2024 Senior Design Conference Project Abstracts

(Projects listed alphabetically by discipline)

Architectural Engineering

AE1 - The Design of a Kingsville Sports Center
Team Members: Jalen Jackson, Tammy Grohman, Kaleb Perez, MsHari Alhereri

Our senior design project introduces a multifunctional sports center in Kingsville, Texas, to fill the gap in facilities for large athletic and community events. This indoor complex will support activities ranging from basketball and volleyball tournaments to fitness programs, promoting youth sports participation and community engagement. The center will feature multiple courts, spectator seating, a lounge area with amenities, and locker rooms, strategically located for easy access by locals and visitors. Task responsibilities among team members include architectural design with Revit software, mechanical system planning for HVAC efficiency, electrical and lighting design for operational needs, and structural integrity to ensure safety and durability. This initiative aims to boost local tourism, provide a community hub for sports and events, and enhance Kingsville's social and economic landscape.

AE2 - TAMUK Recreation Center Redesign
Team Members: Ruth Rojas, Jose Baldazo, Carlos Puentes, Valeria Trujillo

The existing REC center design inadequately supports student needs, suffering from overcrowding, particularly in the weight room, and a lack of sufficient space to introduce new equipment. The outdoor basketball court, in a state of neglect, sees diminished use, while school events frequently monopolize the indoor courts, further restricting access. Compounded by poor air circulation in the weight room, these issues hinder the full utilization and enjoyment of the facility. Our redesign proposal focuses on expanding and reorganizing spaces and enhancing building systems to create a more welcoming and functional environment. This initiative aims to revitalize the REC center, ensuring it better serves and reflects the dynamic Javelina community.

AE3 - Design of the King Entertainment Center
Team Members: Fabrizio Campos, Justin Hernandez, Rashane Hibbert, Omar Montoya

The 4 Kings Entertainment Center project aims to introduce a vibrant entertainment hub in Kingsville, Texas, blending vintage arcade fun with modern dining and a bar area. Targeting a broad audience beyond Texas A&M – Kingsville students, this initiative seeks to enrich the local entertainment landscape, currently limited post-COVID-19, and reduce travel to Corpus Christi for leisure activities. The project involves designing a single-story building to accommodate the town's demographic needs, utilizing AutoCAD and Revit for architectural plans, and ensuring structural integrity through visual analysis software. Mechanical and electrical systems will be meticulously planned and executed, adhering to relevant codes and utilizing Revit 2024 for HVAC and electrical design. By offering a local venue for entertainment and social gatherings, the 4 Kings Entertainment Center aims to boost local business retention, increase revenue, and become a cornerstone for community events in Kingsville.

AE4 - Design of the Javelina Event Center
Team Members: James Chang, Anastatia Guerra, Fernando Garcia, Rafael Salinas

In response to the identified need for more expansive event and meeting spaces on campus, our group proposes the transformation of the unused Turner-Bishop Hall dormitory into the Javelina Event Center. Envisioned as a two-story facility, it will feature a main ballroom, campus catering and event planning offices, and additional rooms for student organization meetings. This new center aims to accommodate the university's 200+ organizations, providing a versatile venue for larger events such as the bi-semester career fair. Unlike the existing setup in the Memorial Student Union Building, positioning the ballroom on the first floor will enhance accessibility, making the Javelina Event Center an ideal hub for campus activities.

AE5 - Design of the Strike Studios
Team Members: Kaleb McDonald, William Marquez, Annelise Garcia, Keishanna Tirado

For our senior design project, we aim to revitalize Kingsville's entertainment options by transforming a portion of the existing Wild Horse Mall into a dynamic two-story entertainment complex. This 22,885 square foot facility will feature a unique blend of a bowling alley, movie theater, and café lounge, located strategically at 601 US-77. By repurposing the mall's infrastructure, our goal is to not only attract new patrons but also stimulate local business growth and community engagement. We anticipate that the project will enhance job prospects for students and potentially increase university enrollment by elevating Kingsville's appeal. To date, we have completed the architectural design, adhering to all relevant codes and ordinances, including occupancy and egress planning. Additionally, HVAC calculations and system analysis, as well as electrical planning including a one-line diagram and receptacle layout, have been finalized. Structurally, the design incorporates a braced frame to ensure stability and safety. Through this renovation, we envision creating a vibrant hub that will draw visitors, benefit the community, and foster economic development.

Chemical Engineering

CH1 - Annie, Are you Ok? (Aniline from Benzene)
Team Members: Riley Doerr, Angelica Gallegos, Yuli Torres, Orlando Villalpando

Aniline is an aromatic amine used to produce rubber accelerators, antioxidants, and pharmaceuticals. The team decided on producing aniline from benzene for the senior design capstone project. The project’s aniline target production rate is 52 thousand tons per year. Producing aniline from benzene requires two reactions. The first reaction will have benzene react with a mixture of sulfuric acid and nitric acid to create nitrobenzene. This initial reaction will occur at a temperature of 360 Kelvin and atmospheric pressure. The produced nitrobenzene will then move on to the second reaction where the final product (aniline) will be created through hydrogenation with a palladium catalyst. This final reaction is highly exothermic and will occur at a temperature of 548 Kelvin at atmospheric pressure. Having two reactions with different conditions requires two separate reactors. After an extensive safety analysis, the team found it critical to have an efficient separation system to ensure the process's safety. The team incorporated all the gathered data into an ASPEN PLUS simulation to achieve a high yield of aniline. An economic analysis, which included capital and operating costs, was performed on the final simulation to ensure the profitability of the project.

