Abstract: Science and Engineering Fair of Houston

1412

Wyatt Project

Aydin Wyatt
SST - Champions College Prep - MS

Category

Robotics and Intelligent Machines

tamala johnson 5:30 PM (2 minutes ago) to me Do you ever feel like you need a helping hand? The reason I chose this project is because sometimes my nana needs a helping hand she had two strokes paralyzing her right arm and for people with no arm that need a helping hand. Using rotobotic arms also "minimize the risk of getting infected by contact with such surfaces, our study aims to design, prototype, and test a new device able to connect users, such as common citizens, doctors or paramedics, with either common-use interfaces (e.g., lift and snack machine keyboards, traffic light push-buttons) or medical-use interfaces (e.g., any medical equipment keypad). Iadanza, Ernesto, et al." My hypothesis is that my robotic arm will be able to pick up 4 to 28 pounds or more. In building the arm we used sevros to make the arm move. My project is based off a type of code from most games using java. At first I wasn't able to move the arm. Then I went to code ninjas to help me code the arm. I got something on the screen to pop up saying that we need to download new libraries for it to work. The robotic arm started to move. Then I went to my school for help but most of my teachers didn't know what to do. So I went to (IT) which was Mr. Kyle that helped me pick up something. After several attempts the Adeept 5-DOF Robotic Arm Kit for Arduino -V4 was able to pick up a rock, cup, bag, and one dice after 3 or 4 runs it would stop and an error appeared. To correct the error I had to swap to another port. Overall it was hard coding the arm and getting multiple errors but I it was very rewarding.

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☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

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Abstract: Science and Engineering Fair of Houston

1413

Vibration Fire Alarm for the Audio Impaired

Ryan Zhang
Taylor Anthony
Lekang Ji
Houston ISD /T. H. Rogers MS

Category

Robotics and Intelligent Machines

The World Health Organization estimates that 466 million people worldwide are affected by hearing impairment. In response to this challenge, we designed a bracelet for the audio-impaired to use in emergencies. Last year, we created a device using the Arduino microcontroller. When a simulated fire alarm was activated, the vibration motor vibrated according to the light. This year, we integrated a notification system to alert family members and close relatives to the device. This ensures that deaf people and their family members stay informed and respond quickly. Not only that, we have improved and compacted our design, giving it a further range of up to 1000m, and adding customization options. By designing fire alarm systems personalized for people with hearing disabilities, we can enhance safety, improve access to safety for deaf people, decrease risks, and guarantee safe evacuations. These bracelets are just a small step toward achieving universal access to safety.

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Abstract: Science and Engineering Fair of Houston

1414

Machine Vision to Aid the Visually Impaired

Aditya Tandon
Clement Ding
Kaiyan Lin
Houston ISD /T. H. Rogers MS

Category

Robotics and Intelligent Machines

Visually impaired people struggle to navigate unfamiliar surroundings making everyday activities difficult and putting them at risk of self-injury. Our goal is to make a portable, accessible, AI based device that will aid with environmental detection and real time updates. We performed a needs assessment with the help of an ophthalmologist at a low vision clinic by conducting an anonymous survey of what blind individuals need. This assessment inspired the design of our device, and to enable the build we first made a 3d rendering. To implement the design we utilized a Raspberry Pi 4 microprocessor, a Raspberry Pi camera module 3, wired headphones, and a portable power bank. The camera was attached to a headband and the raspberry pi plus power bank were placed in a small pouch on the hip. In our first iteration we used live streamed imaging data of objects in the field of view. We then implemented logging to suppress the output from the AI model until a button press, when it would print every recognized object into the console. To enable visually impaired individuals to hear this output we used a text to speech AI model called pyttsx3. We were able to create a product that works so that on button presses the wearer of the device can receive audio output to inform them of what is in front of them. We switched to using a different camera called ELP High Speed Camera for ease of connection to Raspberry Pi via a USB cable, which made programming much easier using a library called opencv. In conclusion, we have created a low cost, effective, functional aid for blind individuals to elevate the quality of their life and their safety. We plan to release the code and the manufacturing process for easy adoption by the visually impaired community. In future versions we plan to build in object distance and movement into the output.

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Abstract: Science and Engineering Fair of Houston

1415

Self Driving Cars Are The Future

Emmanuel Abhilash
Clear Creek ISD /Brookside Intermediate School

Category

Robotics and Intelligent Machines

This experiment is to show people self-driving cars are safe and trustworthy. Humans get older and lose our capability to drive cars, but that doesn't mean we can't go anywhere. Self-driving cars can help people of old age and people with disabilities to get to wherever they need to go. The problem I solved was that not many people trust self-driving cars with their lives but my project can teach people all about self-driving cars, so that they can trust them in the future. My hypothesis was, if more obstacles are added onto the driving course then the amount of time to complete the course will increase. This matters because it shows that a self-driving car may take a long time but it can give a smooth drive to wherever you need to go. My findings matter because they show that self-driving cars can drive smoothly even if there are any obstacles along the way, so as you are sitting in the car you don't have to worry about getting into an accident or anything like that. My approach was to build a model and explain to the observer how self-driving cars work. The answer I obtained was that self-driving cars may take longer than a human driven car but they can give you a smooth and relaxing drive to wherever you need to go. I met my design criteria because I was able to build a model and I was able to explain how a self-driving car works.

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Abstract: Science and Engineering Fair of Houston

1416

Advancing AI

Divyasha Harsh
Ilhum Maredia
Clear Creek ISD /League City Intermediate School

Category

Robotics and Intelligent Machines

As AI continues to advance rapidly, it sparks debates about its potential benefits and harms. While concerns about its misuse are valid, AI tools like Chat GPT can offer significant advantages when used appropriately. This study investigates the usage patterns and effectiveness of Chat GPT, focusing on younger age groups. Specifically, we aimed to determine if younger individuals use Chat GPT more frequently and achieve higher accuracy when leveraging its capabilities. Using a Google Form with general knowledge questions, participants across various age groups were given a 30-minute time limit to complete the test, though most finished within 10 minutes. Participants had the option to use Chat GPT for assistance. We recorded which questions were answered using Chat GPT and analyzed the data using a spreadsheet. Our findings demonstrate that younger participants were more likely to use Chat GPT, either to verify their answers or discover the correct ones, and they achieved higher accuracy as a result. This study highlights the potential of AI tools like Chat GPT to enhance learning and understanding, particularly among younger users.

