Project title: Control Design For Uvic Little Dog

Contact person: Tristan Nixon, tristannixon1@gmail.com

Project description:

UVIC Little Dog Project Statement Background Dr. Li, a visiting PhD from China, has designed and built the structure for a quadruped robot, approximately the size of small dog. For the purposes of this project, the robot has tentatively been given the codename “Little Dog”. Presently, it is in need of a kinematic model, control system, sensors and mounts, in order for it to stand, walk and potentially run. This project will unquestionably be a challenge due to this being a complex mechatronics project and therefore requires a cross disciplinary team. Since this is a mechatronics project it requires knowledge across mechanical, electrical and computer engineering. A multidisciplinary team has been formed consisting of two mechanical engineers, two electrical engineers and one computer engineer. The team will begin with a manufactured manipulator with servo motors in the shape of a small dog with no head. The team will clearly define the problem and create a list of specifications, set out a specific list of deliverables, and then begin the work of implementing the system. The control system will consist of a field programmable gate array (FPGA) and a microcontroller as the basic system to control the stepper motors based upon a kinematics model. This is a desired method as the microcontroller is able to take care of higher level communications to either a basic input system such as a remote control or to a PC that is able to do automation of the system. The role of the FPGA will be to take the required positioning data from the microcontroller and then to properly control the stepper motors into the correct position and to maintain that position. As an FPGA is a highly parallelled system this can be done for each stepper motor simultaneously.

Project title: Paperless Receipt System

Contact person: Thomas Meadows, meadowst@uvic.ca

Project description:

Paper receipts are increasingly becoming an annoyance and a burden with customers as we move into the digital age, and most paper receipts just end up being immediately thrown out. Customers are also increasingly turning to technology to help unclutter their lives and provide streamlined solutions to everyday challenges. For businesses the cost of receipt paper and printers is not insignificant, and there is definitely an opportunity to implement a more costeffective solution. For example, based on rough calculations Walmart is estimated to spend around $100,000 per day1 globally on receipt paper alone. Even though Walmart brings in millions of customers per day, this figure is still sizeable. Furthermore, there is a growing trend moving towards environmentally sustainable practices, and businesses who are seen to be reducing paper usage and abandoning harmful ink and thermal paper products are likely to attract more loyal customers in the future. Based on approximate figures, we calculated that, as a result of their business, Walmart cuts down well over 600 trees per day just for receipt paper.

Project title: Anatomical Modeling using Additive Manufacturing in Biomedical Engineering

Contact person: Daniel Pedde, dpedde@uvic.ca

Project description:

Doctors are currently limited by their visualization techniques as medical images are typically obtained from conventional methods based on successive 2D layers such as MRI and CT scans. This limitation is apparent in surgical applications such as cardiac surgeries and removal of cancerous tumors, where three-dimensional visualization is crucial due to the inherent complexity of biological systems. Additionally, often forgotten modeling – specifically 3D modeling – has been an invaluable tool in previous biomedical breakthroughs. For example, the structure of DNA would not have been discovered if it weren't for Watson's push to physically model DNA rather than taking an alternative approach. Currently, there is no cost-effective and reliable method to produce three-dimensional structures and features for biomedical applications. Large-scale high resolution 3D printers made by industry leaders such as Stratasys® and 3D Systems® typically fall in the $20,000-$50,000 USD range whereas smaller, inexpensive desktop models prove unreliable at the micro/milli-scale. Digital Light Processing (DLP) provides a technology basis for accurate and reliable printing of successive two-dimensional patterns, creating a high resolution 3D model. DLP 3D printing technology can provide the speed and resolution to print small-scale biological features with consideration to porosity, biocompatibility, and material degradation. Additionally, DLP technology is frequently used in common and inexpensive devices such as projectors and TVs and is, therefore, much more accessible than alternative lithographic methods.

Project title: Smart Home

Contact person: Ryan Switzes, switz10@uvic.ca

Project description:

With the increasing demand for automated and smart technology, efficient systems must be designed. A major factor in these systems is cost because existing smart homes can be very expensive. We understand that smart homes are available in the market, but they are more geared towards new homes. Our proposed system will bypass this problem by creating individual modules to be installed at existing switches in order to reduce invasive renovations and high costs. We have decided to focus on lighting and thermostat systems to demonstrate the overall functionality of the system.

