

# Abstract: Science and Engineering Fair of Houston

**1213**

## **Influence of Materials on Iphone Download Speed**

Marshall Lucas

The Woodlands Methodist School - MS

**Category**

**Embedded Systems**

The purpose of the experiment was to find how different materials influence wifi speed. I placed a iphone 10 yards away from a router and put a different material inbetween them. Then repeated each material 3 times. The steel baking pans hindered the signal the best out of all the materials. To answer the question "What materials are best at blocking a wifi signal?" Using my iphone and a wifi router; I put a material in between the phone and the router, then tested the download speed. My hypothesis when I began this experiment was: If there are different materials between the phone and the router then the wifi signal will be absorbed by the metal because it is a conductor. With the data I collected during my experiment I conclude that my hypothesis was correct. The steel baking pans made the signal reduce the megabytes significantly.

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- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

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# Abstract: Science and Engineering Fair of Houston

**1214**

## The Leading Wad

Dellivon Frazier

Jr.

Aldine ISD /Drew Academy

Category

Embedded Systems

The Leading Wand is a device designed to assist the visually impaired by alerting them to oncoming objects or individuals. Unlike a traditional walking cane, which provides tactile feedback, the Leading Wand utilizes ultrasonic sensors to detect objects up to 20 meters away and emits a beep as a sensory warning. This project aimed to evaluate the effectiveness of the Leading Wand in improving the safety and mobility of visually impaired individuals. To test the device, a blindfolded individual was guided using the Leading Wand in a controlled environment, where they were alerted to the proximity of obstacles and other people. The results demonstrated that the Leading Wand successfully detected objects at a distance and provided timely alerts, offering a potential improvement in situational awareness for visually impaired users. The project highlights the value of technological innovation in enhancing accessibility and independence for individuals with visual impairments.

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# Abstract: Science and Engineering Fair of Houston

**1215**

## **How Can you increase the accuracy and the efficiency of medical temperature sensors?**

Pranav Ramprasad

Conroe ISD /McCullough Junior High

**Category**

**Embedded Systems**

This project enhances medical electronic systems, facilitating diagnosis and temperature measurement testing. This experiment demonstrates how temperature measuring sensors can improve efficiency and frequency of usage, making doctors' jobs easier. This project aims to improve diagnosis accuracy, allowing doctors to handle more patients in less time, especially given the high volume of emergency cases.

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# Abstract: Science and Engineering Fair of Houston

**1216**

## **The Auto Diagnoses of Trypanosoma Cruzi Parasite Using Machine Learning**

Aarin Mehta

Yuva Gade

Vidyut Krishnan

Fort Bend ISD /Sartartia Middle School

Category

**Embedded Systems**

Chagas disease, a potentially deadly condition caused by the parasite Trypanosoma Cruzi, can be diagnosed in and only in its acute stage by identifying the parasites in blood smear samples through microscopic examination after staining or by analyzing the data given by a Polymerase Chain Reaction (PCR) test on the blood sample. Microscopic examination is often inaccessible in a low-income setting due to lack of experts in the field. In this project, we created an embedded system consisting of a camera and a microcontroller that can possibly be fitted on a microscope to diagnose the Chagas disease in its acute phase. To power this embedded system, we present a machine learning approach based on a convolutional neural network (CNN) algorithm for the diagnosis of images of peripheral blood smears. We used a pre-existing dataset that was divided into train and test sets, divided into 80% train and 20% test. We then created an experiment that showed that when emulating the attachment of the prototype onto the microscope, our prototype is able to accurately predict whether the sample has a high risk of a Trypanosoma Cruzi infection. Automating the diagnosis with only a few cheap parts and modules is cost-effective for most use cases, particularly in low-income and/or rural areas of the world.

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# Abstract: Science and Engineering Fair of Houston

**1217**

## Converting Computer E-waste Into Modular Electronics

Aviral Panda

Conroe ISD /McCullough Junior High

Category

Embedded Systems

This project explores the creation of a cost-effective network-attached storage (NAS) system using repurposed electronic waste, addressing two critical global challenges: the rising costs of technology and the growing accumulation of e-waste. By reusing functional components from discarded computers, a DIY NAS was built and compared to commercially available systems in terms of cost and performance. The study demonstrated that the DIY NAS achieved an 87% reduction in cost, with a total expense of \$55 compared to \$530 for a commercial NAS. Key savings were realized by reusing components such as hard drives, enclosures, and cooling systems. This project highlights the potential of a circular economy approach, transforming waste into resources while reducing environmental impact. It also shows the accessibility of sustainable technology solutions for individuals, small businesses, and educational institutions. By promoting e-waste repurposing, this initiative encourages resourcefulness and innovation, helping environmental conservation. The results of this project demonstrate that sustainable, cost-effective solutions can be achieved through creativity and reuse, making it a step toward solving global challenges in e-waste management and economic accessibility.