CH2 - Isobutylene from Isobutane

Team Members: Jarrod Pugh, Noe Mendiola, Victor Andrade

Our objective in this design project is to produce isobutylene through the dehydrogenation of isobutane in a plug-flow reactor. Isobutylene is a colorless gas that is very flammable. Isobutylene is used for many production processes, such as alkylation with butane to produce isooctane, a fuel additive; methacrolein; and polymerization, which produces butyl rubber, used in tires. The simulation was executed using Aspen software version V14. The dehydrogenation process starts by going from room temperature and pressure to 580 degrees Celsius and half atmospheric pressure entering the first plug-flow reactor, producing hydrogen and isobutylene. Next, the hydrogen is removed in a liquid-vapor flash separator. Finally, the stream enters a rad frac distillation column to separate our product, isobutylene, through the bottom at a purity of 99.5%. This process is endothermic, which can cause reactor cracking. A precaution must be taken regarding the cracking and the carcinogenic catalyst of CrOx/AlO3. The target production rate is 2.5%, which is 40 tonnes per hour, of the adjusted global production rate. The main factor to account for during the reaction is temperature, because as temperature drops, selectivity towards isobutylene drops.

CH3 - The Production of Biodiesel from Chicken Skin

Team Members: Antony Evangelista, Jacob Gonzalez, Christina Lopez

This project's purpose is to explore a more efficient source of renewable energy as a substitute for fossil fuels, and to address the increased demand for green energy as pollution is a perpetually growing concern. Through computer-generated simulations, the designing of a biodiesel production plant involved both realistic economic analyses and a target production rate of 470 million gallons/year (approx. 11 million barrels/year) that could be applied on an industrial scale. The feed consists of waste materials that major food corporations tend to discard, such as chicken skin, which will be transformed into fuel. This conversion creates a more sustainable fuel source providing an environmentally sound alternative to non-renewable diesel. By heating the chicken waste, the lipids are separated. The simulation can only handle individual chemical compounds, therefore the main component that will represent our input is triolein, a triglyceride. The triglyceride is broken up into three strands forming three monoglycerides (oleic acid). Methanol is then added with a catalyst to react, leading to the creation of biodiesel (methyl oleate) with minor amounts of byproduct (glycerol) that can also be utilized for economic gain.

CH4 - Hydrazine from Ammonia and Hydrogen Peroxide

Team Members: Fatima Hernandez, Andrea Jimenez, Heather Garcia, Jazmin Acosta

Hydrazine is a versatile component which can be utilized for numerous objects. It is mostly known for its usage in rocket fuel and within the pharmaceutical industry. Our group has been working throughout the semester with the goal of finding the most cost-effective way of producing hydrazine. The process our group has chosen uses ammonia, hydrogen peroxide, and methyl ethyl ketone which are fed into a system to get our desired product of hydrazine hydrate. Since hydrazine is a known carcinogen, and can self-ignite under certain temperatures, it is best to produce it as a hydrate, so it is not as hazardous as pure hydrazine. With the use of Aspen Plus, we have attempted many simulations of our process to assist us in achieving eighty percent of hydrazine and twenty percent of water. Upon completing our simulations without

any fatal errors or warnings in Aspen Plus, all costs involved were calculated with the help of CAPCOST economic analysis. With this process, we plan to produce five million pounds per year with a plant operating factor of 320 days out of the year.

Civil Engineering

CE1 - Javelina Garage

Team Members: Othman Alsenafi, Abdualla Alazemi, Mohammad Alazemi, Hamad Alazemi, and Musallam Alazemi

In response to users requirement for parking obstacles and challenges, like crowdedness, lack of accessibility, we have suggested to design additional floor for the parking garage. The current number of parking spaces is approximately 170 spaces, and there will be 331 parking spaces according to the design of it. The layout dimensions investigated according to comfort factor 3.0 which the parking angle selected to be 90 degrees. The parameters of layout dimensions were as follows, stall width project (8 ft), aisle width (17 feet), vehicle length projection (18 feet).

In structural design and loads, we classified panels to be two-way ribbed slab according to distributed of beams in both directions also the ratio of long to short span less than 2.0. So, after the determined the model type of slab, we estimated the required thickness of slab based on the film of stiffness slab to beams (α_{fm}) so was 15 inches, which used the 12" for hollow block and 3" for topping slab (According to ASCE 7 code/ Table C3.1 Minimum design dead loads), and the live load acts on slab of parking garage (40 psf) "Table 4.1 Minimum uniformly dist. Live loads".

