics, and general nerdery for us. Every day in a shirt and tie, like Mr. Yeakley, but with a full blonde ponytail. He encouraged us to chase our passions in electrical and mechanical engineering, told us all the secret ways to get motors, and sensors, and sonars for free; transistor biasing, op amp rules, and how to use an octal D-type latch to avoid blowing up our classic IBM PC that was driving our robot through an actual parallel port. He told us where to find free food in college and where to hang out if we were ever in Massachusetts. He introduced us to Horowitz and Hill. He juggled. I think I am not alone in my experiences. Students universally whine and brag about being challenged. When they are still here it is more of a whine; but when they leave it is more like a thankful brag about how well Mr. Levin helped to prepare us for the world beyond S&E. Mr. Levin always believes the students can succeed if they put forth the effort, even if they do not yet believe themselves. More than once I remember seeing advanced topics in electrical engineering and computer science and remembering I heard them from Mr. Levin first. He inspires the students to wonder what is possible, because some things feel impossible until confronted with a little pressure and a little Socratic Levin questioning. It has been a great pleasure to teach alongside him the last two years.

On behalf of many, many alums, we thank Mr. Levin for his service, for believing in us, and for the gifts he has given us, opening our minds and destroying the limitations we might have thought were there. Congratulations on a well-earned retirement. We wish you all the best.



Ms. Stephanie Pepper will be retiring after 23 years of service to Manalapan High School and the Freehold Regional High School District.

Throughout her career, Ms. Pepper has touched the lives of thousands of students—not only as a mathematics teacher, but also as a mentor, advisor, coach, and role model. Whether through the Science and Engineering Learning Center, the Math Honor Society, Math League, Robotics Club, National Honor Society, or the many other activities she supported, she has always been dedicated to helping students grow and succeed. Ms. Pepper consistently held her students to high standards while providing the support, encouragement, and guidance they needed to meet those expectations. She believed that details matter, precision matters, and that every student is capable of achieving more than they may realize. Her students knew that behind every challenge was a teacher who sincerely cared about their success and wanted the very best for them. Perhaps nothing reflects Ms. Pepper's dedication more than the countless hours she spent supporting students outside of class. Long after the final bell had rung, it was common to see her classroom door still open, students gathered inside completing assignments, seeking advice, or getting extra help. She understood that learning doesn't always fit neatly into a class period, and she was always there when students needed her. Her impact extends far beyond the classroom. She contributed to curriculum development, supported school events and activities, and generously gave her time to the many responsibilities that help make Manalapan High School such a special place.

On behalf of the faculty, staff, students, alumni, and families whose lives you have touched, thank you for your years of service and for the difference you have made in the lives of so many. Congratulations on your retirement. We wish you happiness, good health, and all the best in the years ahead.

Internship at I House Architecture

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Abstract

Residential architectural design extends beyond floor plan development to include detailed exterior representation and construction documentation. During this semester of my internship, I focused on producing comprehensive architectural drawings for a single-family residence in Wall Township, NJ. Building upon previously developed floor plans, I created full exterior elevations, a roof plan, a rough electrical plan, construction details, and a complete 3D model of the house. A major goal of this internship was not only to contribute to the project but also to learn alongside my mentor and gain a deeper understanding of the architectural design process and the day-to-day responsibilities of professional architects. Through observation and hands-on experience, I developed a stronger understanding of how architectural concepts are transformed into detailed construction documents.

Using AutoCAD Architecture 2013, I developed accurately dimensioned and annotated drawings that communicate the vertical, structural, and aesthetic aspects of the home. These drawings incorporated key architectural elements such as dormers, roofing systems, porches, and stairways. Minor design modifications were made to the floor plans throughout the process to improve functionality and maintain visual consistency with the original design intent.

This phase of the project also required consideration of local building requirements while maintaining compliance with Wall Township regulations. Working primarily independently under the guidance of my mentor, I strengthened my ability to translate two-dimensional plans into detailed construction-ready documentation. This experience enhanced my technical drafting skills, improved my understanding of residential construction standards, and provided deeper insight into professional architectural practice.

