DIVISION OF ENGINEERING PROGRAMS

VIRTUAL ENGINEERING DESIGN EXPO

Tuesday, May 4, 2021

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Hello and Welcome!

Thank you for taking time out of your busy schedule to click through our **Virtual Engineering Design EXPO**!

Each year, our Senior Design students design, build, test and repeat until they create a product we are all proud to display at our EXPO. This year's cohort completed their designs in an environment never before experienced, not even by last year's cohort.

Teams were formed without a handshake or conversation in the back of a classroom. Concepts were bounced off one another through various communication devices, and novel strategies were conceived and employed to produce prototypes without cross-contamination. Creativity was truly on display in new and conventional ways this year.

We wish that we were able to gather together in celebration of these accomplishments. Once again, we invite you to enjoy our final presentations in digital format. Although we cannot be together, our presentations will reach viewers farther than ever imagined.

I would like to extend a very special thank you to our Engineering Design EXPO sponsors:

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Without their support, we would not be able to produce such professional projects.

Congratulations to all our engineers! Enjoy the 2021 Virtual Engineering Design EXPO!

Kevin Shanley, Chair
Division of Engineering Programs

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SENIOR DESIGN II

Team 1

Collapsible Electric Bicycle

Sarah Kisiel (ME), Armando Pavon (ME), Patrick-James Piescor (ME), Joshua Pisano (ME), Nolan West (EE)

Advisor: Professor Ken Bird
Co-Advisor: Dr. Reena Dahle

Abstract

The objective of this project was to design and build a collapsible, electric bicycle. The team's goal was to demonstrate the compactness, functionality, and safety of the design. This foldable electric bicycle was designed to mitigate the hassle of carrying and transporting a bicycle by significantly reducing the size and weight. When folded, the side profile of the bicycle was reduced by nearly 50%. The maximum weight goal of 50 lbs. was achieved, weighing in at 47lbs. Through physical iterations, the functionality and safety of the designed mechanisms were tested both physically and through use of SolidWorks and ANSYS. The electrical system features a mid-drive, 350W motor and 36V, 10Ah battery for minimal weight, while still being able to provide over twice the power output of the average rider. Additionally, the bicycle consists of three electrical sensors to mitigate the motors degradation, LCD display for user controls and feedback, and headlight/taillight integration. Using Finite Element Analysis, various loading configurations were analyzed using appropriate weight distributions to determine the safety of the design. The rider's weight distribution ranged from 40/60 to 2/98 and was divided appropriately between the bicycle's seat, handlebars, and crank for each riding style. The information provided from this project can be used as a basis for future bicycle designs, focusing on reducing weight and improving functionality of the bicycle.

Team 2

Induction in 3D Printing Applications

Jevon Hewafonsekage (EE), Christian Olmoz (ME), Vishesh Patel (ME), Bennett Terrill (ME)

Advisor: Dr. Rachmadian Wulandana
Co-Advisor: Dr. Ping-Chuan Wang

Abstract

Proposed as a way to indirectly and rapidly heat materials in manufacturing processes, a 3D printer was modified with an induction module as a potential method to reach higher temperatures. For a design process, an Arduino-based model controlled the induction circuit's temperature, while a keypad was used to input the desired temperature value to the system. By utilizing a thermocouple gated by a relay, a near-constant temperature was maintained. This allowed for more accurate simulations. Simulations using ANSYS were critical to the development of the mechanical components of this device. When designing the components to construct the print head, the effect of heat transfer in mechanical and electrical components were monitored to maintain steady operation. To secure the mount and prevent the flow of electricity between the extruder and induction coil were the primary challenges in the design process. These challenges proved to be an important aspect to design a functional 3D printer utilizing induction.