CE2 - Kingsville Mosque Expansion

Team Members: Mohammad Benmanzel, Hamad Alazemi, Talal Alazemi, Nayef Alazemi

The Islamic Society of Kingsville Mosque encountered various challenges such as inadequate parking, a small prayer hall, and insufficient amenities. The project aimed to enhance the overall worship experience by enlarging the prayer hall and associated amenities while constructing new parking spaces to accommodate the maximum number of vehicles efficiently. To achieve this, a comprehensive engineering system design approach was incorporated, covering structural, architectural, drainage, and parking system considerations. This involved the preparation of layout plans (structural and architectural) plans as well as the planning and implementation of new efficient drainage to prevent water accumulation and infrastructure damage. Additionally, detailed cost estimates and quantity take-offs were prepared for the major engineering systems to clarify budget requirements. A project schedule was developed to outline the tentative timelines for the planning, design, construction, and completion phases, highlighting resourceful project management and on-time delivery. Overall, the proposed design for the mosque and parking lot will not only improve the infrastructure but also enhance the worship experience for the community it serves, aligning with the project objective.

CE3 - H.M. King Pedestrian Bridge

Team Members: Yousiff Albreeky, Abdullah Alazimi, Salem Alharan, Mohand Alharan

The overall scope of the project is to design a “Pedestrian Footbridge” located on 2210 Brahma Boulevard, Kingsville, Texas connecting H. M. King High school and parking lots in accordance with applicable codes and standards. The proposed pedestrian bridge comprises of truss structure of 102ft clear span length, clear height of 16ft, width of 10ft. Horizontal and Vertical loading criteria has been selected in accordance with AASHTO LRFD, IBC Section 1609 and ASCE-7. Member’s material and shape selection has been made in accordance with the conceptual bridge design, calculated loadings, structural adequacy, structural safety, sustainability and cost effectiveness. After finalization of the structural geometry of truss and overall bridge structure, structural design calculations comprising applied design loads, member forces have been calculated using factored load combinations. Using the calculated member forces, preliminary sizing of the members have been performed to ensure that stresses and deflections are within the allowable limits. After the preliminary sizing of truss members, column loads and column analysis has been performed. Preliminary sizing of the foundation has been performed based on the calculated column loads. The proposed footing design comprises of isolated footing of (5ft x 5ft) with 18 inches depth.

CE4 - Seale Street

Team Members: Fahad Alazemi, Faleh Alazemi, Talal Almutairi, Mohammad Alhuraiti, Yousef Alquraishi

What is our project? And where is it? We will rebuild a street, and we will build a bus station. The street that we will work on is Seale Street, and it is the street beside the student housing center. We chose this project because the conditions of the street need to be improved. This street needs to be rebuilt because it is broken and narrow; it also needs to be expanded. We also chose a bus stop because of the poor transportation here in Kingsville, so we did research, and we realized that there is no public transport here that can help people or students. This bus stop can help people who cannot drive or do not have a car. Also, it will help new students who do not know anyone who can take them to any grocery stores. We took a step forward and chose this project to make life easier in Kingsville. For the components, we did the hydrology, structure, transportation, and foundation. We are planning and working on the autocad 2D, Revit 3D, and cost estimation.

CE5 - Javelina Town

Team Members: Ruben Cantu, Ruth Rojas, Nicholas McRae, Jose Baldazo, Kaleb McDonald

The purpose of the Javelina Town project is to provide new, modern, and competitive housing for families and students in the city of Kingsville. The Javelina Town project aims to be the bridge between home buying and apartment renting in Kingsville, by providing the following to the consumer: renting the home, having an onsite maintenance team, personal backyard, two car garage, two story unit, three bedrooms, two-and-a half bathrooms, patio, and in unit storage all at a competitive market price. Each unit's area includes a 1,500 square feet backyard, 544 square feet garage, and 1,370 square feet of conditioned space. The subdivision will be a 26-acre land development, located at 500 General Cavazos Blvd, that will comprise of 19 townhomes, totaling 114 units, an office/maintenance building, detention pond, and community amenities. The community amenities include a dog park, a playground, and picnic areas.

CE6 - Kingsville Community Center

Team Members: John Craig, Elijah Di Lella, Mario Saldivar, Joshua Trimm

Zenith Engineering is proposing a design for the Kingsville Community Center as its senior design project. The main objective of the center is to provide a place for the community to improve their physical and mental health. The main building will be 47,000 square feet and will accommodate all of the indoor amenities of a community center. The main feature of the center is a large event room that can be used for receptions, concerts, banquets, and other gatherings. Attached to the event room is a large kitchen that can cater to the needs of large events. There will also be multiple classrooms available where patrons can learn new skills such as painting, cooking, and gardening. Additionally, there will be multiple indoor sports courts and a gym area with machines and weights for exercise. Large locker rooms will also be available near the courts and gym for patrons to store their valuables during workouts and clean up after workouts. Inside the community center, there will be conference rooms and offices where meetings and business can be conducted. Outside the building, there will be outdoor walking trails through a native plant garden. The gym, sports courts, and outdoor trails are designed to help the community get active and spend time outside to better their physical health. The classrooms and conference rooms are meant to help people learn and benefit their mental health. The Kingsville Community Center aims to bring the community together through friendship and provide a place for the betterment of the community

CE7 - TAMUK Multiplex Theatre Design

Team Members: Agustin Alanis, Kailey Estrada, Ryan Fleming, Matthew McCanna

This project aims to address the desperate need for entertainment at the university while prioritizing the students' well-being. The project seeks to overcome the lackluster university's elements by providing entertainment and resolving the community issue of needing a multiplex theatre in Kingsville. The existing theatre is currently out of commission, making the need for a new theatre even more significant. The new theatre will also serve as a hub for social engagement on the Texas A&M University-Kingsville campus. It will be situated behind the new intramural fields, previously the bonfire's location. The current location of the bonfire is an open field adjacent to a parking lot, both of which are rarely used.