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Abstract: Science and Engineering Fair of Houston

1417

Assisted Homeostasis Using Arduino

Farees Dean
Clear Creek ISD /League City Intermediate School

Category

Robotics and Intelligent Machines

Plants provide many benefits in our everyday lives. These benefits include better air quality, a better mood, and therapeutic qualities. However, if plants are exposed to extreme conditions, or are not taken care of properly, they can get damaged or die. My project aims to provide a simple, inexpensive, easy to use device that can help someone monitor and take care of their plants. This project is beneficial since it can help extend plant's lives, allowing the user to benefit from their plants for longer. My project uses an Arduino as the brain, multiple sensors to measure the conditions of a plant, and an OLED display to alert the user whenever their plant's conditions are not ideal. This device can be applied in many other situations, such as farming to increase crop yield and reduce water waste.

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Abstract: Science and Engineering Fair of Houston

1418

Bluetooth and The Science Behind It

Erick Alfaro
SST - Champions College Prep - MS

Category

Robotics and Intelligent Machines

Bluetooth is a technology that has made the world more efficient and organized. This project dives deep into Bluetooth's science by constructing a functional bluetooth speaker using a recycled can of Coca-Cola. Bluetooth was made in the 1990's to get rid of wires and make things more organized using frequencies and radio waves. Over time, bluetooth has improved in range, speed, and efficiency, making it needed for devices today. To demonstrate how Bluetooth functions, I made a working Bluetooth speaker using a Coca-Cola can, speakers, and circuits along with soldering them together with wires. The Coca-Cola can was recycled into the speaker's case, demonstrating how everyday objects can be transformed into amazing tools. Overall, from this project, I learned all about Bluetooth and the Science Behind it along with how it's influenced modern-day devices.

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Abstract: Science and Engineering Fair of Houston

1419

Hydraulic Robotic Arm

Jonathan Cruz-Espinosa
YES Prep

Category

Robotics and Intelligent Machines

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Abstract: Science and Engineering Fair of Houston

1420

Autonomous Counter Cleaning Robot

Victoria Sifuentes
Clear Creek ISD /Brookside Intermediate School

Category

Robotics and Intelligent Machines

The purpose of this project was to create a more time efficient, and a more efficient Autonomous Counter Cleaning Robot. The autonomous counter cleaning robot would be beneficial for people with disabilities and or medical conditions. This cleaning robot is unique from other cleaning robots because the structure it uses. It was built to have a pushing object in the front to ensure it get all the crumbs. It also has a fan in the back to get all the crumbs left behind. When creating this robot there had to be soldering done to the on/off button. The safety that had to be done with this step was to wear goggles. It was a challenge that was also overcome. To test this the counter cleaning was built and coded. Then, put a human on one side of a counter and the robot on the other. Put 20 crumbs on each side give them 10 seconds and see the results. According to the results the highest average the human picked up was 13.7, and the highest average the robot picked up was 16 crumbs. The invention created contributed to the category of Robotic and intelligent machines because the robot helps people, and helps the world be sanitary. The invention created did meet the design criteria and exceled. The robot did things that was beyond the criteria and succeeded.

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Abstract: Science and Engineering Fair of Houston

1421

Improving Fast Food Order Accuracy Using Weight Detection

Joseph Zajicek
Tomball ISD /Grand Lakes JH

Category

Robotics and Intelligent Machines

My project is a solution which increases order accuracy at fast food restaurants. To do this I have created a prototype that detects if a food item is missing from an order. The system adds the minimum and maximum weight values of the order and detects if the weight of the order is within the range. This allows the system to detect if an order is missing items, if the order is correct, and if an item is missing what item it is. In addition, I also did a range of testing on the prototype and the weight of fast food items.

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Abstract: Science and Engineering Fair of Houston

1422

Testing Different Passwords to see Which one is the Hardest to Guess

Aidan Cunningham
Spring Branch ISD

Category

Robotics and Intelligent Machines

In this experiment I tested different passwords to see what would make one harder to guess. I conducted experiments that included a total of 20 trials. I tested several different passwords using lowercase letters, capital letters, and special characters. As I tested each password, I slowly increased the number of characters in each one. As a result I found out that the more characters that are added the longer it takes to crack the password. In adding only special characters does not increase the passwords level of security as if you would add characters. Merely adding special characters as adding onto the types of characters in the password makes the password stronger. Meaning if I add only characters the password might be strong, but if I add a special characters it will increase the strength, only if I add a new type of character (like a capital letter) will it impact the password differently. (I also tested my friends passwords for fun).

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Abstract: Science and Engineering Fair of Houston

1423

Tidy Titians

Lucky Soe
Trish Nguyen
Alief ISD

Category

Robotics and Intelligent Machines

The experimenters had 3 different robots, or prototypes, to test out and see which one is the best at carrying items that will help people keep their room tidy. The building process took a long time. After building, the builders tested out the robots. The 1st prototype carried the least mass of items, with an average mass of 121g. The 2nd prototype carried a few items, with an average mass of 148.33g. The 3rd prototype carried the most items, with an average mass of 310g. In conclusion, the hypothesis was correct, which is that the 3rd prototype would be the best robot.

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Abstract: Science and Engineering Fair of Houston

1424

Is A.I gender biased?

Ali Abdo
Conroe ISD /York Junior High

Category

Robotics and Intelligent Machines

The study investigates the hypothesis whether artificial intelligence exhibits gender bias by comparing responses from 3 different AI platforms. The study involves 3 trials, each lasting 10 days where 10 identical questions were posed daily to each platform resulting in a total of 900 responses. The answers will be analyzed based on whether they reinforced gender stereotypes, demonstrated neutrality, or showed explicit bias. Visual graphs were created to identify patterns and correlations across platforms. In the end it was proven that AI is gender biased to men by 56.8%.

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Abstract: Science and Engineering Fair of Houston

1425

Neural Networking or Neural Processing?