Index Terms

residential architecture, AutoCAD Architecture, architectural elevations, construction documentation, single-family housing, architectural drafting, residential design, roof plans, electrical plans, 3D modeling, building design, construction drawings, architectural internship, technical drafting, building regulations, architectural visualization, architectural documentation, internship, Wall Township

Visualizing sidereal and solar time in honor of Karl Jansky: Internship at IEEE, AT&T, and Bell Labs

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Abstract

To understand the significance of any discovery, one must grasp the historical context and collective efforts behind its emergence. Bell Labs, an institution famed for foundational advances in communications and physics, provided the environment where Karl Jansky first identified radio emissions from the Milky Way. This project, supported by mentorship from the IEEE, AT&T Labs, and Bell Labs, employs interactive visualizations of Earth and Mars time, a street clock representing Martian sidereal and solar time, and a novel digital sundial to bring these discoveries to a broad public audience. The digital sundial, the project's current focus, is designed to provide accurate digital timekeeping down to the minute. Furthermore, physical models are being developed for dual-sided street clocks destined for placement at the Dr. Robert Woodrow Wilson Park. These clocks, featuring vintage accessories, will allow viewers to directly compare solar and sidereal timekeeping systems. To engage younger audiences, we will utilize the Nano Banana AI model to help children visualize themselves on Mars, using technology to spark a lasting interest in astronomy. Our goal is to implement these prototypes into physical models that inspire the future by showcasing astronomical phenomena both old and new by the end of the semester. Ultimately, this project connects modern science to the historical roots of radio astronomy in a way that remains engaging and accessible to all ages.

Index Terms

AT&T, Bell Labs, Karl Jansky, sidereal time, internship

Manual segmentation of femoral arteries in PET/CT images: Internship with University of Pennsylvania

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Abstract

Peripheral arterial disease (PAD) is characterized by progressive atherosclerosis that can lead to reduced blood flow and long-term vascular damage. While CT imaging identifies structural calcium deposits within arteries, it does not fully capture early biological activity such as inflammation or active microcalcification. This project uses the CAMONA PET/CT dataset to evaluate femoral artery atherosclerosis by quantifying uptake of two molecular imaging tracers: ^{18}F-NaF, which reflects active microcalcification, and ^{18}F-FDG, which reflects inflammatory and metabolic activity. Bilateral regions of interest encompassing the common and superficial femoral arteries were defined on co-registered PET/CT scans, and tracer uptake was summarized using SUVmean. These molecular activity measures were compared with CT-based calcium scoring and available clinical data relevant to peripheral arterial disease. By analyzing the relationship between inflammatory activity, early calcium deposition, and established structural calcification, this study aims to better understand how active disease processes relate to overall arterial burden and clinical status. The findings may help clarify how molecular imaging can detect vascular disease progression beyond what is visible through structural imaging alone.

Index Terms

segmentation, medical images, radiology, artificial intelligence, machine learning, computer vision, CNN, convolutional neural network

Secure identity impersonation for Commvault automated file operations: Internship at Commvault

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Abstract

The ability to move files between servers automatically is essential for modern data management. During my internship at Commvault, I worked on improving this process by moving away from the use of manual passwords. A major security challenge is that many automated programs rely on passwords written directly into the code or stored locally in the registry, which creates a risk of sensitive information being exposed. To address this, I used Microsoft Group Managed Service Accounts to allow the computer to handle logins on its own. I developed a background program in C++ that manages these operations as a Windows service. The system utilizes the Kerberos S4U2self protocol to request digital access keys directly from the network. By using these digital keys instead of stored passwords, the system can securely perform network tasks without human input. This project removes the need for hardcoded login info, making Commvault's automated operations much more secure.

Index Terms

Commvault, internship, gMSA, C++, Windows Service, Kerberos, security, automation

Modeling swarm spacecrafts in Python: Internship at Girl in Space Club

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Abstract

Girl in Space Club is a creative technology and human-systems design lab. They design, prototype, and commercialize equipment, tools, and experiences for people navigating future worlds—on Earth and beyond. It was founded by NASA engineer Sabrina Thompson. As part of our mission, we were tasked with creating a simulation tool that models spacecraft swarms powered by orbital mechanics, presented to users using a basketball representation to aid in understanding of how swarms function. The simulation is built using React.js to create both the backend and frontend. This will be used to demonstrate satellite swarm mechanics and be used as a learning tool for users to learn about swarms. During our presentation, we will present (1) the definition of what Project Swarm is; (2) a demonstration of how the simulation can be utilized; and (3) how the basketball representation connects to orbital mechanics.