The proposed design addresses these issues and aims to create a more efficient and user-friendly building. The architectural design will optimize the use of space and improve the flow of people and resources. The project's scope includes maximizing the utilization of these spaces and providing additional on-campus amenities for students. It will prioritize the development of a structurally sound building while incorporating energy-efficient alternatives to promote sustainability. By adhering to the ISI criteria of the Envision framework, the project will help reduce the overall carbon footprint of the building, resulting in long-term cost savings for the university and reduced maintenance expenses. As an on-campus movie theater, this facility will not only provide entertainment but also generate job opportunities for both students and members of the surrounding community. Overall, the design of a multiplex theatre at the university represents a significant opportunity that provides a niche to society as the role of cinema continues to shape our culture. With careful planning, collaboration, and attention to detail, the project will be a worthy investment that will serve as the hub for student activity and the community of Kingsville for many years to come.

CE8 - General Cavazos Overpass

Team Members: Anaeliz Jacobo, Abraham Ortiz, Guillermo Raul Serna

Our senior design project proposal is an overpass at the intersection of W General Cavazos and S 6th Street. The reasoning for this project is to ease traffic congestion caused by train traffic. Many times the train passing through Kingsville has completely stopped, causing traffic to be backed and creating less than reasonable wait times for it to clear. For that reason, we propose constructing an overpass along W General Cavazos and over S 6th Street. The reasoning for selecting this intersection and not one of the many other streets along the train tracks is that this specific intersection leads to the CHRISTUS Spohn hospital. With the construction of this overpass ambulances will have a route that cannot be obstructed by the train. We cannot predict when the train will come to a complete stop, this project ensures that a route will always be available to an ambulance and other first responders in our community. Using various sources such as the TxDot Roadway Design Manual, TxDoT Bridge Design Manual LRFD, TxDoT Bridge Detailing Guide, the The Federal Highway Administration (FHWA) website, and AASHTO standards, we were about to understand the process of constructing a overpass. Computer software such as AutoCAD, AutoCAD 3D, and CSI bridge were all used throughout this project. Texas highway system bridges have a service life expectancy of 48 years while non state bridges have a service life of around 34 years. For this reason, we are estimating making our bridge to have a service life of at least 40 years. We are estimating the bridge length to be 300 ft , with span lengths of 100 feet, 110 feet, and 90 feet in order for the bridge to clear over S 6th Street.

CE9 - Calypso Hall

Team Members: Homero A. Frausto Castillo, Jaime Silva, Joseph Mikulencak, Brett Kelley

Welcome to Calypso Hall, a groundbreaking project created by team 4 consisting of Homero Castillo, Jaime Silva, Brett Kelley, and Joseph Mikulencak. Calypso Hall plans to transform on-campus living and dining experiences. The three-story multi-use apartment complex responds to the necessary need for expanding on-campus housing and diverse dining options which were all identified through surveys and student feedback. Calypso Hall is set to redefine on-campus living with 36 thoughtfully designed apartment units spread across the second and third floors of the building. With seven distinct layouts, each floor accommodates 42 tenants, while accommodating a comfortable and modern living space. Calypso Hall spans an impressive 18,111 square feet per floor and doesn't just address the housing shortage, it goes above and beyond to improve student life on campus. The second and third floors will feature amenities for reading, studying, conference meetings, and cooking. Calypso Hall also provides a vibrant first-floor commercial area, catering to student desires for more dining variety. Chipotle, Target, Spice Station, Walgreens, Burger King, and McDonald’s are among the exciting options envisioned. Beyond satisfying the taste buds of TAMUK’s students and faculty, this commercial space creates job opportunities for them, contributing to a thriving on-campus community. In essence, Calypso Hall emerges as a solution and a vision to better TAMUK’s future through thoughtful design and strategic planning. We aim to provide not only housing but also a dynamic and diverse environment where students can live, study, work, and enjoy a variety of dining experiences.

CE10 - Garden Square Apartments

Team Members: Pedro Barrios, Jack Hinshaw, Dillon Bredesen, Joshua Garcia

Garden Square Apartments is an on-campus apartment complex that offers a better student living lifestyle with numerous accommodations and living spaces other than outdated student dorms. Our 4-bedroom/2-bedroom units will include a full-size kitchen, walking pantry, individual bathrooms, large storage space, and a full-size washer/dryer unit. Our project will take the place of Martin Hall dorms that are located on campus (1255 Engineering Ave, Kingsville, TX 78363). There will be 12 (4-bedroom) and 18 (2-bedroom) rooms, fitting 84 occupants per apartment building. There will be 3 apartment complexes in total. The structure's general state serves as the basis for building apartments instead of the Martin Hall dormitory. The justification for this new apartment complex is that current dorms have no room capacity due to the closing of 2 dorms on campus. The campus has rented rooms from Legends Kingsville to meet the living quarters for incoming students. Our team's two engineering aspects are having a complete design of the structure and foundation. The key objective of this project is to have affordable and luxurious apartments on campus. Not only will our apartments be luxurious, but as part of our eco-friendly environment; our buildings will include solar panels on the rooftop which will provide renewable energy to our building HVAC and electrical systems, lowering students' monthly overall cost of living at Garden Square Apartments.