Zoey Kelling
Clear Creek ISD /Seabrook Intermediate School

Category

Robotics and Intelligent Machines

This project is intended to show how A.I. is used negatively in the educational environment and prove to students that A.I. is not worth the risks. This project will investigate the difference in quality and accuracy of English Language Arts essays written by A.I. compared to student-written responses. A.I. has many different resources for generating things, so it will most likely receive a higher grade. However, it is predicted that it will not be difficult for teachers to discern AI vs. human-written essays. The hypothesis was correct, as the AI received lower overall scores than the student essays and teachers were regularly able to identify AI-written essays. So much has been learned about how students think. It is now understood that students sometimes honestly can't do an assignment, but A.I. is not where they should go. Students and teachers will benefit most from the project. They are the ones who can make a change in our school system. What we should do, is start a student support system, like SST, but with monitored teacher support.

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Abstract: Science and Engineering Fair of Houston

1426

A novel approach to identifying Mosquito Breeding Grounds with Convolutional Neural Networks, to stop the spread of Vector-Borne Diseases.

Eshaan Ahuja
Conroe ISD /McCullough Junior High

Category

Robotics and Intelligent Machines

We are fighting a war against mosquitoes, and we are losing. According to an independent population health research organization based at the University of Washington School of Medicine, the Institute for Health Metrics and Evaluation (IHME), from 1980 to 2004, the amount of Malaria, a disease spread primarily by mosquitoes, cases per year has gone from 638,005 to over 917,000, a 43% increase. To combat this major problem, I created two custom Convolutional Neural Networks (CNNs) using the You Only Look Once (YOLO) v8 standard. I trained the first model, with over 3 million parameters, 225 layers, and an over 90 percent mAP@50 score, on a dataset of over 5,000 aerial images of Mosquito Breeding Grounds, allowing it to be deployed in most affected areas around the world. For my second model, I used a dataset of just over 1.2 thousand up-close images of Mosquito Breeding Grounds, and it also achieved the same high level of capability. The purpose of building both models was to solve the problem of widespread Mosquito-Borne Disease. My aerial model enables affected regions around the world to detect Mosquito Breeding Grounds from above, so they can take the steps required to remove them. My second model, trained on up close, ground-based, imagery, was developed for countries like India, where most of the population have phones and can use them to detect Mosquito Breeding Grounds. These models help solve a major problem in the world today and have true potential to make a difference.

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Abstract: Science and Engineering Fair of Houston

1427

Optimal Heights for Infrared Turrets

Avaneesh Dhondge
Conroe ISD /Irons Junior High

Category

Robotics and Intelligent Machines

The objective of this science project is to explain the optimal altitude for Infrared (IR) Turrets, how they are used and to indicate other uses of an IR Turret that are currently unused. The findings of this project will help improve the military's weapons and can also be used for space exploration. The hypothesis stated that the optimal altitude for the Turret would be anywhere above the target. In order to test the hypothesis first put the balloon atop a box. Then the turret aimed at the balloon, and its accuracy to hit the balloon was recorded after shooting. Later, by placing one then two boxes beneath the turret to observe changes in accuracy. The data showed that the best accuracy for the turret is when it is leveled with the target. The correlation shows that the turret is most accurate when it is at the same level as the target, and the accuracy decreases as the turret's altitude increases or decreases. This study shows that the optimal accuracy for the IR turret occurs when it is at the same level as the target, and its accuracy decreases when positioned above or below the target.

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Abstract: Science and Engineering Fair of Houston

1428

Smart Screens: Harnessing AI to Predict the Risk of Diabetes

Reyansh Gupta
Tomball ISD /Willow Wood JH

Category

Robotics and Intelligent Machines

For this project, I will use Artificial Intelligence and Machine Learning to predict the risk of diabetes for an individual. The user can input if they are noticing certain signs of diabetes such as excessive thirst, obesity, and other easy signs to notice. Then, the model will output the risk of an individual as high risk or low risk. This is useful in today's society because diabetes tests only tell you if you have diabetes or not. You might not have diabetes, but this model tells you have the risk of diabetes, letting you know that you have to change your lifestyle.

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☒ yes ☐ no

Abstract: Science and Engineering Fair of Houston

1429

Can AI accurately detect Breast Cancer?

Dyuthi Vinna
Conroe ISD /York Junior High

Category

Robotics and Intelligent Machines

This project explores the use of artificial intelligence in detecting breast cancer from patient data using a machine learning algorithm called KNN (K-Nearest Neighbors) to detect if a patient has malignant tumor which is cancerous or benign which is a non cancerous tumor. The project's finding showed that the AI model had a high level of accuracy in identifying cancerous cases, showing that AI is a valuable tool in early breast cancer detection. Using AI for early detection can greatly improve the accuracy of the diagnoses, which leads to quicker treatment and better outcomes for patients. This project not only helps advance the field of medical technology, but it also opens the way for more reliable and faster healthcare solutions.

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☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

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Abstract: Science and Engineering Fair of Houston

1430

Can Humans Recognize AI?

Colin Carr
Conroe ISD /McCullough Junior High

Category

Robotics and Intelligent Machines

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Abstract: Science and Engineering Fair of Houston

1431

A Beacon of Hope: Developing AI for Early Stroke Detection

George Zhou
River Oaks Baptist School - MS

Category

Robotics and Intelligent Machines

Cerebrovascular stroke is a leading cause of death among individuals aged 65 and older, with symptoms that can rapidly progress from facial paralysis and slurred speech to fatal outcomes within hours. Early detection and timely medical intervention are critical to saving lives and reducing long-term disability. In this project, I developed a mobile application that utilizes cutting-edge image-based machine learning technology to detect early symptoms of stroke, specifically facial paralysis, through a single photograph taken with a smartphone camera. The app analyzes facial features in the image to identify signs of asymmetry commonly associated with stroke and integrates user-specific health profiles, such as prior stroke risk factors, to provide personalized feedback and tailored medical advice. The application also addresses disparities in stroke symptom recognition, considering variations in symptoms experienced by underrepresented groups, such as women, to reduce delays in diagnosis and treatment. This innovation empowers individuals to detect stroke symptoms quickly, even when alone, potentially saving thousands of lives each year. Initial testing using publicly available datasets demonstrates strong accuracy in identifying facial paralysis, and future collaborations with medical professionals aim to validate the app through clinical testing. Inspired by my grandmother's experience with a debilitating stroke, this project represents a personal commitment to advancing accessible, life-saving healthcare technology.