Project title: Sunbrella Charging Unit

Contact person: Spencer Yaredic, syaredic@uvic.ca

Project description:

This project aims to design and build a pole mounted sun-tracking solar panel system, designed to provide power to small devices via USB. Incorporated into this design will be the mechanical support and design, charging system circuitry, and control systems. In addition, the design will include an umbrella-like attachment, capable of shading a patio table. In many rural areas, mobile communications are not readily available due to the costly infrastructure and low population; these factors make it difficult to achieve an effective return on investment. A portable base-station could establish wireless communications in mining facilities, oil and gas exploration fields, logging operations, search and rescue operations, and any general rural area without mobile communications at minimal cost. To address this need a portable GSM base station will be designed. This design will include a software defined radio running open source software, such as OpenBTS to implement the layers of GSM protocol. This software will run on a microprocessor powered by a lightweight lithium ion battery bank. To broadcast the radio signal, an off-the-shelf antenna and a custom RF amplifier will be used. To achieve 48 hours of battery powered operation, an external battery pack will be used. The radio components and batteries will be housed inside weather resistant cases that do not exceed the weight or volume limits.

Project title: Aerial Detection of Vegetation Quality using Multispectral Image Processing Techniques

Contact person: Michal Jaworski, mjawors@uvic.ca

Project description:

Modern farming requires a significant amount of technology to accurately measure the growth and quality of vegetation and crops. Direct monitoring methods can be time consuming and expensive. To aid farmers in this problem, NASA scientists developed a method of measuring and indexing plant health in the 1970s utilizing various spectra reflected from plants, which required the collection of near infrared and blue light. From these two wavelengths, a standardized index known as the NDVI, Normalized Difference Vegetation Index, was created and allowed farmers to remotely observe their plant quality. With the advent of inexpensive flying vehicles, modern digital photography coupled with computing power would allow farmers to collect images themselves faster and far less expensively.

Project title: Ree Tee: Automated Automated Golf Practice

Contact person: Craig Hall, craigh@uvic.ca

Project description:

Exerceo is an organization dedicated to improving the game of golfers in North America. As a group of avid golfers and engineering enthusiasts, we possess the skill and motivation to reach our goals. At Exerceo, we want to target the mature golfer with expendable income looking to improve their golf game. A successful golfer starts by spending hours at practice facilities hitting thousands of golf balls in order to train their body for correct form and position. Whether a golfer is at a driving range or hitting balls into a practice net, every time you want to hit another shot, it involves bending over, picking up another golf ball, and carefully positioning it onto a small rubber tee. For many golfers bending over to pick up the ball is one of the biggest burdens when practicing. The repetitive nuisance of re-teeing a golf ball is the target problem we at Exerceo would like to fix with our fully automated Re-Tee system. The Re-Tee system will save time between shots, keep your glove clean when balls are wet and muddy, and most importantly, help prevent unnecessary strain on your back.

Project title: Augmented Reality Advertising Kiosk

Contact person: Xiaoyang Zhao, qq396979355@live.cn

Project description:

The idea of making an Augmented Reality Digital Kiosk is based on our last Co-op experiences. Current AR products on the market are all project based. For instance, Lego Kiosk and IKEA Kiosk are good examples of showing their products by using 3D models. However, what we are going to build is an advertising platform that all advertisers can display their products in a more dramatic way through this kiosk by using AR technology.

Project title: Soft-switching Front End DC-DC Converter for Photovoltaic Array to Utility Interface

Contact person: Tyler Ferweda, tferweda@uvic.ca

Project description:

The plan for this project is to design, test and develop a Boost-half-bridge DC-DC converter to be utilized in a photovoltaic system which interfaces into a utility grid. The photovoltaic system will essentially harvest variable low voltage DC power from a set of solar panels, convert the variable DC input voltage to a stable boosted DC output in which can be inverted to stable 120V AC source , then interfaced into a private or commercial 120V AC power grid. Our group will specifically be focused on the converter in which will provide a stable boosted DC output voltage. The converter will be capable of achieving voltage boost of approximately 7 times the input voltage. This high boost is essential for low voltage applications such as a small photovoltaic array installation. The converter will utilize an integration of boost, half converters coupled with an output voltage doubler. The proposed design will provide an effective solution for low input voltage application in which increased efficiency, and reliability can be realized. Utilizing the combination of converters, the number of system components is reduced, further reducing the cost in comparison on equivalent circuits.