Computer Science

CS1 - TAMUK Interior Mapping

Team Members: Steven Rivera, Kilmer Bluntzer, Albert Alvarado

Indoor navigation of buildings remains challenging due to the absence of dedicated mapping solutions. Our group decided to focus on the development of an Android mobile application to facilitate indoor navigation within Rhode Hall. Leveraging Google Maps API for GPS functionality and map rendering, the application integrates a custom map to enable detailed indoor navigation. By strategically placing nodes to outline walls and pathways within the building, the application aims to provide seamless wayfinding for users.

In crafting the user interface, we prioritize intuitive interactions to ensure accessibility for users from diverse technological backgrounds. Initial testing of the application has yielded promising results, demonstrating tangible enhancements in navigation efficiency within Rhode Hall.

Our group project not only aids navigation but also lays the groundwork for broader indoor navigation initiatives, enhancing campus experiences. By creating a foundation for scalability, with plans to extend the application's coverage to encompass additional buildings, we aim to refine the functionality and user experience through iterative improvements. This paves the way for future enhancements and expansions, ensuring that our group project's efforts contribute to more comprehensive indoor navigation solutions.

CS2 - Finance Portal

Team Members: **Jose Camacho, Temitope Adebambo, David Barrera**

The Finance Portal introduces a user-friendly website interface for financial management that is easily accessible to the public. Unlike existing websites, this platform offers

free access with an individual user profile that ensures data privacy. Functionalities included in this website are an interactive calculator with specific expense categories and a statistical analysis window. The categories are structured to enable the users to input their expenses and income for expenditure calculation. The various spending categories will be displayed in 12 different tabs to represent the months in a year. Utilizing the calculation of the categories in each month, the user will be presented with a statistical analysis of their financial habits according to the amount of expenses made in each category to represent them. The design strategy emphasizes a simple but intuitive layout with seamless integration of components that provides user-friendly navigation for the everyday consumer. Leveraging standard web technologies like HTML, CSS, JavaScript, and Python, the platform ensures accessibility for all users. With the user-friendly interface, the interactive calculator, and statistical analysis, Finance Portal strives to provide the assistance the user may require to better organize their expenses, manage their budget, or even to prepare their taxes.

CS3 - Smart Mirror

Team Members: Carolina Cantu, Diego Trueba, Linh Cao, Liz Dominguez

Introducing our Smart Mirror, which features integrated app connectivity for added convenience. This practical device combines functionality with style, providing an effective platform to manage your day efficiently. By syncing with our mobile app, the mirror serves as a centralized hub for personalized notifications and reminders tailored to your preferences. No more struggling with scattered alerts or missing appointments. With our Smart Mirror, you have full control over the notifications displayed, allowing you to prioritize tasks effectively. Whether it's calendar events, weather updates, or social media notifications, the mirror keeps you informed at a glance, streamlining your workflow and enhancing productivity.

CS4 - ConnecTASKtic ProdAPPtivity

Team Members: Michael Alfaro, Brandon Banda, Alexander Singer, Sebastian Villanueva

ConnecTASKtic ProdAPPtivity is a productivity software that allows Windows PC users to better plan their day. The software stores relevant data such as when a task is supposed to occur. The primary intent of the software is to empower users to better plan their day by setting reminders. These reminders can be configured to automatically open desired applications and websites at set times to encourage productivity. The primary reasoning behind this functionality is that a task started is significantly easier to complete once started. The other intention is to block distracting websites at configurable time intervals as set by the user.

A functional GUI has been designed, and a modest database has been selected to maintain information on the backend. The team has found the software QT to be an intuitive means of developing a GUI. ConnecTASKtic ProdAPPtivity is a lean software designed to make a user's first step of starting tasks while using the computer easier.

CS5 - Multi-Threat Detection: A Well-Rounded Approach for Common Attacks Found in Cyber Space

Team Members: John Cavazos, Anthony Martinez, Leo Martinez, Jalen Williams

The rapid evolution of cyber threats, from early malware attacks to sophisticated network intrusions poses significant risks to many industries worldwide. This senior design project, titled "Multi-

Threat Detection (M.T.D.),” addresses these challenges by employing a well-rounded approach to a multitude of different cyber-attacks. Focusing on intrusion and malware threats, the project utilizes Machine Learning (ML), Deep Learning (DL), and Artificial Intelligence (A.I.) to anticipate and mitigate potential threats. The project's foundation lies in the development of automated malware detection and classification, as well as network intrusion detection and classification techniques. Leveraging specialized Python libraries such as Scikit-learn, TensorFlow, and others, the team aims to create a robust cybersecurity solution capable of effectively addressing a wide range of threats. The project's strategy includes creating an Android app capable of scanning for a multitude of cyber threats and a public website, making the cybersecurity solution accessible to a broader audience. Educational resources, tutorials, installation, and walkthrough guides will further empower users in understanding and utilizing the application effectively. The comprehensive approach, coupled with educational resources, supports the project's goal of improving consistency, accuracy, and reliability in cybersecurity, especially in smaller Internet of Things (IoT) devices such as mobile smartphones.