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Team 3

Remote-Control Robotic Bobber

Farzana Akhter (ME), Afridi Bhuiyan (ME), Waliur Bhuiyan (ME), Md Emtiaz (EE), Fairooz Haque (ME), Tanvir Khan (CE)

Advisor: Dr. Julio Gonzalez
Co-Advisor: Dr. Varad Karkhanis

Abstract

The overall purpose of this project is to design, test and build a wireless remote-controlled robotic bobber to streamline the fishing experience. In general, the robotic bobber will be able to move according to the user's preferences. The essence of this control process is, if the bobber moves, so does the fishing hook connected to it. One important objective is to be able to make fishing automated and dependable by employing robotic technology. Luck will play less of a role in the fishing experience. We have created three sets of prototype designs on SolidWorks and 3D printed samples of our design. The prototypes are now undergoing testing phases to make sure they are buoyant, waterproof and large enough to accommodate the electronics within the bobber. We considered these factors with the aim of having a working model by the end of the semester.

Through testing and research, we figured out how to make the bobber float using Bernoulli's principle along with the buoyancy test. We utilized electronic components that are not waterproof and do not have the capability to work in water, hence the casing itself is waterproof. Some parts of the Arduino, the DC motor and servo motor radiate heat, so they need to be able to transfer heat appropriately. The best way is to use a protective 3D printed casing and silicone to cover the joints/welds of connection points. We used silicone as well as gel polish to make the electronics waterproof. Regarding power, we needed to use a voltage source that would stay within the size constraints of the device. We chose a lithium ion battery because it has enough discharge to handle all the internal components. This project is important because the project allows for technology to be used in recreational activities such as fishing. If this is possible, technology will be able to close the gap to make fishing more automated in the future. The ability to choose where you want to move your bobber would revolutionize the fishing industry.

Team 4

Low Cost Ventilator for Developing Countries

Sarah Abdo (EE), Nataniell Ilyayev (ME), Melissa Keefe (ME), Olivia Kelsey (ME), Eric Migliaccio (ME)

Advisor: Dr. Julio Gonzalez
Co-Advisor: Dr. Heather Lai

Abstract

In the beginning of the COVID-19 pandemic, many patients were hospitalized due to their respiratory complications. With over 130 million cases worldwide, there has been an increasing demand for breathing ventilators to assist COVID-19 patients [1]. This inspired the research into other uses for low cost ventilators in the medical field, which became the purpose of this Senior Design project.

A medical grade ventilator can cost more than $20,000 [2]. With this knowledge, the goal was to develop a low cost innovation solution. With consideration of the cost, the prototype ventilator designed for this project was budgeted under $1,000 for all the materials and supplies needed to operate efficiently, which provides ample room for continued future works. Using a position controlled motor encoder, the gear assembly was powered to compress the ventilation bag at desired breaths per minute. This resulted in an output flow to the patient. This mechanism was chosen to mitigate common health risks associated with medical ventilation and functions with the use of a flow sensor, DC motor and Arduino. Communication with the Arduino established the flow rate using a plot to visualize the input into the patient's lungs.

[1] "Coronavirus Update (Live): 13,565,264 Cases and 2,996,608 Deaths from COVID-19 Virus Pandemic—Worldometer," Worldometers.info, 2021. [Online]. Available: https://www.worldometers.info/coronavirus/?utm_campaign=homeAdUOA?Si. [Accessed: 15-Apr-2020].

[2] H. Glass and M. C. by H. Glass, "High-Acuity Ventilator Cost Guide," Medtronic, 05-May-2020. [Online]. Available: https://hcpresources.medtronic.com/blog/high-acuity-ventilator-cost-guide. [Accessed: 12-Nov-2020].