Index Terms

Girl in Space Club, interface, Python, Internship, swarm, Swarm Autonomy, orbital mechanics, backend, relative motion, autonomous, spacecraft, frontend, basketball, React.js, simulation

Optimizing the fabrication process of microspheres for extended-release drug delivery: Internship at ACON Pharmaceuticals

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Abstract

Frequently and consistently taking pills to treat schizophrenia can be inconvenient or impossible for many patients. As a more reliable method to ensure patients consistently get their medicine, ACON Pharmaceuticals works to develop a procedure to make microspheres, small quantities of drug encased within polymers, for long-term diffusion of medicine into the bloodstream. Our goal was to continue upscaling this a process called "The China Method" and adjust it accordingly to continue to maximize drug loading on a larger scale, thus being ideal for mass production. The basis of the method consists of dissolving the polymer using dichloromethane (DCM), adding methanol (MeOH) and the drug to the solution, and then stirring the solution in 1% polyvinyl alcohol 88 (PVA-88) for 2 hours. With this method we have maximized the percentage of drugs loaded into the microspheres on the 30x scale and have moved on to the 50x scale. Furthermore, we began testing a second method, a new procedure that we explored with the purpose of finding a more time or material efficient technique to streamline the mass production of microspheres. This method requires melting the polymer and drug together, allowing the mixture to cool into a solid, and then breaking the solid apart with a rotational milling machine.

Another product produced by ACON Pharmaceuticals is nasal spray, a medicated solution intended to be delivered as a mist. We conducted solubility tests with different ratios of water, solubilizing molecules, and the drug, S212, to test the optimal water to drug ratio. We then made multiple samples of nasal spray with varying concentrations of the drug and solubilizing molecules.

Index Terms

microspheres, emulsion-evaporation, co-acervation, encapsulation rates, the China Method, solidification, fracture, rotational milling machine, nasal spray

Recurring malware checker using MISP: Internship at Commvault

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Abstract

During my internship at Commvault, I have created a tool that recurrently checks for malware in a user's data by using the Malware Information Sharing Platform (MISP) to obtain newly discovered malware hashes and comparing these against the user. A hash is a unique way of representing a piece of data by encoding it where small changes in the input create big unpredictable changes in the output. This creates a unique signature for each file that can be used to share found malware and compare against it. MISP is an open source software that organizes and collects different feeds of data from various sources including MalwareBazaar and abuse.ch, among many others. Commvault currently uses Google Threat Intelligence and my project evaluated MISP as a free, open source alternative. I created a dummy system to test with 100 files of randomized text and a list of hashes of these was created. Some were selected as malware and were checked against the list. I set up a local instance of MISP in Virtual Box that is perpetually running and able to be queried for found malware. PyMISP, a Python library to query MISP, is used to connect these parts together and recurringly check for malware. I created a write-up for my process of setting up and using MISP for Commvault to use in the future.

Index Terms

Commvault, malware, Malware Information Sharing Platform, MISP, PyMISP, hash function, MalwareBazaar, abuse.ch, open source, internship

Internship at Matrix New World Engineering

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Index Terms

Matrix New World Engineering, water, civil engineering, internship

The Bridges of Monmouth County: Internship at Monmouth County Engineering

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Abstract

Monmouth County Engineering's Bridge Department is responsible for the construction, maintenance, and improvement of county-owned bridges. Of the aforementioned duties, the county's main duty is to maintain its already existing bridges and ensure the maintenance of each bridge goes smoothly. As most of the design-work and calculations are done out-of-house, the county is mainly responsible for the allocation and proper compensation of the work to private contractors.

During my internship at the county, I gained hands-on experience of each step of a bridge project that most private engineering firms would be unable to get, as the county oversees the entire process. I was able to learn about reading and interpreting construction plans, the different techniques used to ease construction, the use of AutoCAD, and the correspondence required to make these jobs possible. All of this was aided by my mentors' guidance and frequent visits to their many job-sites. Some of these job-sites include the bridges U-33, MT-10, A-38, S-15, and S-13.

Index Terms

Monmouth County Engineering, civil engineering, internship, bridges

Waterfront civil engineering: Internship at Watermen LLC

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Abstract

During my internship at Watermen, through work on waterfront development projects, I gained practical experience in coastal engineering, permitting, and geospatial analysis. My responsibilities included prepping permit requests for waterfront projects in Autodesk Civil 3D, where I created technical drawings, sourcing and importing sounding and tidelands claim data, and added required engineering notion and project details. I contributed to environmental assessments, including work related to the Riverside Industrial Complex in PA. I also assisted in bid tabulations, budget estimation, and project proposals. This internship strengthened my technical drafting, data analysis, and project management skills while providing valuable insight into the environmental and regulatory processes involved in coastal and marine engineering projects.