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Abstract: Science and Engineering Fair of Houston

3397

Soft Robotics in Gastrointestinal Endoscopy: Engineering a Novel Hydraulic Colonoscope to Minimize Risks and Enhance Usability

Sai Spoorthi Maram
Jiya Joshi
Fort Bend ISD /Travis High School

Category

Robotics and Intelligent Machines

Over 25,000,000 colonoscopies are performed annually in the U.S., but only 18,756 active gastroenterologists in 2025 can provide treatment, rendering 10,000,000 patients underserved. Compounding the issue, with over 50% of gastroenterologists nearing retirement within the next decade, colorectal cancer detection encounters a growing challenge. This shortage stems partially from the complexity of conventional colonoscopes (CC). This project introduces a robotic colonoscope made of soft materials to lower entry barriers, enhance usability, and reduce adverse reactions. The system combines a soft design and hydraulic control unit to create a semi-autonomous, self-propelling colonoscope. The design features three modular sections with a central stiffening mechanism, optimized via FEA simulations and kinematics. The robot is fabricated using silicone in custom-made 3D-printed molds. The hydraulic control system powered by two reverse polarity peristaltic pumps includes two four-way fluidic channels each with its own activated solenoid and pressure sensor. These components are managed by an Arduino Mega for precise actuation along with a programmed control interface. This disposable, cost-effective approach eliminates lengthy disinfection and offers enhanced maneuverability with greater degrees of freedom and bend angles compared to CC systems, supported by video and motion tracking. Additionally, this soft robotic colonoscope has navigated through a series of colon structures, proving its compatibility with a diverse patient population. Embedded force sensors within the soft colonoscope supply colon pressures during procedures, providing the haptic glove with real-time tactile feedback. This innovative system improves accessibility and efficiency, addressing critical challenges in colorectal cancer detection.

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Abstract: Science and Engineering Fair of Houston

3398

AI sign recognition in foggy conditions

Vedha Bontu
Spencer Teltow
Kyler Eimerbrink
Conroe ISD /ACES: Academy for Careers in Engineering and Scien

Category

Robotics and Intelligent Machines

Our experiment tested how well a camera system in a self-driving car could see stop signs in different amounts of fog and at various distances. We predicted the camera would stop working after 20 minutes of fog, but it surprised us by detecting the stop sign every time, no matter how foggy it was or how far away the sign was. This showed us that the system is much better at handling fog than we expected. In the future, we want to see if it works as well in heavy rain or snow, at night, or in low light. We also think adding things like thermal sensors or improving the AI could make the system even better. This research shows that self-driving car technology has a lot of potential and could become even safer and more reliable with more testing and upgrades.

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Abstract: Science and Engineering Fair of Houston

3399

Symptom Based Virus Prediction Using a Large Language Model

Srilalitha Trisha Madasu
Houston ISD /DEBAKEY HIGH SCHOOL FOR HEALTH PROFESSIONS - HS

Category

Robotics and Intelligent Machines

Dengue virus is a global issue most prominent in South American countries such as Brazil, Nicagua, Chile but can also be found in several other countries including Malaysia, Thailand, Taiwan, etc. Dengue virus has been around since the 1960's and is present to this day as there are nearly 400 million cases per year, which isn't including the suspected cases present in several rural areas. The problem is that many people do not have access to a doctor to give them medical aid. To help people without good healthcare facilities, the large language model comes in and serves as the doctor. The large language model predicts the virus that one has based on the symptoms that they are experiencing. Although there is no official vaccine for dengue virus, there are vaccines for other viruses such as Japanese Encephalitis, Malaria, Yellow Fever, etc. Based on the large language model's prediction of which virus one is experiencing, the appropriate treatment can be given to the patient.

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Abstract: Science and Engineering Fair of Houston

3400

Influence of Artificial Degrees of Certainty in Large Language Model Reasoning-Based Tasks

Gary Sun
Arnold Zhang
Clear Creek ISD /Clear Lake High School

Category

Robotics and Intelligent Machines

As large language models (LLMs) are increasingly integrated into various decision-making processes, understanding how human inputs influence their outputs is essential. Prior research suggests that factors such as specificity, wording, and tone can influence LLM responses; thus, our project investigates how the specific human input of artificial degrees of certainty affects the bias and accuracy of LLMs in reasoning-based contexts. Employing the GSM8K dataset of 1,319 grade-school math problems, we benchmark the performance of various LLMs with diverse capabilities, including OpenAI's GPT-4o Mini, Meta's Llama 3.1 70B, and Mistral's Mistral Large. Each prompt includes a predefined certainty level and sample answer attached to a reasoning-based task derived from GSM8K to evaluate LLM behavior and susceptibility to such inputs. Our findings reveal that LLMs often adopt the artificial answer provided by the prompt, even when such an answer is incorrect. Additionally, boosting the certainty level of prompts can enhance model performance up to a certain threshold, highlighting a key tradeoff between confidence and robustness. These results emphasize the importance of mitigating input-based vulnerabilities, as errors in human-generated prompts could perpetuate further inaccuracies. Understanding and addressing these dynamics is essential for designing LLMs that balance responsiveness with resistance to flawed inputs, improving their reliability in real-world applications.

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Abstract: Science and Engineering Fair of Houston

3401

NeuroSim - A Digital Twin-Enhanced Sim-to-Real Autonomous Neurosurgical Robot Using Deep Learning

Rayhan Papar
Conroe ISD /AST: Academy of Science and Technology

Category

Robotics and Intelligent Machines

Each year, over 1 million patients experience complications from neurosurgical procedures, ranked among the most challenging surgeries by researchers. Studies indicate 64% of complications result from technique error by the surgeon. Neurosurgery requires extreme precision to navigate complex, hard-to-reach anatomy and avoid irreversible damage, yet human limitations often cause complications and make some procedures impossible. To address these challenges, NeuroSim presents an autonomous robot that independently conducts neurosurgical tasks with intelligent decision-making and precision, trained using machine learning and simulation. NeuroSim employs deep learning to synthesize patient medical scans into a digital replica reflecting patient anatomy, including white and grey matter, cerebrospinal fluid, and cerebral vasculature through encoder-decoder neural networks. This "digital twin" helps the robot, developed with IsaacSim, understand how to navigate the brain and avoid damage to critical structures. The robot trains in IsaacLab simulation with realistic soft-tissue deformation mimicking brain tissue physics. Robots are controlled by a Reinforcement Learning (RL) policy, which rewards completing tasks and penalizes excessive force on sensitive tissue like vasculature. Using this approach, NeuroSim performed surgical tasksâ€"such as reaching, lifting, and passing objectsâ€"on patient digital twins with minimal tissue interference, with success rates up to four times higher than benchmark robots. Behaviors learned in simulation were then transferred through Sim-to-Real to a physical robot, which performed on a patient phantom with a 97% success rate. NeuroSim has the potential to revolutionize neurosurgery by eliminating human error. Robots performing complex, high-risk procedures autonomously will reduce complications and improve outcomes for millions of patients.