Team 5

Load-Bearing Assistive Exo-Suit

Kevin Thomas Kurian (ME), Enrico Licata (ME), Xavier Manuel (ME), Carl Pascarella (ME), Thomas Spreitzer (ME)

Advisor: Dr. Heather Lai

Abstract

Bodily wear and fatigue are something that plague thousands of workers employed in jobs that require them to lift and move heavy objects throughout their daily shifts. It is the wear and tear from this repeated lifting that diminishes the health and wellness of workers in these occupations. By transferring the weight of the load the worker is carrying, away from their arms and onto the core of the body, the worker's arms and shoulders are relieved of the stress which causes the wear and tear. The goal of this project is to design a lightweight and flexible power-driven exoskeletal device that shifts an amount of weight of a load from the arms of the wearer to their body through a frame which attaches at the arm and connects to a frame worn on the torso. The torso frame is attached to the wearer by a harness that will distribute the weight. Additionally, this device will use a power system to support the load and mitigate the load on the user.

Team 6

Digital Regulator Phase Control Board

Sarah Denatale (EE), Adam Greenberg (EE), Kenneth Hauser (EE),
Yuriy Langer (EE), Ian O'Connor (ME)

Advisor: Dr. Mohammad Zunoubi
Stakeholder: Scott Nelson, P.E., Neeltran, Inc.

Abstract

In this senior design project, research and development was conducted for Neeltran Inc. to produce a digital phase control board that will be used in conjunction with a pulse rectifier system which utilizes thyristors for AC-DC rectification. This digital phase control board will operate a pulse rectifier system capable of producing either three, six, or twelve pulses using SCR's (Silicon Controlled Rectifier) for AC-DC rectification. This new controller will serve to replace the long standing analog controller currently in use by Neeltran Inc.

Research and testing was conducted on an unfinished prototype that was previously developed for Neeltran by an outside consultant. Initially, the controller itself was not functional. Review of the code and reverse-engineering of the controls was necessary to restore the controller to operable condition. Once control systems and power systems were developed and established, a successful test on the lab bench was performed. The digital controller was capable of firing a multi-pulse SCR system demonstrating full PID (proportional–integral–derivative) feedback control for either output current or voltage. Upon restoring the digital controller to an operable condition, the controller was reviewed for discontinued and obsolete components. The process to update the digital controller board was initiated. During this review process, potential improvements in functionality upgrades and updates were noted where necessary.

During the second phase of this project, power testing of the controller board on industry standard high power rectifier and transformer was conducted using a six-phase star-connected design. The test successfully demonstrated full functionality on a large rectifier under a light load. The rectified pulses were viewed on an oscilloscope during both voltage and current PID control. A thermal analysis was performed to confirm safe operating temperatures.

Upon final revision and completion of this project, the Digital Regulator Phase Control Board will be ready to replace and upgrade Neeltran's current analog control board for future customer use.

Neeltran Inc.

Team 7

Kinesthetic 3D Audio Mixer

Kiera Cavanagh (ME), Susan Ko (ME), Maxx MacRae (EE),
Matthew Muller (EE), Seth Pearl (ME)

Advisor: Dr. Heather Lai

Abstract

3D audio is a quickly growing field thanks to the proliferation of virtual reality and affordable Surround Sound systems. To date, there have not been any devices developed specifically with 3D audio production in mind. The goal of this project was to develop a device which allows for efficient and intuitive positioning of 3D sound sources using kinesthetic (touch-based) input from a user. This was accomplished using a Raspberry Pi and a camera held within a transparent sphere. While the user moves their finger about the surface of the sphere, the Raspberry Pi uses a Computer Vision algorithm and data from the camera to track the user's position on the sphere. This position is then translated to Azimuth and Elevation values, which are sent to the user's computer via MIDI messages to be read by a Digital Audio Workstation (DAW). Within the DAW, certain Ambisonics plugins can receive the MIDI messages and correspondingly transform an audio file to sound like it is coming from the direction input by the user. Through multiple designs, it was found that placing the camera underneath the sphere produced the largest field of view, with a single camera covering most of the sphere. The limited processing power of the Raspberry Pi proved to hinder the device's intended real time functionality. Future projects may build on these discoveries and correct these issues in order to construct a valuable device for the audio production industry. In the burgeoning field of 3D audio, such a device would not only be useful to professional audio engineers, but it would also flatten the learning curve for 3D audio production and allow inexperienced users to more easily enter the field and create.