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# Abstract: Science and Engineering Fair of Houston

**1218**

## **Driver Distress Detection: A Novel ML Based System Using Physiological Signals**

Vihaan Shah

Tomball ISD /Creekside Park JH

Category

[Embedded Systems](#)

Often we are heartbroken with news of tragedies like fatal accidents due to sudden health conditions, fatal crashes while driving under intoxication, suicidal crashes or even homicide. Unfortunately, these incidents catch us off-guard. But, retrospectively, these tragedies highlight few glaring similarities: 1) person was distressed ( Physically Or emotionally) and needed help 2) Often a specific venue is targeted and subject drives to the location and 3) Family and loved ones did not see any warning signs of this coming. Now one may argue, these are extreme cases, However in day to day life occurrences of stressful conditions such as bullying in college or chronic work stress are increasing which if not addresses in time can gradually build up and result into extreme distress condition. Through my project I attempt to build a prototype of embedded system for detecting distress providing warning signs to loved ones in the hope to thwart some of these tragedies. I hope that loved ones can track/monitor the stress levels on daily basis and intervene before they build up into distressed situation impacting their loved one's health or mental well being.

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# Abstract: Science and Engineering Fair of Houston

3191

## The Problem You Can't Smell!: Atmospheric Methane Detection in Rural Areas Continuation III

Addison Binford

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Embedded Systems

Public awareness of climate change has been focused on the effects of CO<sub>2</sub> in the atmosphere. However, recent studies have shown methane is also a key contributor to the greenhouse effect. Oil and gas production, septic systems, marshes, and glaciers are just some of the ways methane can be introduced into our atmosphere. We cannot eliminate all possible sources, but it is possible to observe and report when methane concentrations increase in your own area. Companies that make methane detectors have products that are either too expensive, bulky, or are made to detect large amounts of methane and ignore the small concentrations. In previous years, the goal of this project was to design a methane detector that can be part of a large network of small, inexpensive detectors that are accurate enough to provide useful information. With too few people to check all the sites, it is possible that many methane leaks are missed. The idea here is to help industry by allowing the general public to help out with monitoring and reporting. For this project, I built a small methane detector capable of detecting methane concentrations of less than 1% in air, verified with 2.5% methane calibration gas. This project's goal for this year is to continue methane detection by making minor adjustments.

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# Abstract: Science and Engineering Fair of Houston

3192

## FarmSmart: Empowering Agriculture through AI-Driven Precision Farming with Aerial Drone-Driven Pathology Detection, Advanced Soil Monitoring, and Mobile App Integration

Jose Barrios

Category

Embedded Systems

Developing countries across the world suffer many challenges in their agricultural sectors due to climate changes, population growth, and significant crop loss. One of the main reasons is due to narrow access to many modern agricultural technologies, which impedes the efforts to decrease crop loss caused by crop diseases, pests, and soil degradation. Expanding access to modern technology is vital for improving food security. This study focuses on developing a precision agriculture network coupling drone imaging, ground sensors, and an app powered by generative AI to monitor field conditions, detect crop diseases, and provide insights to help farmers reduce overall crop loss. A cost-efficient soil monitoring system using NPK and moisture sensors was connected to a UNO R4 WiFi, which recorded the nutrient levels and sent them via a web server to the app (Flutter). In addition, an automated drone capable of detecting crop diseases using a self-trained machine learning model with 80.65% identification accuracy and mapping farm plots for facilitated aerial localization. The nutrient monitoring system data and the drone-captured images were sent to the Flutter app, which was integrated into pages of the home screen. Integration of a generative AI was used to provide key insights for each section. To understand key insights better, the generated insights were implemented onto a small field, and results showed slightly improved results, a 27.195% height increase, against the controlled half of the field, establishing a promising advancement in a cost-efficient way in a short period.