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Abstract: Science and Engineering Fair of Houston

3402

Flexible manipulator designed based on bionic elephant trunk for fire fighting

Zhengyang Chen
The Village School

Category

Robotics and Intelligent Machines

In the face of the overwhelming in numbers and increase in complexity of fire scenarios with the numerous drawbacks of traditional firefighting methods, such as the inaccessibility of fire extinguishers, the uncontrollable spraying range of sprinklers, and the poor flexibility of rigid robotic arms, our research has been dedicated to developing an innovative firefighting solution. We designed a bionic elephant trunk robotic arm, which has become the focus of our study. This robotic arm features a spiral structure and primarily utilizes TPU as its material. Through a series of experiments, we have optimized the structural parameters, including the diameter, height, thickness, and pitch of the spiral, to determine the optimal configuration. In terms of hardware, we have carefully selected a variety of coherent components to ensure the realization of its functions. In terms of control, it employs multiple pull wires and servo motors to achieve precise motion control and integrates cameras as well as sensors to enable intelligent operation. The experimental results demonstrate that this robotic arm can perform precise fire extinguishing through remote control, skillfully bypass obstacles, and exhibits excellent performance in object grasping and handling experiments. Moreover, its telescopic flexible body demonstrates good performance, with a maximum jet distance in optimal range. The achievements of this research provide a new direction for the development of firefighting technology and hold the promise of more effectively combating fires and reducing losses in complex environments. Key words: Bionic Elephant Trunk Robotic Arm; Flexible Design; Firefighting Breakthrough; Intelligent Function; Experimental Success

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Abstract: Science and Engineering Fair of Houston

3403

Robotic Future

Morgan Abbey
Spring Branch ISD

Category

Robotics and Intelligent Machines

I designed and revised designs for a simple robotic arm while keeping the cheap budget in mind. I did thorough research to find the best motors and materials that balance performance and price. I then 3d-printed and constructed the arm. I used visual studio 2022 and Arduino ide to program control for the arm. Through these steps, I successfully made a budget friendly robotic arm to bring us to the robotic future.

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Abstract: Science and Engineering Fair of Houston

3404

Automated Remote Deployment of Telecom NIBs during Disasters using UAVs

Alex Chirayath
Pranav Pulluru
Ojeifo Okhiria
Harmony South District

Category

Robotics and Intelligent Machines

Timely communication is critical during natural disasters, yet damaged infrastructure often isolates affected areas, delaying emergency response efforts. Recent hurricanes, such as Helene and Beryl, caused widespread telecommunications outages, with restoration relying on traditional methods like Satellite Cells on Light Trucks (SatCOLTs), which face logistical challenges, delayed deployment, and incomplete coverage. This project introduces a system that integrates artificial intelligence (AI) algorithms and UAVs (unmanned aerial vehicles) equipped with telecom network components to deploy a dynamic Network-in-a-Box (NIB) architecture. The system leverages data from Weather Application Programming Interfaces (APIs), network outage triggers, conditions, and warnings from operators' "operations and maintenance (O&M)" systems to monitor the disaster landscape. An Artificial Intelligence/Machine Learning (AI/ML) algorithm determines where, when, and how network restoration should occur, dynamically determining the required number of UAVs, loading non-conflicting network configurations on each, and ensuring optimal coverage without inter-UAV frequency interference. This enables the restoration of the terrestrial network to its maximum possible extent, providing critical communication capabilities for first responders and survivors. Simulations tested various configurations, scenarios, and network conditions to validate the system. Results demonstrated a significant reduction in deployment time compared to traditional ground-based solutions, as well as consistent, reliable network coverage and adaptability to dynamic disaster environments. By combining real-time environmental and network monitoring, adaptive deployment strategies, and scalable UAV-based NIB architecture, this innovative approach enhances emergency communication resilience and sets a new standard for disaster recovery in telecommunications.

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Abstract: Science and Engineering Fair of Houston

3405

Rise of the Robots: Outpacing Human Builders?

Ezra Fruge
Andrew Descallar
Aidan LeBlanc
Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Robotics and Intelligent Machines

Robots have been replacing countless careers, such as producing goods and storing data, however, can robots surpass the construction crew and reduce injuries and cost in the field as a result? This project looks into whether a human or a robot can build a Lego wall faster, and is important because it could possibly reduce the injuries in the construction field. To start, the robot was constructed out of Legos and coded to create a Lego wall. Once the machine was built, the robot was then recorded twenty times to find the average time it took to build the Lego wall. After the trials, twenty different humans that consented to participating in the project were recorded for how long it would take them to build a wall. The null hypothesis is that there is no statistical difference between humans and robots when it comes to speed in construction buildings. The alternative hypothesis is that there is a statistical difference between humans and robots. The results supported the null hypothesis by demonstrating that the t-value calculated(0) is less than the critical value(1.68). Moreover, the average time of the humans(10.66 seconds) was significantly lower than the robot's (23.89 seconds). In conclusion, the robot developed was slower than humans by 76.5%.

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[X] yes [ ] no

Abstract: Science and Engineering Fair of Houston

3406

Novel Application to Translate ASL from Live Recording into Natural English Language via Artificial Intelligence

Sophie Dai
Emma Chen
Emily Chou
Fort Bend ISD /Clements High School

Category

Robotics and Intelligent Machines

Our project focuses on the enhanced ability for hearing disadvantaged individuals to speak to an audience or groups larger than a few people via live recording of the upper body. Individuals will sign ASL in the recording, which will be converted into the natural English language using several AI models. It is divided into three sections with one corresponding AI model for each section. First, we utilized Google's AI camera application MediaPipe, to be able to generate 3D coordinates for hands, face, and upper body while an individual is signing in ASL live. The second section of the project features another AI model that is trained to recognize the 3d coordinates from the first section to actual ASL signs, these individual signs will be formatted into gloss. (gloss is the written format of ASL). Lastly, the gloss received from the 2nd section will be used in the 3rd section where, yet another AI model will be utilized to translate this gloss into the final result, the recorded ASL signs into natural English language. Graphs on the accuracy of the model as it is trained as well as other statistics will be shown. As a final result, we have an application comprising of several programs to run a live camera that recognizes ASL signs and converts it into the English language for people to understand the speech of hearing disadvantaged individuals.