Index Terms

civil engineering, Watermen LLC, internship, waterfront development, coastal engineering, geospatial analysis, permitting, project management, data analysis, environmental, regulatory, marine, waterbending, earthbending, Riverside Industrial Complex

Math-focused screenreader for accessibility: Internship at IEEE

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Abstract

Mathematics relies heavily on symbolic notation, spatial relationships, and non-linear structures that challenge traditional text-to-speech systems. While screen readers have improved accessibility for reading text, their performance for mathematics remains insufficient due to inconsistent formatting standards, unclear interpretation of mathematical meaning, and a lack of audio representation for visually intuitive math layouts and structures. We were tasked with evaluating current screen reader technologies and developing ideas to improve mathematical accessibility for visually impaired users. Our research involved testing existing screen readers with mathematical symbols, conducting interviews with visually impaired individuals about their experiences accessing mathematical content, and identifying accessibility features that should be included into our website from the initial design phase.

Along with this, we have been working on a book in braille to help memorialize Karl Jansky and educate children. While doing this, we tested out more efficient ways to automate writing in braille.

Index Terms

assistive technology, mathematics, screen reader, blind, visually impaired, low vision, Americans with Disabilities Act, ADA, access, mathematical notation, inclusive design, internship, IEEE, braille, radio astronomy, Karl Janksy, book, website, HTML

Operational Longitudinal Analytics Validation Engine (OLAVE) for the National Football League (NFL): Internship at CAHSAA AT&T

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Abstract

OLAVE-NFL (Operational Longitudinal Analytics Validation Engine for the NFL) is a sports analytics platform designed to evaluate and visualize contextual NFL play-by-play data using predictive modeling and advanced statistical metrics. Current sports analytics systems often focus primarily on traditional player statistics, limiting deeper situational analysis. Our project addresses this by integrating play-by-play data from the nflfastR repository with machine learning models and interactive visualizations to quantify offensive efficiency and game-state value. Using over 100,000 NFL plays from the 2021–2023 seasons, we engineered features including down, distance, field position, score differential, and time remaining to calculate metrics such as Expected Points Added (EPA), Win Probability (WP), Success Rate, Red Zone Efficiency, and Drive-Level Efficiency. We implemented gradient boosting models through XGBoost to estimate situational success probabilities and contextual play value. The resulting analytics pipeline combines R, Python, pandas, Plotly, FastAPI, and PostgreSQL to support both predictive modeling and interactive visualization. OLAVE-NFL aims to provide coaches, analysts, broadcasters, and fans with a more comprehensive understanding of decision-making and efficiency in professional football.

Index Terms

AT&T, internship, CAHSAA, National Football League, NFL, sports analytics, play-by-play, statistics, nflfastR, R, Python, pandas, Plotly, FastAPI, PostgreSQL, predictive modeling, interactive visualization

Interactive and data-driven web applications: Internship at WIT

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Abstract

At WIT, a sports marketing and program activation company focused on enhancing fan engagement, we are taking part in an internship centered on developing interactive and data-driven web applications. Guided by the company's emphasis on user experience and engagement, we utilized HTML, CSS, JavaScript, and React to design and implement two key projects. Our first project involved creating a personal resume website to establish a professional digital presence and demonstrate foundational front-end development skills. The second project was a global data dashboard that integrates data from the World Bank API, allowing users to compare GDP and other economic indicators across countries through dynamic visualizations, such as a bar chart, line chart, and a pie chart. Throughout the internship, we are focusing on emphasizing intuitive design, responsiveness, and seamless user interaction.

Index Terms

WIT Sports, internship, sports marketing

Mathematically modeling the spread of opinions

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Abstract

Opinions in social environments are often influenced by their peers through interaction rather than personal decision-making. In a school setting, students frequently discuss a variety of social questions with friends, which can influence how their views ultimately shape up. With our project, we aim to mathematically model how opinions spread within a high school grade by using a voter model. We want to address the following hypothesis: over repeated simulations, students with lower stubbornness levels (closer to 0) are more likely to change their opinions over time, leading the network towards a consensus, while higher levels of stubbornness leads to persistent division. The specific opinion that we are going to study will be responses to the question: "Is it ever okay to lie?" A random sample of approximately 25 students will be selected from the senior grade using a randomly generated wheel with every student. After being selected, each student will be assigned a numerical ID. We will then collect the student's initial opinion, neighbor set (amount of friends within the sampled group), influence weight, and stubbornness level. Using the data, each student will be modeled as a node on a graph. The graph will have opinion states, stubbornness parameters, a neighbor set, and an adjacency matrix. This will allow us to create a voter model. This model will be implemented as a computer simulation using network and initial opinion data. We will run the simulation multiple times to observe how opinions evolve. This project combines real survey data with a mathematical voter model to study how opinions spread in a real social setting. It goes far beyond simple equation-based modeling by emphasizing network structure and behavior.