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# Abstract: Science and Engineering Fair of Houston

3193

## Hands of Connection: A Smart Glove for Real-Time Sign Language Translation

Anitta Sajeesh

Suhani Dave

Rani Joseph

Fort Bend ISD /Ridge Point High School

Category

Embedded Systems

Barriers to communication between Deaf and non-Deaf individuals can lead to miscommunications and limited interactions. The World Health Organization estimates that over 5% of the world population or 430 million people worldwide experience hearing loss, with many relying on sign language to communicate. However, the lack of sign language knowledge among non-Deaf individuals often hinders effective daily communication. Often, hearing individuals perceive communication with Deaf individuals as too complex or time-consuming, which can lead them to avoid engaging, thereby exacerbating social isolation for the Deaf community. This project aims to address these challenges by developing a wearable glove that translates American Sign Language into spoken words and text for non-Deaf users, while converting spoken language into text for Deaf individuals through a mobile app. This procedure is accomplished by a smart glove which is equipped with sensors that will detect the bending or flexing of each finger. Additionally, the use of an inertial measurement unit will foster detailed data on the motion and orientation of the hand during sign language gestures. The flex sensors and the IMU will then send the data to the microcontroller, which serves as the central processing unit of the device by fostering real-time translations. This tool provides an effective solution for improving communication between Deaf and non-Deaf individuals. It differs from previous studies by facilitating two-way communication, while prior approaches mainly supported one-way interaction. By offering real-time translation, the device enables seamless communication, fostering an open, inclusive exchange of information between hearing and Deaf individuals.

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# Abstract: Science and Engineering Fair of Houston

3194

## A Novel Flexible Rehabilitation Glove Device for Regaining Hand Function: Utilizing Soft Robotics, EMG sensors and Nitinol, a Low-Temperature Curable Shape Memory Alloy to Effectively Regain Control in a Patient's Hand

Anvesha Subramanian

Category

Embedded Systems

Neuromuscular impairments caused by conditions such as stroke, multiple sclerosis, muscular dystrophy, and amyotrophic lateral sclerosis (ALS), as well as physical trauma from accidents, often result in significant loss of hand mobility. These limitations severely affect a patient's hand movement freedom and their range of grasping. Rehabilitation is critical to restoring motor control, but existing methods are often costly, time-consuming, and limited in their use cases. Nitinol, a class of shape memory alloys, have tremendous potential to be utilized in the actuator component found in soft rehabilitation gloves due to their extreme elasticity, high recoverable strain limit, and ability to regain their original shape after excessive deformation. This project leverages the properties of Nitinol shape-memory alloys (SMAs) to allow for a novel, lightweight form factor and higher efficiency in actuators compared to traditional motors which are large and rigid improving conformability to a hand's natural geometry. EMG sensors have been utilized in traditional rehabilitation glove devices and have been shown to increase the rate of neural plasticity but there is a lack of literature on integrating EMG sensors into rehabilitation glove devices based on Nitinol. This study fabricated a lightweight, silicone-based rehabilitation device mimicking the natural anatomy of a finger with the novel use of Nitinol wire as an artificial tendon and utilized it in conjunction with integrated EMG-based forearm sensors, increasing the rate of neural plasticity and enabling more efficient patient rehabilitation.

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# Abstract: Science and Engineering Fair of Houston

**3195**

## **An innovation to the current airbag system**

Teddy Garza

Clear Creek ISD /Clear Brook High School

**Category**

**Embedded Systems**

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# Abstract: Science and Engineering Fair of Houston

**3196**

## **TraffiConnect: Real-Time Vehicle Connectivity for Fast, Secure, and Low-Cost Traffic Optimization**

Shaan Patel

Conroe ISD /AST: Academy of Science and Technology

**Category**

**Embedded Systems**

As 21st century demand on connectivity has amplified traffic congestion, every year, slowed transportation contributes  $\frac{1}{3}$  of all U.S. greenhouse gasses produced, \$70.4 billion costs in U.S. commerce and infrastructure, and 1.19 million deaths globally (EPA, 2025; Pishue et al., 2024; WHO, 2023). Vehicle-to-everything (V2X) communication, a possible solution, includes internet, cellular, and radio networks that risk unaddressed cybersecurity threats, and underdeveloped hardware and facilities (Alnasser, 2019). This project aims to improve V2X scalability using ESP32 microcontrollers and GPS modules to produce low cost on-board units (OBUs) for informability of a traffic signal optimization model. First, a realtime database authenticates OBU MAC addresses and autonomously pairs in range. Then, OBUs acquire GPS sentences sent to a central intersection ESP32 using ESP-NOW, a peer-to-peer network with AES-128 encryption with SHA-256 (secure hash algorithm). Next, the Q-learning model's state updates in realtime with parsed data, implementing Density-Based Spatial Clustering of Applications with Noise (DBSCAN) to detect queues and members. Finally, reward is calculated minimizing total queue lengths, average wait time, and maximized throughput when altering phase durations. Physical testing environments were inaccessible, but Simulation of Urban Mobility was used to successfully test the model. The transmission was successful in eliminating 75% of V2X cybersecurity threats and training data will improve performance. OBUs cost approximately \$6, transmitting encrypted data 200m with 95.3% record-level completeness when positioned stationary along a road, requiring 160mA for operation. Vehicle-to-vehicle communication and broadcasts can use identical hardware, improving safety and connectivity on roads.