Project title: Solar Simulator

Contact person: Meng Zhai, vzhai@uvic.ca

Project description:

The UVic ECOSat-2 project is currently in the process of performing Hardware In Loop testing in preparation for launch. This HIL testing process requires hardware to simulate the conditions of normal operation for the satellite. The goal of this project is to design and build a solar cell simulator as part of this HIL testing procedure.

Project title: Spatial Echolocation Enhancement System (SEES)

Contact person: Ian Brown, ian.campbell.brown@gmail.com

Project description:

The goal of this project is to design a system to aid visually impaired or blind individuals in independently navigating the world around them. Currently, there already exists a variety of aids for individuals suffering from partial or full blindness. While effective in specific scenarios, these solutions are limited in either their capability, usability, or availability. Canes can only be used to detect obstacles nearby and may be intrusive in some scenarios. While guide animals can detect and report on a variety of subjects, they too are limited in availability and applicability.

The SEES project presents a novel solution to this problem through a device that acts as a natural augmentation an individual's ability to locate and identify objects using audio cues alone. The device is worn as a headset and is mounted with a depth sensing camera used to detect and analyze the environment around the user. Using the information gathered by the depth camera, the system synthesizes and appends spatialized audio cues to objects in the scene and feeds them back to the user through a pair of headphones. Not only does this significantly improve the individual's personal independence in being able to comprehend the world around them on their own, but it is also provides navigational aid in a manner non-intrusive to both the user and to the individuals around the user.

Project title: Design of an Off-Grid Power System

Contact person: Mike Fioretti, fioretti.mike@gmail.com

Project description:

The Vancouver Island Cave Exploration Group is constructing a new cabin near Tahsis Hill to be used as a base camp for caving expeditions in the area. The intent of this project is to design and implement an off-the-grid power generation system to supply two 6V DC batteries powering the cabin. The scope this project includes power generation via a Pelton Wheel and Solar Panels, power transmission from the sources to the cabin, and both charge and load control. The Pelton Wheel will be designed and built, and the charge controllers will be coded and implemented.

Project title: Autonomous Guide Drone

Contact person: Daniel Apperloo, apperloo@uvic.ca

Project description:

The University of Victoria Engineering Department hosts multiple groups of high school students and other guests, and provides them with a tour around the campus. During this tour, it will be exciting to have an example which demonstrates what students in the engineering department can accomplish at Uvic. To address this issue, we propose the construction of an "Autonomous Guide Drone" that will lead a group of people around a building. This drone will follow a set tour path while maintaining a given distance away from the tour leader. At desired points of interest, the drone will power down until the group is ready to proceed. While the tour is traversing the building, the building remains open for normal use. The drone is therefore required to be aware of its surrounding, avoiding imminent collisions as necessary. This project will also serve as the basis of future project at the University of Victoria. Collision avoidance is a mandatory base component to nearly all autonomous navigation tasks. This is accomplished through the use of an expandable open-source platform. Future development on either the onboard navigation platform or the control software will be possible.

Project title: Breathing Simulator

Contact person: Henry Coll, hcoll@uvic.ca

Project description:

The client has requested a breathing simulator that will mimic the breathing action of human lungs. The desired capabilities of the simulator include an inline system to produce, regulate and monitor the simulator's output so that temperature, humidification, and CO2 content can be measured and adjusted. To accomplish this, it is necessary to be able to monitor pressure, flow rate, humidity, and work of breathing. All outputs from sensors need to be data-logged and transmitted to an interface to view and analyze data. The scope of the project includes the mechanical design of the lung simulator, the production of gases such as CO2 and water vapour, and sensor interfacing and data logging.