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Abstract: Science and Engineering Fair of Houston

3407

Democratizing First-Aid: A fully autonomous, cost-effective, AI/ML powered first-aid robotic delivery system

Tanush Solai
Chirag Tripathi
Mehdi Benseddik
Klein - HS

Category

Robotics and Intelligent Machines

Every year, over 350,000 out-of-hospital cardiac arrests occur in the United States, with immediate CPR and AED use doubling or tripling survival rates. However, research indicates that EMS response times are approximately 10% longer in low-income communities, with averages reaching 43 minutes in the lowest-income ZIP codes compared to 37.5 minutes in the highest-income areas. These disparities are further intensified in "ambulance deserts," where emergency medical services take over 25 minutes to arrive, far exceeding the critical 5-minute window for AED administration. To address this life-threatening issue, our team developed the AutoMed AURA-1, an autonomous robotic emergency medical assistance system designed to deliver rapid first aid in hard-to-reach areas. The AURA-1 leverages cutting-edge technologies, including machine learning, computer vision, and additive manufacturing, to provide a cost-effective, sustainable, and fully autonomous solution. Equipped with a 6x6 autonomous drivetrain, LiDAR, and AI-powered navigation, the AURA-1 can quickly respond to emergencies in dense urban areas, industrial sites, and low-income communities. By reducing response times and eliminating the need for diesel-powered ambulances in non-critical situations, the AURA-1 not only saves lives but also minimizes environmental impact. Our system is designed for deployment in various settings, including hospitals, corporate campuses, event venues, and rural health centers. With a focus on affordability and accessibility, the AURA-1 is produced using 3D printing, significantly lowering production costs and making it feasible for widespread implementation.

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Abstract: Science and Engineering Fair of Houston

3408

AI-Driven Weather Communication: A Multi-Lingual Livestreaming System Enhancing Public Awareness

Andy Shi
The Kinkaid School - HS

Category

Robotics and Intelligent Machines

Access to real-time weather updates is crucial for preparedness during extreme weather events, yet language barriers and low engagement limit access in Southeast Asia, where 400 million people have low English proficiency (EF English Proficiency Index, 2023): most official weather agencies communicate primarily in English and rely on text-heavy websites with unengaging content. Although traditional media transforms, translates, and shares official information, the manual process is too slow for rapidly evolving weather events like typhoons. To address this, I developed an automated broadcast system powered by large language models (LLMs) to deliver real-time, localized weather updates in multiple languages. The system collects data from reputable English-language sources, organizes it by topic, and transforms it into engaging content for multilingual audiences. A Retrieval-Augmented Generation (RAG) framework ensures the information is accurate and contextually relevant, while Python Asyncio minimizes delays, enabling real-time updates. Users can also ask questions and receive immediate, informed responses in their preferred language via usage of APIs. In four months, this system has reached over 400,000 viewers, surpassing an official forecasting agency website (JTWC's) visits in the same period - demonstrating the potential of AI to overcome information barriers and enhance disaster preparedness for underserved communities.

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Abstract: Science and Engineering Fair of Houston

3409

Design and Development of a question Answering System Utilizing a Large Language Model

Megan Wu
The Kinkaid School - HS

Category

Robotics and Intelligent Machines

This project aims to design and implement a chatbot application that leverages a large language model (LLM) trained on organization-specific data. The chatbot is deployed on a website for an organization that serves children with special needs. The app is designed to answer visitor questions with precise, accurate, and easily accessible information. By integrating ChatGPT, Python, and AWS, this chatbot app can provide more tailored answers based on the specific data from the organization's website.

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Abstract: Science and Engineering Fair of Houston

3410

Automated ISS Material Analysis using A.I.

Francisco Delgado
Clear Creek ISD /Clear Falls High School

Category

Robotics and Intelligent Machines

The Materials International Space Station Experiment (MISSE) has been assessing the durability of materials in space since its first mission in 2001. This program exposes materials to extreme space conditions, providing crucial data for the development of resilient materials for spacecraft, flight hardware, and astronaut clothing. Since MISSE-9, high-resolution photographs have been taken monthly to monitor the degradation of these materials in orbit. Furthermore, the enhanced MISSE-X platform introduced real-time monitoring, daily photography, and advanced experimental replacement systems. Currently, human inspectors analyze these images, focusing on color and other visual changes that indicate material degradation. This project explored the use of an Artificial Intelligence (AI) infused computer vision system to perform this imaging analysis, hypothesizing that the AI could detect degradation with comparable accuracy to human inspectors. If successful, AI could offer significant time and cost savings, streamline the analysis process, and be applied to other space assets and Earth-based materials exposed to extreme environments. The system provided very good results identifying the visual color changes that would indicate material degradation. The AI algorithms were trained on a variety of Earth Material images that showed color changes over time, similar to those that would be seen on images from MISSE. The detection of color changes was comparable to what would be expected by human inspectors. Given this success, the next step involves collecting further images from MISSE to use for additional AI training and further analysis of materials in space.