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# Abstract: Science and Engineering Fair of Houston

3197

## How Does Instruction Complexity and Clock Speed Affect CPU Temperature?

Surabhi Kashyap  
Clear Creek ISD /Clear Brook High School

Category

Embedded Systems

As an aspiring software engineer, I wanted to explore the fine line between software and hardware. My topic this year is about how code complexity affects the temperature of a particular CPU of a computer. In addition to this, I studied the frequency of clock speed, because at times there was a direct relation between it and CPU temperature, and other times it was an inverse relationship. Seeing how and increased code complexity increases clock speed, it is most probable that the CPU temperature will be the highest with the most complex code, in an ambient temperature that is warmer. I conducted this experiment in two settings, indoor, and indoor with a fan directed towards the computer's CPU. I wrote five codes in python, all with varying complexity and ran them while monitoring the CPU temperature on the app Core Temp. I ran each code five times, so I ended up having 25 trials per setting. Each trials was measured at the 3 second mark. To conclude, my hypothesis was disproven. I did not account for thermal throttling, which is built into computers to automatically cool down CPU temperature as code complexity increases. That began to kick in during the progression of codes that were more complex. My results are applicable to most computers and CPU's in the present day.

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# Abstract: Science and Engineering Fair of Houston

**3198**

## **SightLine: First Responder AR Head Mounted Display**

Dawson Zhang

Matthew Yu

David Gong

Conroe ISD /AST: Academy of Science and Technology

**Category**

**Embedded Systems**

Rapid and accurate decision-making is critical in high-risk industries, such as emergency rescue operations, where rapid and accurate decision making can mean the difference between life and death. Situational awareness is crucial for first responders operating in chaotic and hazardous environments. Current tools, including dispatcher reports, search dogs, thermal imaging cameras, sound detection devices, and drones, provide valuable information but have limitations in integrating data seamlessly. Emerging research suggests that augmented reality (AR)-assisted technology can significantly enhance the efficiency and effectiveness of emergency medical technicians (EMTs). In this project, a cost-effective, AR head-mounted device was developed to display real-time critical information. The lens apparatus was constructed by connecting a 1.25" OLED display and a 9 DoF sensor to an Adafruit Feather M4 Express microcontroller and then mounted in front of a magnifying sheet and acrylic mirror panel. This was then encased in a custom 3D-printed chassis and attached to a pair of safety glasses. The apparatus is capable of detecting an EMT's position, angular orientation, and reference time-stamp, and display the location of various points of interest relative to the user by leveraging a back-end AR algorithm developed by the researchers. The accuracy and precision of the algorithm was then evaluated through testing in different environments. While augmented reality EMT devices are already in development, this project aims to drastically reduce production costs relative to operational effectiveness. With future development and testing, this mounted-display technology can be expanded to fields such as military, healthcare, and other high-risk operations.

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# Abstract: Science and Engineering Fair of Houston

3199

## ImpairiLink: A novel, machine-learning based attentiveness and navigation aid system for the blind/impaired using haptic technology.