Team 8

Hybrid Dual-Sport Motorcycle

Bshara Dababneh (CE), Kyle Harkin (CE), Wilfredo De Leon Maldonado (ME), Joseph Vara (EE), Brian Vigilante (ME)

Advisor: Dr. Mahdi Farahikia
Co-Advisor: Dr. Mohammad Zunoubi

Abstract

Among technologies whose popularity is ever-growing is hybrid technology. Hybrid technology is evolving with better and higher qualities being innovated. The goal of our Senior Design Project is to design and build a prototype of a hybrid gas electric motorcycle. This project's motivating factor is to introduce the benefits of hybrid power systems to the motorcycle market. Using such technology in a two-wheeled vehicle will help to reduce dependency on fossil fuel and will also help to increase the driving range of the vehicle as the driver will have the option to choose either electric or gasoline mode.

Chassis designs were made using CAD software and assembled using one inch diameter steel tubing. Construction of the chassis consisted of learning novice fabrication and welding skills. A hybrid system converting the mechanical power of an engine to electrical power was designed and implemented. This system consists of an in-house designed battery pack and aftermarket electric motor connected to the primary gasoline engine via belts and pulleys. Data collection and regulation of this project consists of two microcontrollers. The microcontrollers are essential in providing the rider with crucial information such as system temperature as well as diagnostic data in the event of a mechanical failure. The two controllers used were the ATMega2560 and the STM32 NUCLEO. The ATMega2560 was used in the collection of data and display to the rider while the STM32 NUCLEO was used to record diagnostic data for later use. With both controllers used, C programs were created to facilitate the above-mentioned functions.

Team 9

Wireless Pressure Sensor for Radon Mitigation System

Konrad Brzoska (EE), Reese Robinson (EE), Quinn Santangelo (ME), Gurnaz Virk (ME), Daniel Waligurski (ME)

Advisor: Dr. Reena Dahle

Abstract

Radon is a naturally occurring gas produced by radioactive decay of uranium and is extremely dangerous to humans. Natural uranium deposits can be difficult to detect, and homes built on soil with a high uranium concentration may be subject to radon gas buildup [1]. Radon exhaust systems continuously exchange stale air from areas without adequate ventilation. These systems are typically monitored using a manometer, which requires visual inspection to confirm whether the system is working. In this project, a radon pressure-monitoring system is designed to provide wireless monitoring of the radon mitigation system by the homeowner. A U-tube manometer is fitted with a transmission line and Arduino transceiver chip in order to detect failure in a radon mitigation system. A second Arduino, wired to an identical NRF24L01 chip, receives a signal in order to check the status of the system. On the receiver side, a green LED is used to indicate proper operation, while a red LED and buzzer indicate a system failure. The wireless pressure sensor's antennas are manufactured for operation at 2.4GHz. The Arduino processor is powered by a battery pack or wall outlet. The transmission line is constructed with 35µm thick copper tape on Rogers 4350B substrate board with a relative dielectric constant of 3.48. A WiFi-Band signal is sent from the NRF24L01 transceiver through the transmission line into an antenna. Should the radon mitigation system fail, the olive oil (relative dielectric constant of ~3) in the U-tube will rise to cover the transmission line's surface. This will cause a change in the effective dielectric constant of the transmission line, leading to reflections and losses of signal power transmitted to the antenna. This eliminates the risk of an unnoticed system failure. Once a system failure is detected by the drop in pressure, a signal will be sent to a homeowner informing them of possible danger. This wireless radon mitigation system is easily adaptable to most radon systems installed in homes. It is a cost-effective solution due to its small size and low power requirements.