CS6 - EnhancerTracker: Leveraging Neural Networks for Enhancer Identification in Genomic Sequences

Team Members: Rolando Garcia, Luis Solis

Transcriptional enhancers represent pivotal regulatory elements within a genome, orchestrating gene expression by serving as binding sites for proteins, akin to genetic "switches" that can activate or deactivate genes within a cell. Enhancers have been implicated in various diseases ranging from cancer to neurological disorders, underscoring the importance of identifying tissue-specific enhancers for treatment. However, one of the many major setbacks in enhancer discovery is the insufficient numbers of confirmed enhancers in tissues, complicating the identification of said enhancers through computational methods. In this study, we explored the potential of computational approaches, specifically neural networks, in deciphering the tissue-specific activity of these genomic elements. We introduce EnhancerTracker, a tool harnessing the collective strength of deep separable convolutional neural networks through an ensemble, requiring only two validated enhancers as its input. EnhancerTracker uses a critical dataset comprising of 52,789 confirmed enhancers sourced from the FANTOM5 Project, along with control sequences from the human genome for training, validation, and testing. EnhancerTracker demonstrated robust performance metrics on a testing set: an accuracy of 64%, a specificity of 93%, a recall rate of 35%, a precision of 84%, and an F1 score of 49%.

Electrical Engineering

EE1 - Cost-Effective Room Mapping/Modeling Module

Team Members: Christopher Trevino, Brandon Medina, Grady Besancon, Zachary Kolodziejczyk

Our project introduces a cost-effective 3D mapping module centered around a Raspberry Pi 4 as the core processing unit. The primary objective is to develop a compact device capable of efficiently scanning entire rooms using a 15M/50FT Infrared Distance Measuring sensor mounted on a telescope tripod with stepper motors for controlled movement. The goal is to create a 3D mapping module adaptable to different room sizes, offering accurate and reliable scanning for residential and commercial spaces. The core motivation of this project is to

create a spark of re-evaluating room mapping methodologies. Recognizing the importance of safety and compliance, our project will follow FDA or IEC regulations for infrared technology. We ensure that our infrared distance measuring sensor meets classification standards, power levels, and safety measures to guarantee secure operation. While similar products exist, integrating a Raspberry Pi 4 as the core processing unit offers not only affordability but also provides an open-source platform. This enables users to customize the module according to their needs, further enhancing its versatility and appeal.

EE2 - Plant Monitoring and Defense System

Team Members: Agustin Omar Perez, Logan Atkinson, Cedric Cerda, Carlos Martinez III

The main objective of this project is to ensure safety and monitor the well-being of an indoor plant with little to no outside intervention. Most beginner or busy plant owners struggle to care for house plants given either a steep learning curve or time constraints. This usually leads to the death of the plant from over-watering, dehydration, attacks from pets and pests, and numerous other causes. This can be especially distressing for gardeners who lose prized or even multiple plants. Thus, the aim of this project is to make it much easier to care for a single plant and protect it from outside threats. The system is designed to constantly monitor the health of the plant through several sensors. It will record light exposure, humidity, and moisture levels and warn the owner if any of them are outside acceptable ranges. Moreover, the system will utilize an ultrasonic sensor, IR motion sensor, and infrared-capable Raspberry Pi compatible camera to detect and record any potential threats within the vicinity of the plant. If any threat is detected to be within a certain range, a turret will then spray it with a short burst of water. All of these features will allow plant owners to rest easy, knowing their prized plant is protected from environmental hazards 24/7.

EE3 - Autonomous Robot for Material Handling

Team Members: Martin Ramos, Althahir Ceja, Xavier Mendoza, Leonardo Beltran

The primary goal of our project is to design and implement an autonomous robot for efficient material handling in an industrial environment. Utilizing ROS Foxy, SLAM, and Nav2, we aim to create a robust robotic system capable of mapping its surroundings, localizing itself accurately, and navigating autonomously. Equipped with sensors such as LIDAR and a camera, the robot will be able to perceive its environment and make informed decisions. The focus lies in developing a reliable material handling mechanism, which could involve the integration of a robotic arm, conveyor belt, or another suitable solution. The autonomous robot will streamline material handling processes, enhancing efficiency and reducing the need for human intervention. Through rigorous testing and validation, we intend to ensure the robot's reliability and adaptability to different indoor scenarios, ultimately contributing to increased automation in material handling applications

EE4 - Autonomous Smart Light

Team Members: Jazmin Ray, Jacob Tuley, Jonathan Brooks, Hugo Tavares

The autonomous smart light was created to decrease energy usage; thus, decreasing energy cost. Light dependent resistors are used in conjunction with Arduino boards, to sense the varying amount of light intensity inside of a room. This information is transmitted wirelessly and

received by an Arduino board controlling the room's light source. The light source is dimmed or brightened to a target level based on the received information. This project is applicable to single rooms in commercial and residential properties smaller than 160 square feet.