Vatsal Sharda

Cinco Ranch - HS

Category

Embedded Systems

Vision impairment is a significant global issue that affects millions of individuals, hindering crucial activities such as surrounding awareness and navigation. While traditional solutions have been developed, many fall short due to high costs (over \$500), adaptability, and large footprints, reducing opportunities for those reliant on these aids. ImpairiLink, a novel haptics and machine-learning system, provides a better alternative. The system involves a central computation hub with a camera, ultrasonic sensor, and a microphone via a smartphone, along with Bluetooth-enabled wireless haptic wristbands. The hub uses machine learning, trained on a variety of common objects, and data from the other sensors to create a multi-sensorial map of the user's environment. This information is then used to selectively trigger the left/right wristbands through the BLE protocol, providing the user with multi-sensory feedback. Through touch, these haptics transmit environmental information, ensuring the user perceives crucial sounds without obstruction, a feature many other aid devices lack. The mobile app provides an accessible UI for fine-tuning the haptics. Testing demonstrated ImpairiLink's ability to recognize objects accurately and deliver corresponding feedback, with distance measurements reflected through vibration pulses, as well as personalization of feedback depending on the user. The ImpairiLink prototype showed significant potential for controlled haptics for the impaired, being able to be further expanded to provide haptic feedback for other impairments, like deafness. With a total cost of only \$50, this device surpasses existing solutions by being affordable, less intrusive, and adaptive, significantly enhancing the mobility and daily lives of the impaired.

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# Abstract: Science and Engineering Fair of Houston

**3200**

## **NavOptics: Obstacle-Detecting Glasses for the Visually Impaired**

Nursel Eski  
Farizah Alam  
Zainab Al-Ameri  
Harmony South District

Category

Embedded Systems

This research presents NavOptics, a wearable device designed to enhance navigation for visually impaired individuals. Currently, there are over 2.2 billion people worldwide affected by some form of visual impairment, including 39 million who are blind. There are available navigation aids that exist today, like canes and guide dogs; however, they have significant limitations. Canes primarily detect ground-level obstacles, while guide dogs are costly and require extensive care. NavOptics addresses these gaps as lightweight glasses with built-in ultrasonic sensors that detect obstacles at various heights and distances. The system uses a buzzer to indicate proximity, with the sound becoming more frequent as the user approaches an object. The research involved designing the glasses, developing the circuit, and programming the system. It was then tested under diverse conditions, such as lighting and distances, to compare its efficiency to current navigation tools. Results indicate that NavOptics offers greater accuracy and responsiveness than traditional aids. Its user-friendly design enhances mobility and safety, contributing to improved quality of life for users. NavOptics demonstrates a practical and innovative approach to addressing the challenges faced by visually impaired individuals, offering an affordable solution to promote confidence in daily navigation.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

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- yes       no





# Abstract: Science and Engineering Fair of Houston

**3201**

## **REMIND - Real-time Environmental Monitoring and Identification for Neurodegenerative Diseases**

Brock Kelly  
Max Martin  
Henry Denham  
ST. JOHN'S SCHOOL

Category

Embedded Systems

With a cost of care of up to \$120,000 a year, dementia has become extremely difficult and expensive to manage. Some of the most common symptoms of dementia are forgetting faces and names as well as wandering and getting lost. These conditions are especially difficult to manage because they do not constitute full 24 hour care, but supervision is necessary in order to assure the safety of the patient. An affordable solution is needed to combat the rising cost of memory care and enable patients to live their lives without expensive supervision. In order to do this, the team plans to create a pair of augmented reality glasses that uses facial recognition to identify and label registered faces, track the patient's location with gps, and use orientation sensors to detect falls. So far, the team has completed the augmented reality projection technology, the facial recognition algorithm, and developed the structural components of the augmented reality glasses. The team is currently testing and refining the integrated system.

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# Abstract: Science and Engineering Fair of Houston

**3202**

## **Developing a low-cost Peltier-element-based Precision Temperature Controller PCB**

Alexander Park  
Cinco Ranch - HS

**Category**

**Embedded Systems**

In the fields of medicinal research and chemical engineering, a common necessity in the lab is being able to precisely heat or cool a vial to a specific temperature. For example, when synthesizing chemical compounds, the reactants must be held at a very specific temperature in order to allow the reaction to happen properly. Crystallization is another advanced research application which requires precise temperature control. In recent years, peltier elements have become more affordable. Allowing for both cooling and heating between a range of -30C to 110C when an electric current is applied, they are an appealing choice for the aforementioned research applications. However, peltier element controllers can be expensive, which can make the technology inaccessible in developing countries. I designed a PCB to drive and manage a peltier temperature controller, including a thermocouple, precise temperature regulation, and computer integration to allow for more advanced features such as gradual temperature changes. It works by using a thermocouple to read live temperature data, which is processed by a RP2040 microcontroller to precisely regulate heating and cooling cycles. Switching between heating and cooling modes is done using two relays which flip the direction of current through the element. Overall, this innovation represents a step toward a future where research is more equitable, making chemistry research more accessible in areas where access to high-end laboratory equipment is impractical.