Project title: Mouse Step Detector

Contact person: Michael Peirone, Peirone1@uvic.ca

Project description:

The ability to perform simple, everyday tasks, such as tying a shoelace or buttoning a shirt, are often lost after experiencing a stroke. The Brown lab at the University of Victoria dedicates their research to understanding what happens to the brain after a stroke, allowing them to devise intelligent strategies to help stroke patients recover some motor functions and achieve a higher quality of living. Mice and rats are commonly used to model the effects of strokes because they display similar poststroke motor deficits to humans. Strokes are induced in a specific motor part of the brain, which leads to subtle defects in how well the rodent uses its left forepaw. This project targets the challenge of quantifying these subtle defects in the sensory-motor function of the affected paw. The testing system will feature a horizontal ladder with rungs spaced 1-2 cm apart, and the placement of the affected paw on each rung of the ladder will be measured to determine stroke severity. The rungs of the ladder will be wired to act as sensors such that a complete grasp will result in the completion of two circuits, while a partial grasp and a slip will result in the completion of only one or neither circuit. Healthy rodents are expected to display only full grasps, whereas those with induced strokes are expected to show a significant number of partial grasps and slips. The grasp results from each trial will be displayed in table format on a screen connected to the testing system.

Project title: DocNet: A documentation markup generator for C# and Visual Studio

Contact person: Stephen Bos, sjlbos@uvic.ca

Project description:

DocNet is a software documentation tool for the C# programming language. Taking one or more C# source code files as input, DocNet uses the C# code's XML documentation comments (special comments written by the code's developer explaining its usage and purpose) to generate a collection of HTML files. These output HTML files will contain well-formatted, pretty-printed documentation of the code's classes, functions, and variables based off of the documentation comments contained it contains. Hyperlinks will connect related documentation files, so that when taken as a whole, the output HTML files form an interconnected graph of web pages documenting the user's software's public interface. These documentation files can then be hosted online or in a shared location to provide other developers an organized and navigable means of understanding the documented software.

Project title: Target-Cam

Contact person: George Ritchie, gpritchi@uvic.ca

Project description:

With approximately 2 million firearms owners in Canada target shooting is a popular pastime, however, there are currently no small and portable electronic target scorekeepers available on the consumer market. Continuing on from work performed during Elec 399 in the winter of 2014 and by a previous Elec 499 group, an inexpensive and portable electronic target scorekeeper will be implemented. Currently a system has been built that can capture images of a target and transmit these images to a computer located up to 200 m away. This system was developed during the spring of 2015 by another Elec 499 group, based on an idea researched and developed for an Elec 399 project. We wish to refine this system into a more sleek and user friendly version, focusing on enclosing the transmitter in a weather resistant housing, increasing the battery life to 5 hours, and dramatically improving the receiver and user experience. We will be using the same transmitter and receiver framework, but we will be using commercially available Raspberry Pis and Zigbee wireless transmitters to implement both the receiver and transmitter. The transmitter, which will be placed near the target, will comprise of a battery, a Raspberry Pi, a camera, and a 802.15.4 wireless transmitter. The Pi will activate the camera to capture an image of the target and transmit the image to a receiver using the Zigbee. The receiver is to be comprised of a battery, a Zigbee, and WiFi equipped Pi. The Pi will act as a wireless access point (WAP). A mobile device will then wirelessly connect to the receiver and display the received, processed images. The processing will consist of Canny edge detection and/or the Hough Transform.

Project title: Laser Harp

Contact person: Divyanshu Samant, dsamant@uvic.ca

Project description:

Innovation in modern electrical instruments has soared in the past 20 years. Many traditional instruments are being adapted and changed as technology progresses. Here at Laser Music Inc., we like to push the envelope for musical innovation. Live musical performances are often more than just a showcase of musical ability, but often a visual entertainment display. In order to enhance and add sensational element to musical performances and give audience members a memorable experience, we decided to develop a fresh take on one of the most classical instruments: the harp. By removing physical strings, and replacing them with laser beams, we will create a device to spearhead the live entertainment industry.

Project title: Dual Axis Solar Tracking System

Contact person: Owen Marchall-Glew, owenmg@uvic.ca

Project description:

The goal of this project is to develop an autonomous dual-axis solar tracking system capable of maintaining normal incidence of light onto an on-board solar array regardless of geographical location. The electrical components of the system consist of a solar panel, 32-bit ARM cortex m0 micro-controller, a rechargeable battery pack, a power management integrated circuit, a buck/boost DC to DC converter, and a USB output for charging electronics. The mechanical components of the system will include 2 servo motors, a gear box, a belt drive with rolling bearings, rotating platform, and a supporting mechanical apparatus. Once completed, the system will be capable of automatically finding the sun regardless of geographical location or system orientation. The micro-controller will use the solar cell as the primary transducer to to sample the voltage and current via the on-board analog to digital converter, while doing a calibration sweep of the sky. Once the micro-controller has detected the strongest sample it will lock on and track the sun throughout the remainder of the day ensuring the solar cell is harvesting energy with the highest efficiency possible. Once the sun sets, the system will reset to the east waiting for the sun to rise the next day.