Index Terms

psychology, consensus

Augmented reality laser tag

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Abstract

Laser tag is usually played in large pre-existing arenas that require heavy physical equipment. This can be costly, and inconvenient for casual players who do not want to invest heavily into it. As such, the goal of this project is to recreate laser tag in augmented reality (AR) to improve convenience of playing laser tag while demonstrating the capabilites of current mixed-reality systems. This project will leverage the Meta Quest 3 due to its color passthrough and room-scanning abilities to combine virtual and real elements.

Index Terms

augmented reality, AR, laser tag, Meta Quest 3, virtual environment, colocation, MetaSDK, Unity, OpenCV

Translating road signs in real time onto heads up displays

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Abstract

We propose a heads-up display (HUD) system that augments driver navigation and safety by translating road signs in real time. This is particularly relevant in regions where travelers frequently cross boundaries - both territorial and and linguistic - such as in Europe or Asia. This system enables drivers to quickly identify the critical information without having to divert their attention from the road.

This system utilizes a vision-language model capable of recognizing and translating road signs across a wide range of source languages into a user-selected target language. These translations are then overlaid onto the screen in front of the driver. For the development and demonstration purposes of this project, we are using a Meta Quest VR Headset

Index Terms

text recognition, translation, heads up display, assistive technology, linear affine transformation, camera calibration, optics

Study on methods of memorization

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Abstract

Memory is formed in the hippocampus of our brains and is something that has been researched over the last century. Many different encoding and retrieval methods can impact the way our memories are processed and stored in our long-term memory. This study evaluates the effectiveness of several strategies in order to enhance both short-term and long-term memory. We test techniques such as semantic association, mnemonic devices, and the method of loci, using three separate test groups, against a control group which utilizes a shallow processing technique such as re-reading. After gaining informed consent, briefing the participants, and following ethical guidelines, we used a random sample of 70 Manalapan High School seniors, randomly assigned to four equally sized experimental groups, in order to execute our study. Each participant was provided a list of 20 words, given 5 minutes to memorize them, a 5 minute break, and then 2 minutes to recall the 20 terms. Our dependent variable was the number of words recalled immediately after (testing short-term memory) and the number of words recalled after a 48-hour period has elapsed (testing long term memory). Using these experiments, we also observed the mean recall score per group, percentage of information retained after 48 hours, and used analysis of variance (ANOVA) to compare differences across groups. Using this data, we hope to prove our hypothesis that Deep Encoding strategies (the three test groups), specifically method of loci, will outperform shallow-processing strategies (our control group).

Index Terms

psychology, memory, recall, association

Rock paper scissors robot hand

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Abstract

Rock Paper Scissors is one of the most recognizable, easy, and popular hand games out there. And while it is sometimes fun to play as a last resort in an incredibly boring situation, winning roughly 50% of the time isn't good enough for us. We want to not only win, but crush the competition. Humans are terrible at being random, and we want to make a robotic hand to exploit this human weakness.

Over the course of this semester, we have created a robotic hand that will beat humans at rock paper scissors. By using OpenCV, the Multi Armed Bandit Problem, and some open sourcing from rpscontest.com, we were able to create a program that can recognize the human's move and calculate the best strategy against it. And with 3D printing, some servos and basic electronic parts, we created a basic robotic hand that utilizes a Raspberry Pi and Arduino to make the move to crush the human, in the game.