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Abstract: Science and Engineering Fair of Houston

3411

Swarm Scan: An Autonomous Lidar-Based Drone Swarm Solution for 3D Mapping

Ayaan Dhuka
Caiman Moreno-Earle
Landon Doughty
ST. JOHN'S SCHOOL

Category

Robotics and Intelligent Machines

The U.S. is in the midst of an infrastructure crisis. Throughout the nation, over 40% of our bridges and roads are over 50 years old. Current inspection methods are primarily visual and are costly and time-consuming. These methods necessitate bridge closures for over three days, a certified inspector to be present, and upwards of $40,000 per inspection. With these rising financial and time costs, U.S. infrastructure often undergoes long periods (longer than the federally required biannual period) of negligence, leading to dangerous conditions and potentially unchecked issues. To solve this problem, the team aims to design a scalable drone swarm-based solution that combines LIDAR, a digital camera, and infrared cameras to generate 3D maps of the structure. These 3D maps allow inspectors to perform virtual preliminary inspections without physically requiring them to be present at the structure, significantly reducing the cost and time required to perform routine bridge inspections. To accomplish this goal, the team split the project into three main subsystems: code, electronics, and structural. The code subsystem focuses on the control algorithms for in-flight stabilization, localization, and mapping. The electronics subsystem aimed to develop the drone's electrical systems, primarily the custom flight control PCB and gimbal. Finally, the structural subsystem focuses on the drone agents' structural design and the manufacturing of physical components. The swarm of multiple drones navigates utilizing Multi-agent Simultaneous Localization and Mapping (SLAM) and scans its surroundings, providing cheaper and more efficient inspections.

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Abstract: Science and Engineering Fair of Houston

3412

Developing Non-Invasive Prosthetic Limbs for Paralyzed Individuals using Electroencephalogram Technology Analyzed with Machine Learning Algorithms

Vidipsai Pitta
Satvik Maggavi
Conroe ISD /AST: Academy of Science and Technology

Category

Robotics and Intelligent Machines

In the United States alone, approximately 2.3 million individuals suffer from the loss of a limb. Currently, the majority of prosthetic limbs require extensive surgery as well as external mechanisms to control the limb. However, by utilizing electroencephalograms (EEGs,) a prosthetic limb can be created without the need for surgery. The design of the 3-D printed prosthetic limb includes a stepper motor connected to a Raspberry Pi. By connecting the Raspberry Pi to an external power source, the motor's functions can be coded to correspond to the EEG. EEG technology analyzes brain activity by utilizing electrodes placed around the cerebral cortex. Extensive data has been collected to train the Random Forest Classifier Machine Learning model in order to determine whether there was a kick. This data is used to stimulate knee movements with the prosthetic leg. By connecting the data gathered to the Raspberry Pi, the EEG data will be connected to the computer, enabling the connection to import data and test the prosthetic limb live. The Random Forest Classifier had a very strong accuracy in classifying the data as a kick. The designed prosthetic proves that the EEG method for a non-invasive prosthetic limb is successful, with the only limitation being the slight delay due to the lack of sophisticated technology for this project.

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Abstract: Science and Engineering Fair of Houston

3413

SpectraVision

Avyukt Satish
Arjun Hariharan
Neeraj Aluru
Fort Bend ISD /Clements High School

Category

Robotics and Intelligent Machines

The purpose of our project, "SpectraVision", was to develop a cost-effective pair of glasses capable of performing functions typically associated with real-time smart glasses, but without relying on a powerful and expensive projector. The device was designed to display text and images directly onto the lens using LEDs while maintaining affordability and accessibility for a broader audience. The methodology involved designing and 3D-printing a lightweight frame to house the essential components, including a microcontroller, and an embedded OLED screen. The development process included iterative adjustments to the frame, calibration of display configurations, and refinement of models for real-time operation. Results showed that the device effectively displayed clear text and images on the lens as long as the lens was clean. Importantly, the glasses demonstrated functionality similar to high-end smart glasses at a fraction of the cost, ensuring accessibility for users with budget constraints. The research demonstrates the feasibility of creating affordable wearable devices for applications such as navigation aids and augmented reality systems. Future work could focus on expanding capabilities, including voice command integration and multi-language support, to broaden the scope of the device's usability.

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Abstract: Science and Engineering Fair of Houston

3414

Optimizing and Implementing Real-Time CNN Models for Nutrient Deficiency Detection in Corn Using Drone Imagery

Dev Sinharoy
Seven Lakes - HS

Category

Robotics and Intelligent Machines

Corn serves as a foundational crop in global agriculture, sustaining livestock industries and supply chains. However, nutrient deficiencies - particularly in nitrogen, phosphorus, and potassium - pose significant challenges to maximizing yields, threatening agricultural productivity. Current solutions for diagnosing and addressing these deficiencies are often computationally prohibitive or financially inaccessible, with commercial options from companies like DJI being unaffordable for small-scale farmers. This project seeks to address these barriers by developing a prototype system that enhances the EfficientNet architecture to enable real-time nutrient deficiency diagnostics in cornfields and integrates a custom fertilizer dispersal mechanism for targeted intervention. Through architectural modifications, the system achieves both greater computational efficiency and precision, allowing high-resolution drone imagery to be processed directly on resource-constrained platforms without reliance on cloud infrastructure. The drone is equipped with an integrated dispersal system designed to autonomously apply fertilizer to deficient areas identified during diagnostics, enabling immediate and targeted nutrient intervention. Initial field testing demonstrated that the prototype system achieved 91.2% accuracy in identifying nutrient deficiencies and performed precise, efficient fertilizer application, minimizing waste and ensuring resources are used sustainably. While the results are promising, the prototype has room for improvement in scalability, robustness, and long-term usability. By bridging advanced AI research and practical agricultural applications, this system empowers small and medium-scale farmers with cost-effective, actionable, real-time insights into crop health. It provides a transformative approach to precision agriculture, ensuring sustainable resource use, reducing yield losses, and meeting the growing demands of modern farming practices.

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Abstract: Science and Engineering Fair of Houston

3415

AgriAid: Harnessing Machine Learning and Artificial Intelligence To Revolutionize Sustainable And Precision Agriculture

MANASHWIN NELLURI
AARAV ASUNDI
Conroe ISD /AST: Academy of Science and Technology

Category

Robotics and Intelligent Machines

The purpose of this engineering goal is to determine if it is possible to build a cost-effective, environmentally friendly, and efficient agricultural robot that is easily obtained by farmers in third world countries. This study explores the feasibility of developing such a robot by examining current technological advancements, material costs, and the specific needs of farmers in these regions. The research aims to identify key design principles that balance affordability with functionality, ensuring the robot can perform essential agricultural tasks such as planting, watering, and harvesting. Additionally, the study evaluates the environmental impact of the robot's production and operation, aiming to minimize carbon footprint and promote sustainable farming practices. By addressing these factors, the goal is to create a viable solution that enhances agricultural productivity and supports the economic development of third world countries.