[1] "What is radon gas? Is it dangerous?," Environmental Protection Agency, 21-Aug-2019. [Online]. Available: https://www.epa.gov/radiation/what-radon-gas-it-dangerous. [Accessed: 19-Apr-2021].

Team 10

Pure Sinusoidal Wave Inverter/Single to Three-Phase Power Converter

Nikiforos Fokas (EE), Caroline Kucher (EE), Matthew Smith (EE)

Advisor: Professor Mike Otis

Abstract

There are two main ways to power electrical devices: by using a Direct Current (DC) source or by using an Alternating Current (AC) source. In some cases, the source that the device calls for is not readily available. For example, in systems like vehicles, the main source of electricity is from the car's battery which can only provide DC. The only way to provide current to devices that run on AC is to use a device such as an inverter which converts DC to AC. Typically, this is done using a modified square wave, but for some very sensitive devices, this will not work. Another issue involved with powering devices is that, not only do some devices run on AC, but they also run on a special type of current known as three-phase AC. This project contains three parts: generation of a pure sinusoidal wave from a DC source, splitting this single-phase generated waveform into a three-phase balanced system and filtering and amplifying the signal to drive a load. The first stage of the system is a variable frequency and variable voltage, single-phase AC power supply that utilizes a STM32 microprocessor with supporting circuitry to generate a sinusoidal waveform. The second stage of the system is a phase splitter that transforms the single-phase AC input with a phase angle of 0°0° into a three-phase balanced output with phase angles 0°0°, 120°120° and 240°240°; where the output phase angles can also be changed anywhere between 0°0° and 180°180° per phase. The third stage of the system incorporates a filtration design that includes a low-pass filter at the output to filter out unwanted frequencies higher than 1k Hz, as well as a power amplifier to allow higher voltage devices to be powered by the system. This system ensures that the design provides single-phase and three-phase sinusoidal waveforms for all types of AC devices and does so in a cost-effective manner.

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Team 11

Laticrete Tool Development for Resinous Coves

Haris Deljanin (ME), Matthew Miraval (ME), Ivan Radonjic (ME), Mark Shkolniy (ME), Devin Ursprung (EE)

Advisor: Dr. Kevin Shanley
Stakeholder: Matthew Carli, Director of Innovation and Strategic Planning, LATICRETE, International Inc.

Abstract

Installation of resinous flooring is a labor-intensive task. Specifically, coves between the floor and wall are a manual and challenging aspect. Cove installation can be very laborious when using a cove trowel to apply resinous material with zero variability. This process requires an intense amount of manual labor along with specific physical application techniques. LATICRETE International, Inc. has tasked the SUNY New Paltz Senior Design Team 11 with developing a tool to distribute material in a manner that will form smooth coves at the proper angle and depth. Our team has engineered an electro-mechanical device for installation of resinous coves. This device utilizes a centrifugal pump to deliver resinous material to an outlet specifically designed to meet LATICRETE's desired specifications. The pump is conveniently powered by a conventional wall outlet power cable rated for 120 volts and wields a motor speed control to adjust flow rate if necessary. This device significantly reduces time and variability, and removes most of the necessary training and technique required for application as the tool automatically yields the proper angle and depth of coves.

LATICRETE®

Team 12

Gyroscopic Self-Balancing Mechanism

Terence Costigan (ME), Michael Cunney (EE), Randy Earl (ME), Schuyler Mann (ME), Ryan Martinez (ME), Patrick Pfeiffer (ME)

Advisors: Dr. Ping Chuan-Wang with Kevin Kolvenbach
Stakeholder: Dana Jones, CEO, Accessadoor, Inc.