Index Terms

rock, paper, scissors, robot hand, OpenCV, machine vision, cues, machine learning, Raspberry Pi, Arduino, 3D printing, multi-armed bandit problem

Optimization of sensor placement for water network contamination detection

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Abstract

Municipal water distribution networks are complex systems in which contaminants can spread rapidly, making timely and effective detection a significant challenge. This project develops a simulation-based optimization framework to determine the most effective placement of a limited number of sensors within a water pipeline network. By modeling contamination events at random entry points and simulating their spread based on network flow dynamics, the system evaluates different sensor configurations using performance metrics such as detection rate and detection time. Multiple algorithmic approaches are explored to identify high-performing sensor placements under a fixed sensor budget (k). Additionally, the project examines the tradeoff between cost and protection by analyzing how system performance changes with varying numbers of sensors. This work aims to provide a practical tool for improving water system safety and resilience through data-driven decision-making.

Index Terms

machine learning, ML, piping system, contamination, design, sensor placement

Grapple gun

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Abstract

We are designing a functional grapple gun inspired by Spider-Man's ability to retrieve objects from a distance. We are looking to translate this fictional ability by developing an efficient launching and grabbing tool that will be able to launch across a room, latch onto a handheld item, and pull the item back to the user. The mechanism will launch an individual clasping system, inspired by bear traps and other spring-loaded traps, connected to a rope for retrieval. We will explore the kinematics and forces required to launch the claw to a desired item, as well as the processes involved in bringing the item back. A tool like this can be helpful when trying to reach trash and dropped belongings from high places, assisting the physically impaired, and reaching the remote without getting off the couch.

Part of our design process will consist of looking at what exactly makes for an optimal grapple design, and if that changes depending on the use case. We could consider different mechanisms for the use of a first responder compared to grandparents. We plan to experiment with claw designs, different strengths and size of rope, and manual vs. automatic launching and retraction.

Index Terms

Spiderman, grapple gun, engineering design, assistive technology, superhero, super-ability

Laser sound visualization

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Abstract

This project investigates laser optics and demonstrates how sound frequencies and waves can be converted into light patterns using a laser, speaker, membrane, and a mirror. A small mirror is attached to a stretched membrane mounted over a speaker. When audio signals of varying volumes, frequencies, tones, and more are played through the speaker, the membrane vibrates, which causes the mirror to oscillate and project different patterns. The patterns are specific to the characteristics of the sound wave and how it is applied. By testing different frequencies and amplitudes, this project demonstrates the relationship between sound, vibration, and light. This system is a simplified model of technologies used in more intricate laser systems and other signal visualization projects while illustrating fundamental concepts of waveforms, physics, and resonances.

Index Terms

lasers, light, LED, sound, physics, mirrors

Biomechanics of a tennis serve

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Abstract

Beginners in tennis often struggle with the serve since it involves complex motions. The purpose of this project is to improve tennis serves by analyzing key components of the serve and the kinetic chain (from the ground up to the racket): leg bend, shoulder rotation, arm extension, and wrist pronation. We measured the effects of these on serve speed using a radar gun. In addition, we recorded the accuracy of said serves by determining whether the ball landed within the service box (i.e., in or out of play). Using the motion-capture tool Factorial Biomechanics, we uploaded videos of our serves, allowing us to collect angular, vertical, and horizontal displacement data of our body parts and joint angles. We tested six individuals of varying backgrounds, skill levels, and experience over a series of trials. Each research subject gave feedback and their reaction to changes in their serve. Our findings provide a guide for new players to learn the serve and its mechanics. Our comparisons include: varying the angle behind the knees and elbows, wrist stiffness, and vertical vs. horizontal-based shoulder rotation. In the end, test subjects' services improved with increased speeds and lowered risk of injury through the implementation of the data we received from the biomechanical analyses.

Index Terms

biomechanics, sports, tennis, serve, kinematics, kinetic chain, Factorial Biomechanics, radar, speed

Spy car: Wireless remote control camera robot with live streaming

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Abstract

For the duration of this semester, we have designed and built a remotely controlled car that utilizes a camera to wirelessly relay a live video feed from the car back to the user. The project consists of three main parts: the car, the controller, and the camera. We experimented with different chassis, used a Logitech F310 to control our rover, and a Raspberry Pi motor hat to facilitate the signals received from the controller to the motors. We created smooth communication between the car and controller through the use of a WiFi connection and a Raspberry Pi setup. We also were able to relay live video and allow for video recording, as well as transmit data using serial communication.

This project allowed us to study different aspects of robotics, programming, and project design. We learned to use microcontrollers to command different electronic components, and our goal was to obtain wireless communication between devices. We combined both software and hardware aspects in this project.

Index Terms

Traffic Safety Division, Monmouth County Engineering, spy car, road study, Raspberry Pi, 802.11, wi-fi, video, electronics, robotics, Arduino

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