EE5 - Portable Solar Charger
Team Members: Angela Rios, Apolonio Esquivel, Timothy Hemming, Roel Lopez

The main objective of this project is to develop a device that allows users to charge their mobile devices without access to an outlet. This charger will not only meet the basic expectations of the target consumer, but also provide a user-friendly interface and other smart features such as data tracking, and charge-time predictions. To accomplish this, the device will come complete with a small solar panel, a USB port, and its own display. All encased in a convenient package which can comfortably fit in a backpack, purse, or laptop case. Alternatively, it can be clipped to the outside of the consumer's backpack or bag, for easy on-the-go charging.

Environmental Engineering

EV1 - Cyanide Reduction in Wastewater Effluent
Team Members: Reeshemran Davis, Madilyn Dugosh, Victor Garcia, James Martinez, Alexander Solis

The Howard Energy Partners (HEP) Javelina Plant is facing multiple cyanide contamination source possibilities in its facility wide processing and municipal water sources used within the facility, which leads to the concern on its outfall for free cyanide levels. Elevated free cyanide levels in the outfall might harm marine life, more specifically, the native crab species that reside there. Thus, the objective of this project was to design a sustainable-innovative system that is cost effective and eco-friendly to reduce excess cyanide in the plant's discharge. The primary focus was the Electro-Bio Reactor effluent (EBR), where the largest concentration of free cyanide emanates from. Based on a thorough literature review and testing we recommend a full scale activated carbon substrate bed, layered with coco coir granular carbon, for the adsorption of the free cyanide anions to reduce the contaminant's concentration below permitted TCEQ levels. This system is expected to feature minimal annual maintenance, low operation complexity, and a high eco-friendly impact. A bench scale model with lab created activated carbon using orange peels, and steam as the oxidizing agent for its activation, was created. The model was constructed and tested for its efficiency utilizing activated carbon as the primary filtration media and coco coir as its secondary filtration layer. Subsequently, the results from the bench scale were used to design the full-scale system to be implemented at the HEP plant. The cost analysis for the full-scale implementation was also conducted for the plant's consideration.

EV2 - Alternative Septic System Solutions for Texas Colonias
Team Members: Ahjanay Dixon, Desiraee M. Silvas, Fernando Menjares Jr., Mary-Anna Roberts

Lack of adequate infrastructure and limited access to resources contributes poses a significant threat to the well-being and safety of residents in Texas colonias. The challenges

primarily faced are related to infrastructure deficiencies and flood events. In collaboration with South Texas Colonia Advocates, Cindy Park was selected as an underserved colonia in need of infrastructure improvements. Being an unincorporated community, Cindy Park utilizes septic systems as their primary form of sewage disposal. The current flood prevention practices include the use of shallow open-channel drainage ditches that fail to divert flow away from the residences. This project focused on recommending and designing a commercial-sized septic tank and drainfield system to accommodate multiple homes and produce a broad scale implementation plan. To reduce flooding impact, the drainage ditches are recommended to be altered and redefined to accommodate potential overflow. To properly sustain the longevity of the system and considering the economic hardships faced by the residents of Texas colonias, it is recommended that maintenance is conducted by the county and included in the yearly allocated budget, which can be achieved through State and Federal grants.

Mechanical Engineering

ME1 - Scorp-Bot

Team Members: Josh Bailey, Lianna Vela, Caden Rozacky, Adrian Lopez, Isaac Moreno

This abstract introduces a novel initiative focused on creating a robotic system for applying polyurethane liner for concrete culvert repair. Culverts, critical components of transportation infrastructure, often need meticulous maintenance to ensure structural integrity and mitigate potential hazards. Traditional repair methods involving manual application of liners are not only labor-intensive but also pose significant safety risks to workers.

The impetus behind this initiative is its multifaceted approach to addressing key challenges inherent in culvert repair projects. By automating the liner application process, the system enhances worker safety by minimizing exposure to hazardous environments and mitigating the risks associated with manual labor. Furthermore, its ability to operate continuously without disrupting traffic flow not only expedites project timelines but also minimizes disruptions to transportation networks. The robotic system, operating semi-autonomously, features adaptable nozzles for circular and rectangular culverts. Its key goals include reducing labor costs, enhancing worker safety, minimizing personnel requirements, decreasing maintenance time, enabling continuous operation without disrupting traffic, and accommodating various culvert sizes.

This innovation does not just make projects more efficient; it also changes how future construction projects will be managed. The development of the semi-autonomous robotic system for polyurethane liner application opens a new era in culvert repair methodologies, marked by efficiency, safety, and cost-effectiveness. This groundbreaking initiative holds immense promise for reshaping the future of transportation infrastructure maintenance on a global scale.

ME2 - SAE Baja Competition

Team Members: Ian Brewer, Emilio Hernandez, Aziel Moreno, Creighton Osornia, Eric Perez, Zane Strickland

Our team has chosen the 2024 SAE BAJA design competition as a senior design project. SAE BAJA is a multiple day collegiate competition used to test the quality and performance of

student-designed, single seat, off-road vehicles on harsh terrains. The competition is intended to help each team develop engineering, manufacturing, and marketable skills as they design a prototype vehicle for mass-production. This project showcases the design and manufacturing goals for Team 1's vehicle. Three major subsystems are to be designed using proven engineering techniques: a chain driven speed increaser for the transmission, CV axles and driveshafts, and the tubular steel chassis of the vehicle. To begin the design effort, quantitative performance parameters and objectives were established, and the SAE BAJA rulebook was consulted. Then, conceptual schemes were considered and ranked according to stated design objectives. Iteration and optimization techniques were subsequently applied to the best conceptual scheme. Due to time constraints, only a few subsystems of the vehicle could be fully engineered. The remainder rely on standard practice and competition constraints. Intentional effort has been dedicated to utilize engineering principles on several subsystems to avoid the finished project being "build only"