Abstract

The goal of this Senior Design Project focuses on developing innovative solutions for people with neuromuscular disorders. The focal point is on the production of a stability apparatus governed by the physics of gyroscopic motion. The gyroscopic concept is based upon the relationship between three components: the precession rate, angular momentum of a flywheel and the gyro torque. The product of the angular momentum and roll axis rotational speed generates a natural precession 90° out of phase of the roll axis, which generates an opposing torque to the rolling motion. It is hypothesized that utilizing the gyro-dynamics of a flywheel at high rpm will create a large enough angular momentum to provide a stabilization torque opposite of the rolling (falling) motion to keep a person upright, maintain balance and prevent falling. The relationship between the rolling motion and precession of the flywheel was studied to examine the possibility of actively controlling the precession rate to provide a larger stabilization torque at a lower spin speed. A small-scaled model was constructed with the intention of providing a proof-of-concept design for gyroscopic self-balancing prior to implementation to a human body. This preliminary design consists of a spinning flywheel mounted to a frame extrusion, which is allowed to rotate in one plane of motion, and electric linear actuators mounted to the bottom of the flywheel cage to actively control the precession rate. Future innovation would utilize the gyroscopic principles from this design to implement into a spinning apparatus around a person's waist, such as a hoop-shaped structure attached to an exoskeleton body, to provide assistive stabilization.

Team 13

Music Practice Timer

Edgardo Campos (EE), Juan Cardenas (ME), Rumi Dutta (EE), Nikki Maher (CE), Daniel Perez (CE)

Advisors: Dr. Baback Izadi with Dr. Eric Myers (Physics)

Abstract

Music Practice Timer is a device that tracks the time a musician physically spends practicing their musical instrument, versus idle time during a practice session. The device uses an analog sound sensor to detect nearby sound, fine-tuned with software to distinguish amplitudes and peak frequencies utilizing a Fast-Fourier Transform [FFT], which helps differentiate between the sound of the instrument being practiced versus background noise nearby. An IR motion sensor is also used to detect nearby motion and body heat from the musician, making it hard to fool. The user-experience is made as simple as possible with the incorporation of an LCD display for visual-text directions and menu options, along with four colored push buttons for the user to select their options. Menu options for the device include a Count-Up Timer and Count-Down Timer, giving the musician the option to either set a desired practice time to count down from, or begin practicing and count up the practice time until they decide to stop. All parts are soldered together in a sleek and portable three-dimensionally designed case, powered by an STM32 Nucleo microprocessor with a rechargeable battery. At the end of the practice session, the device displays the total sit-down time for the practice session, the time spent idle with no musical practice, and the time spent actually practicing the musical instrument. Overall, Music Practice Timer will motivate musicians of all ages to improve the productivity of their practice sessions, empowering them to become a better musician.

Team 14

Recycled Plastic 3D Printing Filament Extrusion System

Meagan Blair (ME), Alex Jaquin (ME), Amal Jiji (ME), Kevin Nelson (EE), Jazmine Remache (ME)

Advisor: Dr. Ping Chuan-Wang

Abstract

Filament extruders are low-cost electro-mechanical devices that can precisely produce plastic filament for Fused Deposition Modeling (FDM) 3D printing. These devices can help reduce the environmental impact of 3D printing's growing popularity. It is estimated that 6–19% of 3D printing material becomes waste. This waste comes in the form of support material, bed adhesion and failed or unused prints. In this design project, a high-performance extrusion system was designed that effectively recycles 3D printed plastics by implementing an Arduino based Proportional Integral Derivative (PID) temperature controller and Computer Aided Design (CAD), as well as design optimization using Finite Element Analysis (FEA) and, Computational Fluid Dynamics (CFD) simulation tools. The filament extrusion system consists of a single screw extruder, water cooling line, diameter measurement and pulling system. This project raises awareness regarding filament recycling and will provide others with the tools and resources to build similar systems using off-the-shelf and 3D printed components.