Project title: wireless Bluetooth Dongle

Contact person: Albion Bunjaku, abunjaku@uvic.ca

Project description:

We aim to create a solution to rid the world of audio from cables and clutter. With Audio Stream any audio player capable of Bluetooth connectivity will be able to stream audio to any device that has an audio jack. This opens up possibilities of playing audio wirelessly in the car or at home, quickly converting older or high end systems into efficient Bluetooth capable systems that can be controlled from anywhere in the house. The Bluetooth adapter will be reasonably low priced, efficient, small in size, and plug-and-play ready for day-to-day life. With the current component setup this device will be able to achieve a high quality rate of audio transmission with a range of 30-40 meters allowing for control of home audio systems from anywhere throughout the house. With Android, IPhone, and support for various other devices this product will prove a one-stop shop for the needs of any consumer. The device will require no additional software for use making it a truly universal plug-and-play system that anyone will be able to use. Break free from the binds of wires and cables and envision a world of communication through the air, a future starting with the world of sound and music.

Project title: Fall Alert Signal Transmission System

Contact person: Bai Xiang Jin, Boc.barryjin@gmail.com

Project description:

Fall arrest systems are often used to help minimize injury to a worker falling from a height. Typically composed from fabric, a safety harness is worn by the worker and is attached to an anchor to help reduce the consequences of fall. While these fall arrest systems work to some extent, the fallen worker is still at high risk of injury, suspension trauma, loss of consciousness and even death as a result of prolonged suspension in the harness. It is therefore of great importance that a fallen worker be rescued quickly in order to minimize the effects of prolonged suspension on the worker. This Fall Alert Signal Transmission (FAST) System will improve upon existing fall arrest systems by providing a means to instantly and automatically send a signal containing information such as a worker's ID and location to emergency personnel in the event that the worker falls from a height. The system is a small and simple addition to the currently existing equipment and procedures required to make rescues which are already in use. This allows for a simple integration of the new product with the already existing safety systems, which will result in a modernized version of existing safety systems that is faster and more reliable.

Project title: Interactive Beer Pong Table

Contact person: Steven Morrison, Stevemor@uvic.ca

Project description:

In every university around the world there are parties that take place. At a majority of these parties there is a common game that is played, Beer Pong. This project wants to take the classic beer pong table and bring the party to the party. This table incorporated with lights that flash and dance along to the music as well as other lights that activated upon scoring in the cup. Also included in this table is a scoreboard included with custom messages to the players. This table is designed to centralize the party around the table and get people excited about the game that is being played.

Project title: Never Flat Pressure Tap

Contact person: Eric Krystofiak, erickrys@uvic.ca

Project description:

Creating a self-pressurizing keg will allow for constant pouring of drinks without the need to manually pump and pressurize the keg. An LCD will be included and will be programmed to display current keg pressure, desired pressure, as well as total and remaining volume of the keg. It will also be programmed to include a timer that begins when liquid release is triggered, and reset the previous timer when the new timer begins. Ideally, the keg will self-pressurise to approximately 10-12 psi, and should begin re-pressurizing prior to actually needing it. In other words, while liquid is still capable of being dispensed, the keg should begin re-pressurization in order to ensure a constant pour. A typical keg will allow for approximately 4-8 drinks being served prior to requiring re-pressurization, however with this system, ideally the entire keg should be able to be dispensed with one pour.

Project title: Design and Build of a Switched-Mode Power Supply

Contact person: Peter Kremler, pkremler@uvic.ca

Project description:

Audio amplifiers, specifically for high power applications, can be expensive for the average consumer. The cost can be attributed to certain speciality components that are commonly found in many audio amplifiers available on the market. This project aims to produce a power supply for an audio amplifier that provides the same performance at a lower cost compared to commercial products by eliminating some of the more costly components. To power a specific audio amplifier, the power supply will require 1.4 kilowatts of power with ±70 volts on a common rail.