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Abstract: Science and Engineering Fair of Houston

3416

Stopping Each Shot II: A Natural Language Processing Model for Gun Violence Threat Detection and Instantaneous Preventative Action

Mia Wang
Praseedha Maddipatla
Conroe ISD /AST: Academy of Science and Technology

Category

Robotics and Intelligent Machines

Gun violence has become a national crisis in the United States, claiming over 48,000 lives in 2021 alone—the highest annual toll ever recorded. Alarmingly, firearms have been the leading cause of death for children and teenagers from 2021 to 2024, surpassing car accidents and cancer. Schools have not been spared, with a 124% increase in school shootings recorded between the 2020–2021 and 2021–2022 academic years. These events profoundly impact school environments, leading to life-long trauma, mental health challenges, and teacher attrition, especially in vulnerable communities where gun violence disproportionately affects minority children and teens. To mitigate these threats, a natural language processing (NLP) model was developed to detect written threats of violence with high precision and accuracy. Publicly available text datasets were processed and tokenized to train a Bidirectional Encoder Representations from Transformers (BERT) model. The dataset was divided into training, validation, and testing subsets to ensure thorough evaluation. The model achieved an accuracy of 98.66%, a precision value of 0.9406, and a recall of 0.9557. Additional metrics, including an F1 score of 0.9481 and a Cohen's kappa score of 0.9639, stress the system's reliability in identifying threats. This research provides a scalable, proactive approach to identifying potential threats in written communication, enabling faster and more effective preventive actions. Future extensions could focus on incorporating multimodal datasets and deploying the model within real-time surveillance systems to enhance its practical application and efficacy in reducing gun violence.

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Abstract: Science and Engineering Fair of Houston

3417

Evaluation and Prediction of Parkinson's Disease Through Machine Learning

Ava Hatchell
Siya Adur
Conroe ISD /AST: Academy of Science and Technology

Category

Robotics and Intelligent Machines

The objective of this science fair project was to use machine learning to track and monitor the progression of Parkinson's disease. Innovative technologies and programs aimed at tracking the progression of biomarkers offer promise. Such advancements could lead to more personalized treatment plans and interventions, ultimately improving patient outcomes. Furthermore, increasing public awareness and understanding of Parkinson's disease may drive funding for research and provide support for those affected by it, fostering a more informed community that can advocate for better care and resources. By addressing the complexity of this disease, the role of biomarkers, the necessity for early diagnosis, and the potential for technological solutions, a more comprehensive discussion surrounding Parkinson's disease and its impact can be created. Open-source Parkinson's data was used to code and develop the program. In addition to this, we created a website that would be able to track the progression of Parkinson's by comparing the patient's data to previous data. The model we coded used the statistical ANOVA test to calculate the accuracy rates of each dataset. The models achieved high accuracy rates of 85%, 90%, 90%, and 95% across the different tests, and our model had high accuracy with a mean of 90%. Our ultimate goal is to create a framework for Parkinson's disease that not only focuses on early detection and progression but also ongoing support and collaboration within the healthcare system and the community.

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Abstract: Science and Engineering Fair of Houston

3418

GermGuard: Design and Development of a Novel Wristband for Far-UVC Enabled Assistance in Hospital Associated Infection(HAI) Prevention

Arav Mehta
Aayan Pattanayak
Tomball ISD /Tomball HS

Category

Robotics and Intelligent Machines

In 2023, healthcare-associated infections(HAIs), or infections contracted during patient care in a healthcare facility, affected 136 million individuals, resulting in an estimated 99,000 fatalities and 40 billion dollars in damages. However, the World Health Organization (WHO) reports that 70% of HAIs are preventable through proper hand hygiene, exemplifying the need for a comprehensive, automated hand hygiene solution that addresses both human error and non-compliance in hand hygiene practices. This study proposes a novel wearable device utilizing far-ultraviolet radiation to sterilize and cleanse the user's hand with three objectives in mind: safety, efficacy, and ergonomics. This was achieved by designing and optimizing three subsystems: radiation, reflection, and software integration. While most ultraviolet radiation is considered harmful to the skin and eyes, the team's radiation subsystem consisted of a krypton-chloride excimer lamp with variable pulse control and an optical filter, ensuring only radiation of wavelengths concentrated around 222 nanometers, which are safe according to the National Institute of Health, were emitted. The reflection subsystem consisted of a UV-enhanced aluminum reflector and precise servo motor configurations, allowing for one degree of freedom and variable ultraviolet beam width for the accurate direction of ultraviolet radiation along the hand. Finally, the software integration subsystem comprises a multi-platform application and a back-end data collection and storage framework. The application provides a user interface for the ccamera analysis personalization of the user's hand. Testing procedures analyzed GermGuard's irradiance and its effect on hand-sampled pathogens, demonstrating its ability to reduce the hygiene burden on healthcare workers.

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Abstract: Science and Engineering Fair of Houston

3419

A Biologically-Inspired Quantum Machine Learning Algorithm

Sanskriti Manoharan
Fort Bend ISD /Hightower High School

Category

Robotics and Intelligent Machines

The biological brain is the most efficient computer in existence, performing 10^18 operations per second using only 20 watts of power. State-of-the-art machine learning lags exponentially behind in energy efficiency, optimal coding, and robustness compared to biological systems of similar scale. This project constructed a biologically-inspired machine-learning vision model that mimics the behavior of specific biological neural circuits, to improve model performance and efficiency. This project hypothesizes that a quantum approach will more aptly mimic biological behaviors and demonstrate increased benefits due to intrinsic quantum properties such as the global quantum entanglement for feature extraction and increased parallelization. The proposed model is comprised of two units. The first unit models simple and complex cells for preprocessing, and the second unit extracts abstract, global features of the image using a quantum kernel convolution, whose weights are trained with an Adam optimizer and cross-entropy loss function. The proposed model was compared to classical CNN and biological models. Models were trained on MNIST and Fashion-MNIST datasets. To test the similarity of the models to biological networks, they were presented with novel image distortions, such as noise, contrast modulations, adversarial attacks, and shape-vs-texture bias. Due to the high adaptability and robustness of the human visual system, augmented images are easily recognizable by human observers, but historically difficult for machine learning models. When tested, all models achieved similar raw accuracy, but the proposed quantum model surpasses other models in robustness and energy efficiency. This project concludes that quantum properties hold promise for biologically-inspired machine learning.

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