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Team 15 and Team 16

Electric Race Car

Syed Alam (ME), Jason Becker (ME), Thomas Grogan (ME), James Keshecki (ME), Aibel Kurian (ME), Sam Mani Mathew (ME), Anthony Maurice (ME), Justin Simon (ME), Michael Staudigel (ME)

Advisors: Dr. Rachmadian Wulandana with Professor Mike Otis

Abstract

The Shell Eco-marathon is an international, world-leading engineering competition focused on developing energy-efficient vehicles. This project focuses on designing, analyzing and constructing an electric race car within the constraints of the Shell Eco-marathon rules. During this project, a chassis and vehicle shell was developed using modeling software, such as SolidWorks and ANSYS. Each design iteration was analyzed in terms of load capacities, stress capacities, and aerodynamics using the finite element method, analytical methods and physical testing when applicable. Different types of frame connections had undergone stress/strain testing to ensure optimal safety to the driver and surrounding drivers. Furthermore, the team developed a system consisting of an electric motor, motor controller and a bike wheel. This system shows the speed and power outputs of a single driving wheel design. Power requirements can be determined through analytical methods based on the desired velocity and the vehicle mass. Energy efficiency was the forefront of the component selection in the electrical system. Lastly, additional systems such as the brake assembly, steering assembly and axle shaft assembly, were designed and configured using similar methods. All aspects of the electric race car are expected to result in foundational knowledge in efficiency and alternate means of energy generation, following the trends of the changing world. This project will set the basis for adaptation and development for years to come.

Team 17

Automated Ground Delivery Robot

David Betolatti (ME), Nicholas Cullen (ME), Mario Lema (ME),
Christopher Maggio (EE), Jordan Scocozza (ME)

Advisor: Dr. Mahdi Farahikia

Abstract

The purpose of this project is to design an autonomous ground-delivery robot. The robot's primary function will be to travel from one point to another autonomously on SUNY New Paltz's campus to deliver packages to students, faculty and staff. By automating package delivery, several benefits for the local SUNY New Paltz community begin to emerge. For example, an automated ground delivery robot would provide a contactless transaction for the consumer—something that is essential now to mitigate the effect of COVID-19 and other infectious diseases. In addition to maintaining public health and safety standards, an automated ground delivery robot would spur interest for students who are contemplating whether they would like to study Science Technology Engineering and Mathematics (STEM), giving students an opportunity to see what can be accomplished with a quality engineering education. The robot consists of an Arduino Mega microcontroller, an ESP8266 NodeMCU microcontroller, a Global Positioning System (GPS) sensor, a rotary encoder, two Liquid Crystal Displays (LCD), a keypad, four Sharp infrared proximity distance sensors, four 150-Watt Direct Current (DC) motors, four BTS7960 motor controllers, four steel motor mounts, weather-proof electronic housing, a locking mechanism and an aluminum frame. The GPS sensor and the ESP8266 NodeMCU microcontroller work together to collect and broadcast the latitude and longitude coordinates of the robot to a Graphic User Interface (GUI) on a smartphone application. The infrared proximity distance sensors will constantly scan for any obstructions in the robot's path, and then communicate that information to the Arduino Mega microcontroller. If there is an obstruction, the microcontroller will send a signal to the DC motors to halt all motion for a brief period while the sensors continue scanning for obstacles. If the obstacle is not removed, then the robot will move around it. The rotary encoder will keep track of the speed of the robot and will provide incremental increases or reductions in power. Lastly, an LCD with a keypad will allow the user to interact with the robot by entering in a password to obtain their package. If the user inputs an incorrect password, the user will not be able to access the package.

Team 18

Wearable Device Smart Shirt

Daniel Benjamin (ME), Hiba Iqbal (CE), Stephanie Matos (EE),
Ronald Mera (EE), Tawfiq Shamsudeen (ME), Jordane Thomas (CE)

Advisor: Dr. Damodaran Radhakrishnan
Co-Advisor: Dr. Ping-Chuan Wang

Abstract

The fixation of the project was to develop a user interface that naturally connects and operates with its user. This pointed us in the direction of wearable technology. The chosen wearable to best fit this purpose was a vest, incorporating an improper posture detector. The overall composition of the device consists of an STM32F46 Board, wired to an IMU, connected to a mini-vibration sensor.