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# Abstract: Science and Engineering Fair of Houston

**3203**

## **FANE (Functional Arm Nitinol Exoskeleton)**

Muhammad Umair Shaikh

Avi Singa

Conroe ISD /AST: Academy of Science and Technology

**Category**

**Embedded Systems**

FANE is an innovative Nitinol-based exoskeleton system designed to enhance motor function and provide support for individuals with limited upper body mobility. The exoskeleton utilizes the unique properties of Nitinol, a nickel-titanium alloy that contracts in response to heat or electrical stimulation, to replicate natural arm movements. By integrating surface electromyography (sEMG) electrodes, FANE detects muscle signals from the user's body and translates them into electrical impulses. These impulses are processed by an adaptive signal processing algorithm and sent to the Nitinol springs, enabling precise, user-driven motion. The system is particularly beneficial for individuals with paralysis or restricted motor abilities, helping them perform daily tasks such as reaching, grasping, and lifting. FANE's design also includes a motor controller that manages the functional output of electrical signals, ensuring smooth and dynamic movements. Through repeated use, the system's algorithm adapts to the user's evolving motor abilities, refining movement patterns and progressively improving motor control. The ultimate goal of FANE is to reduce dependency on the exoskeleton by fostering the user's self-improvement in motor function. Over time, the device serves not only as a support tool but also as a rehabilitative aid, helping users regain autonomy and independence in their daily lives. By combining Nitinol's responsive material properties with adaptive algorithmic control, FANE offers a novel solution for enhancing mobility, rehabilitation, and quality of life in individuals with motor impairments. This dual function of support and rehabilitation exemplifies FANE as a revolutionary tool in assistive technology.

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# Abstract: Science and Engineering Fair of Houston

**3204**

## **Building a Device to Automatically Tune a Violin**

Akhil Rajarathnam

Clear Creek ISD /Clear Springs High School

**Category**

**Embedded Systems**

Tuning violin strings can be difficult, stressful, and prone to accidents. A device that can automatically tune a violin can avoid these problems and save time and effort. This project is aimed to construct a prototype that can automatically tune a violin. An Arduino Uno microcontroller was used to control the device, which included a microphone for inputs, and a servo motor for outputs. To detect the frequency of the strings, the audio inputs of the microphone were processed using Fast Fourier Transform (FFT). Using the frequency inputs, the servo, with a 3D printed end-effector, would rotate until the frequency input was correct. To test the prototype, it was used to tune each violin string ten times, with the final frequency being recorded each time. The results showed that the tuning device was more accurate at higher frequencies, with the G string (the lowest frequency string), consistently being the least effectively tuned. Most of the tests ended up with the pitch of the tuned string being within 1 Hz of its intended frequency, with an extremely low standard deviation that is undetectable to the human ear. Some issues that arose included the robustness of the end effector, and the torque output of the servo. Despite these minor problems, most tuning tests ended with the string being tuned within the just noticeable difference (JND). While there are some improvements to be made, this experiment showed that a device like this is feasible.

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# Abstract: Science and Engineering Fair of Houston

**3205**

## Car Control

Luiz Coimbra  
Lynn Pham  
John Eikenburg  
ST. JOHN'S SCHOOL

Category

Embedded Systems

The US Department of Transportation requires cars built after May 2018 to have backup cameras, but 88% of cars on the road today were manufactured before 2019. As a result, many cars built before then lack backup cameras and modern sensor systems to assist in parking. Due to economic pressures (in the third quarter, average used car prices jumped from \$20,683 in 2019 to \$27,177 in 2024), it is unaffordable for many to purchase an entire new car just for these features, even though they are life-saving. To resolve this issue, the team has designed and built an affordable, non-invasive camera-sensor system capable of storing data for transfer to an app developed by the team, offering crucial safety features to those who do not have or cannot afford cars with updated safety features. The team utilized Swift to develop a user-friendly app containing different tabs dedicated to connection, active display, and passive display. The active display is for a live camera feed with sensor overlay (for parking) and the passive display is for constant display of sensor data (for driving). The camera-sensor system is housed in a license plate frame and contains a Raspberry Pi, distance sensor, and camera. The team tested both an Arduino-based design and a Raspberry Pi-based design for processing and storing camera and sensor data; the Raspberry Pi was more efficient. The camera-sensor system is on its fifth prototype and can gather sensor and camera data and store it for transfer to the app.

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