Project title: Rapid Deployment GSM

Contact person: Wilson Leishman, wleish@uvic.ca

Project description:

In many rural areas, mobile communications are not readily available due to the costly infrastructure and low population; these factors make it difficult to achieve an effective return on investment. A portable base-station could establish wireless communications in mining facilities, oil and gas exploration fields, logging operations, search and rescue operations, and any general rural area without mobile communications at minimal cost.

Project title: Drop Hammer Testing System

Contact person: Jorge Conde, Jorgeg@uvic.ca

Project description:

CAP Management Services requires a drop hammer testing system to conduct PDA testing on deep foundations. Currently, onsite equipment is being used, which is delaying work and slowing production rates. The drop hammer system will have a hammer weight that is adjustable from approximately 4000 lbs to 12000 lbs, and a drop height that is electronically adjustable from 1' to 4'. The hammer will be raised using a hydraulic pump and cylinder, with height adjustable through electronic sensors and a digital handheld controller. Manufacture of the mechanical and structural components will be done by CAP Management Services in Edmonton Alberta using the design schematics provided by the design team. Assembly and programing of the electrical components and sensors will be done in Victoria BC, and integration of the two systems will be done in Edmonton.

Project title: Solar to Utility Conversion

Contact person: Brodie Campbell, brodieca@uvic.ca

Project description:

When discussing environmental sources of energy, solar power is often regarded as one of the lowest impact sources. Solar panels are versatile because they can be deployed by companies and general consumers alike, however, there is an issue of where to store the energy once it is captured. A common solution is to purchase a large bank of batteries that can be charged by the panels and discharge when needed, but this is both costly and takes up lots of space. Alternately, the DC energy that is gathered can be converted to AC and - at the correct phase and frequency - deployed back to electricity providers such as BC Hydro. This method is much more cost and space effective, but will require a very precise level of regulation of the AC voltage and current in order to properly feed back to the utility grid.

Project title: Audio Signal Separation with Microphone Array Beamforming

Contact person: Michael Abel, mabel@uvic.ca

Project description:

The plan of the project is to separate an audio signal from other audio signals and noises. A common analogy is the cocktail party, where we are trying to separate one person's voice from everyone else and other noises. We are starting from wav files that have been provided by Dr. Driessen , and since the files used a nine microphone array, the first task is to use a technique known as beamforming. This will delay and sum all the sounds from the microphone array which will remove the reverberations and some noise. From the output of the beamformer, the next task is to apply an adaptive filter to reduce the noise. From research done in ELEC/CENG 399 the best filter to use would be a Wiener Filter and then use a technique known as Blind Source Separation would be used to separate the desired audio signals from the other signals and noises. With beamforming there are two options, one is known as the Frost Beamformer and the other is the Phased Beamformer. Both beamformers are very usefully and they have their own advantages and disadvantages; however, only one will be chosen. Once the beamformer is selected, it will be tested with the wav files provided by Dr. Driessen, and then a Wiener Filter will be applied and Blind Source Separation used to and obtain the desired audio signal. Once this process works with the wav files, the next step would be to do the same thing but in real time. To do this in real time we are looking into obtaining a Microsoft Kinetic.

Project title: Divi; Group Budgeting App

Contact person: Jeremy Kroeker, jeremyk@uvic.ca

Project description:

Divi is an Android application which allows users to easily manage expenses within a group. This is perfe ct for weekend getaways with friends, or splitting bills between roommates. Divi leverages Facebook for quick login and group setup; it takes just seconds to create a new group and invite your friends. As users log their expenses within a group, the server automatically recalculates each member's balance. At any t ime, a user can check exactly how much they need to pay or how much they are owed. The application a lso breaks this down per person, so a user can see who they owe money to and who owes them money. Each expense may also have an associated receipt which allows other group members to verify that the purchase was legitimate. Once users have exchanged money, they may confirm within the application to update their balances. All expenses and settlements are logged and viewable as history. A user may be i nvolved with many groups and may join and leave groups as they please. The application is designed to make the process as seamless as possible so that users may spend less time divvying and more time doing.