The design of the wearable integrates a two-part system consisting of a mobile application that serves as the primary visual interface and heavy-duty computing device along with the vest, which will act as the housing unit for the sensors/device. A smart phone will effectively control the vest with connection via Bluetooth to IOS connection.

The vest functions by monitoring the user's back alignment and provides posture correction feedback through vibration notifications. Once worn, the integrated sensors will monitor and provide functionality to the user, while providing feedback to help maintain and better their health.

Team 19

Automatic 3D Part Dispenser

Michael Orlando (ME), Christopher Reale (EE), Skyler Rubin (EE),
Steven Scribani (ME)

Advisor: Dr. Ghader Eftekhari
Stakeholder: Aaron Nelson (Hudson Valley Additive Manufacturing Center)

Abstract

The goal of this project was to design and build a machine that will dispense SUNY New Paltz students' 3D printed parts that are ordered and printed at the HVAMC (Hudson Valley Additive Manufacturing Center). This dispenser will be placed in the Engineering Innovation Hub lobby near the HVAMC. The dispenser utilizes a rotating carousel design to store and deliver 3D printed parts to a locked door which will only be accessible to the correct student. The dispenser requires keypad entry of order numbers provided by the HVAMC database to retrieve the part from the locked door of the machine.

A scaled down version of the dispenser was created to demonstrate the intended function of the machine and how it interacted with the computer program and part database. A cubic frame and part designs offered experience with material selection and fabrication processes in order to better design the final machine.

The final machine incorporated two carousel sections of different capacities to store all 32 parts. The parts are loaded into the carousel compartments, which are rigidly attached to a suspended axle; a stepper motor, which is connected to the axle, allows for precise carousel rotation; locking doors, with electronic sensors, keep student's parts secure; and carousel access is then granted once rotation finishes. A transparent design shows off the printed parts to campus visitors, while also displaying the function and internal workings of the machine. An access door locks and allows service and adjustment, if necessary.

Computer modeling and assembly simulation yielded solutions to fit and performance, though the bulk of learning came from physical design manufacturing. Dimensions were adjusted, hardware was re-selected and the gear train was redesigned to more effectively provide reliable and secure operation for years to come.

HUDSON VALLEY ADDITIVE MANUFACTURING CENTER at SUNY NEW PALTZ

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Team 20

Mechanized Leveling Device

Austin Bartlett (ME), Damian Flash (ME), Julio Rebolledo (EE)

Advisor: Professor Ken Bird

Abstract

The mechanized leveling device seeks to provide safety to tools and equipment, such as a ladder. The design utilizes an I-beam structure as a leg that extends out until a level working surface is contacted, using an actuator capable of supporting a minimum of 250 lbs. A 12" Stroke 180 lb. Thrust Heavy Duty Linear Actuator was chosen because it exceeds the technical requirements, such as being able to hold 500 lbs. of static load and has three potentiometers to provide feedback to the microprocessor. The current leg design uses 3D printing with PLA components. This mechanism will be controlled using a microprocessor and a triple-axis accelerometer that will provide feedback, telling when the extension leg (actuator) has achieved stability. For this project, a triple axis accelerometer is used. This chip provides feedback of where in space the device is located and knowing when the device has met the required level for it to reach stability. The current prototype uses a wood frame constructed to house the actuator and electrical components; the wood design was chosen as a method to save money while prototyping. The supply power options have been upgraded to include the use of the Ryobi One+ 18-volt batteries, to provide quick and easy charging and swapping options while being used in the field. A variety of ANSYS models were created to give a comprehensive idea of how the prototype should react in the field and to highlight any possible failure points. The ANSYS models show that the prototype should be able to support the weight, coming within 90% of the maximum yield strength of the materials. All aspects of the design described above are important as they form a system that will increase the safety of a variety of dangerous tools.

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