ME3 - Design of a Multi-Tool Actuator
Team Members: Jordan Cantu, Ryan Carrion, Christian Gonzales, Japhet Izeh, Alex Jaurequi, Angelo Villarreal

The multi-tool kit represents a novel system that simplifies many tasks in remote locations. The design intent is to utilize a single "power module" to drive a variety of mechanisms. These include but are not limited to: an automotive screw jack, an automotive torque wrench, a conduit bender for the electrical trade, and a reinforcing bar shear for concrete contractors. Design parameters for the various devices will be established at the outset, many based on codes and standards. Subsequently, conceptual schemes will be evaluated and ranked according to the stated objectives. The best conceptual candidate for each subsystem will then be analyzed by proven engineering methods. Iteration and optimization techniques will be applied to the model subsystems converging to optimal solutions. To summarize, the multi-tool kit will provide a means to facilitate a variety of tasks in a safe and efficient manner.

ME4 - Design of a Combustion Chamber and Fuel System for a Mirco-Turbine
Team Members: Robert Avalos, Choi Wooseok, Matthew Contreras, Eulalio Martinez

Gas Turbine engines have been used to power many types of machines such as aircraft, electrical generators, gas compressors, and ships. These engines utilize the Brayton Cycle to produce network. The Ideal Open Brayton Cycle is comprised of four phases: isentropic compression (compressor blades), isobaric heat addition (combustion chamber), isentropic expansion (turbine blades), and isobaric heat rejection (exhaust, thrust). The impetus of this project is based on the Brayton Cycle; however, the compressor and turbine components of the process will be combined into one assembly. A commercially available diesel "turbocharger" will be acquired for this purpose. Subsystems to be designed are the combustion chamber, fuel pump, fuel atomizers, exhaust nozzle, and concomitant piping. These subsystems will be designed to satisfy the following objectives: maximize thrust, maximize thermal efficiency, minimize cost, and maximize safety. Lastly, a prototype will be fabricated to prove that the calculations satisfy the problem statement.

Multi-Disciplinary Projects

MD1 - Oil Spill (USV) Unmanned Surface Vehicle
Team Members: Nicole Escamilla, Bailey Kolb, Monica Perez, Shaun Gill, Joaquin Haces-Garcia, Edgar Villanueva
The overall objective is to design a USV (Unmanned Surface Vehicle) that will collect oil samples from an open ocean oil spill site. Based on a previous senior design project, the team will design and optimize the following features: to facilitate the assembly and disassembly of vehicle for transportation, to carry a custom-made sensor, to develop a faster way to sample oil spills, and to decrease the amount of variability in the collected samples from the intended ideal. Other deliverables include manufacturing, assembly, and programming of the USV and designing a platform that will support the sampling mechanism. During the project, the team will focus on the analysis and iteration of potential designs that converge to an optimal solution. Lastly, a prototype will be constructed to verify that the final design satisfies customer requirements and other codes and constraints.

Natural Gas Engineering

NG1 - Design of an Indirect Heating System for Treating Emulsified Crude Oil
Team Members: Jake Chapman, Alexander Medina, Genaro Garza
Our team has opted to create an indirect heating system for treating emulsified crude oil. Water oil emulsions are hard to separate, especially at lower temperatures. The system we are designing comprises a free water knockout separator to eliminate the majority of free water, followed by a heat exchanger to raise the temperature of the crude oil before it enters a secondary separator. A shell and tube heat exchanger was selected due to its common usage in the oil industry. The cold crude oil from the initial separator will pass through the heat exchanger and exit into the second separator at temperatures exceeding 100°F. A portion of the free water exiting the separator will be directed to a water heater, with the resulting hot water circulated back into the heat exchanger to elevate the temperature of the crude oil. This process aims to ensure that emulsion-free crude oil leaves the separator and enters the wash tank. The design will encompass cost analysis, the selection of standard equipment, and considerations for environmental issues

NG2 - Improvement and Optimization of Eco-friendly Drilling, Mud Properties Using Field Equipment
Team Members: Scott Park, Rene Yzaguirre
Drilling fluid, also referred to as drilling mud, is essential for facilitating and aiding in the well drilling process. Its primary roles include removing rock cuttings, regulating well pressure, stabilizing the borehole, and preventing the infiltration of drilling fluid into the surrounding rock formation by forming a mud cake in permeable beds. Key characteristics of drilling mud include viscosity and filtration rate. Bentonite, renowned for its gel properties, is a primary constituent of drilling mud, whether water-based or oil-based. In efforts to minimize environmental impact, biodegradable substances such as pine needle powder, black sunflower seeds with shells, and soy-bean oil are favored over conventional chemicals like crude oil, diesel, and emulsifiers

typically employed in oil well drilling operations. The project aims to develop drilling fluid samples utilizing biodegradable materials that demonstrate comparable rheological and filtration properties to conventional drilling fluids commonly utilized in the industry today.